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## Disclosure Deregulation of Quarterly Reporting

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# 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 that are listed on the Frankfurt Stock Exchange, our results reveal that over the period from 2012 to 2019, lower quarterly reporting levels on average have increased information asymmetry and reduced firm value. We find that this effect is stronger for second-tier stocks and firms with low media coverage. Our 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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## 1. 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 there is virtually no evidence of how *deregulation* affects information asymmetries. Fu et al. (2012) addressed voluntary retrenchments of quarterly reporting among firms in US in the 1950s and 1960s and found that higher reporting frequency reduces information asymmetry and the cost of equity. More recently, a working paper by Knappstein et al. (2021) has 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 of whether information asymmetry persists over time. The present study extends previous findings by investigating the medium- to 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, liquidity, and firm value over a period of four years after deregulation.

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.<sup>1</sup>

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<sup>1</sup> Please note that 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 were exogenously forced to comply with higher levels of disclosure before the year 2015.

Overall, our findings confirm that reduced disclosure on average increases information asymmetry and diminishes firm value. The evidence shows that the increase in information asymmetry is the result of selection effects regarding firms' choice of quarterly reporting content levels, while the reduction in firm value can be traced back to the policy change *per se*. Moreover, the analysis of the firms' information environment reveals substantial heterogeneity. Second-tier stocks and firms with low media coverage display stronger adverse effects for liquidity and firm value. Thus, we extend previous research on disclosure regulation by showing that information asymmetry increases and firm value decreases for second-tier stocks and firms with low media coverage, but not for firms with an already very good information flow. 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: second-tier stocks and stocks with low media coverage suffer from deregulation, whereas reducing quarterly reporting is irrelevant when the information flow is already high.

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.

## **2. Institutional Framework**

Quarterly reporting has a short tradition in Germany. German firms began publishing quarterly reports voluntarily only in the 1990s.<sup>2</sup> 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 cashflow statement, a change in equity statement, and explanatory notes. The Interim Management Report has to be prepared

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<sup>2</sup> For example, Volkswagen AG already published quarterly reports voluntarily in the 1990s.

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 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 cashflow 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.

### **3. Hypotheses**

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 premium 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 illiquidity 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. Increased financial reporting of lesser-known firms enriches a firm's investor base and improves 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 estimation 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).

Because disclosure reduces the cost of capital and increases firm value, firms are expected to disclose information voluntarily, especially if the benefits outweigh potential costs arising from disclosure. However, the argument that all firms have incentives for full disclosure no longer holds if the costs of disclosure are sufficiently high (Dye, 1990). Costs of disclosure are incurred directly in the preparation and certification of reports as well as indirectly through the publication of sensitive information to competitors. The optimal level of disclosure is thus firm-specific (Leuz and Wysocki, 2016). Accordingly, a mandatory disclosure rule cannot be justified across the board by stating that the benefits of the disclosure generally outweigh the costs.

There are three arguments justifying the necessity of regulation of financial reporting.<sup>3</sup> First, the existence of externalities in the private production of information can lead to an over- or underproduction of information. By mandating the socially optimal level of disclosure,

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<sup>3</sup> For a detailed overview regarding the economics of mandated or regulated disclosure, see Leuz and Wysocki (2008).



regulation can mitigate this problem by reducing investors' incentives to collect and use private information, in this case because information acquisition is viewed as endogenous (Kim and Verrecchia, 1991; McNichols and Trueman, 1994). However, incentives to produce private interim information exist even if interim and annual reports are mandatory, because the timeliness of mandatory reports cannot be great enough to avoid insider information (Mahoney, 1995). Market forces themselves might also limit an overproduction of information because prices tend to reveal at least some of investors' private information, which in turn reduces the incentives to acquire private information (Grossman, 1977; Grossman and Stiglitz, 1980). Thus, the gap between over- and underproduction of information is small, and therefore it is difficult to say whether the resulting externalities are socially desirable.

Second, a mandatory disclosure regime implies a commitment to reveal information in good times and bad (Mahoney, 1995; Rock, 2002), resulting in reduced information asymmetries and less uncertainty (Verrecchia, 2001). Even if firms can voluntarily make such commitments, mandatory disclosure results in lower cost commitment. In the case of a voluntary commitment, investors anticipate that there is still a residual probability that firms withhold at least some information. Investors thus demand compensation and raise the demanded return (Leuz and Wysocki, 2008).

Third, producing a sufficient level of disclosure privately can be difficult for firms for many reasons. Corporate insiders can act opportunistically and forego profitable investment decisions in favor of their own private benefit (Shleifer and Wolfenzon, 2002). The mandatory character of regulated disclosure offers access to penalties and remedies, which are often not available or at least limited in private contracts. Thus, costs from fraud and agency conflicts can be mitigated through mandatory disclosure. Moreover, mandatory disclosure reduces social losses because it limits the ability for controlling insiders to waive a disclosure commitment voluntarily in order to consume private benefits (Shleifer and Vishny, 1997; La Porta et al., 2000).

Despite these benefits, direct and indirect costs must nevertheless be considered, which is why regulation is a trade-off of imperfect alternatives (Djankov et al., 2003; Shleifer, 2005). Previous research has been limited to the study of the capital market effects—information asymmetries, cost of capital, and firm value—of different disclosure levels by studying the adoption of International Financial Reporting Standards (IFRS) or the extent of voluntary disclosure (Leuz and Verrecchia, 2000; Botosan, 1997; Botosan and Plumlee, 2002). In the case of quarterly reporting, most empirical studies have examined the capital market effects of *increased* disclosure (Butler et al., 2007; Fu et al., 2012; Kajüter et al., 2019); there are relatively few articles studying the capital market effects of *reduced* levels of financial

disclosure (noteworthy exceptions are Fu et al., 2012 and Knappstein et al., 2021). While Fu et al. (2012) find that an increase in reporting frequency is associated with lower information asymmetries, they cannot find a significant change in information asymmetries for firms decreasing their reporting frequency. In a sample of firms listed at the Singapore Stock Exchange in 2003, Kajüter et al. (2019) find no relation between the introduction of mandatory quarterly reporting and information asymmetry. 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. Brown and Hillegeist (2007) have examined the potential mechanisms by which disclosure affects information asymmetry for firms that have Association for Investment Management and Research disclosure quality scores for the period 1986 to 1996. They find a negative effect of disclosure quality on information asymmetry only when private information is reduced in the market.

In line with the ambiguous effects of disclosure on information asymmetries, the effects on cost of equity and firm value are also mixed. The seminal study by Botosan (1997) finds a negative correlation between voluntary disclosure in annual reports and cost of equity of firms with low analyst coverage. Fu et al. (2012) find that an increased reporting frequency leads to lower cost of equity. In contrast, Botosan and Plumlee (2002) show that a voluntary higher reporting frequency, such as quarterly reporting, results in higher cost of equity. Recently, Kajüter et al. (2019) find a negative association between mandatory quarterly reporting and firm value for small firms.

The mixed results of empirical studies indicate that the theoretical debate over capital market effects of higher 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 numerous empirical studies on tightening regulations. Overall, 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 in 2015, firms can respectively reduce both the accuracy and quantity of information in quarterly reports. We expect firms’ quarterly reports to be on average less accurate, to provide less information to investors, and to be difficult to compare, requiring an increase in private information in the market. Therefore, we hypothesize:

**H1A: Lower quarterly disclosure levels increase information asymmetry.**

**H1B: Lower quarterly disclosure levels reduce firm value.**

Besides the general effects of lower quarterly disclosure on information asymmetries and firm value, it is unclear how capital market effects of a lower disclosure level depend on the information environment of a firm. Because the quarterly disclosure level is not a comprehensive measure of the overall information environment of a firm, other factors such as analyst following and firm size are also important factors influencing investors' information set (Botosan, 1997). In theory, capital market effects under a mandatory quarterly reporting regime may be firm-specific given the particular benefits for unknown or smaller firms with a smaller investor base and an insufficient information environment. Disclosure by these firms improves risk-sharing and enables them to increase their investor base, which in turn improves their information environment. Consequently, they enjoy easier access to capital, which in turn reduces cost of capital and increases firm value (Leuz and Wysocki, 2008). Under mandatory disclosure, it is also easier for lesser-known firms to prove commitment to the capital market, making it easier for them to raise capital (Ferrel, 2004; Leuz and Wysocki, 2008). However, the existence of externalities in the production of information makes it difficult to draw a precise conclusion regarding whether a large investor base reduces or increases private information in the market (Kim and Verrecchia, 1991). The better the information environment of a firm, the less important the quarterly reporting level may be because alternative information channels enrich the overall information available in the market (Brown and Hillegeist, 2007).

Under the assumption that larger firms have a better information environment due to their larger analyst following and greater media coverage (Collins et al., 1987; Bhushan, 1989), the marginal effects of lower quarterly reporting levels on information asymmetries and firm valuation are larger for small firms operating in a generally inferior information environment. However, there are also theoretical arguments that quarterly reporting can be less beneficial or even costly for small firms. Fixed costs for disclosure can make quarterly reporting burdensome for small firms (Leuz and Wysocki, 2016). 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 blockholders typically have more timely access to information (Kajüter et al., 2019).

Empirical research suggests a moderating role of firm size regarding the impact of disclosure on capital market effects (Botosan, 1997; Kajüter et 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 followed by fewer analysts, increasing the importance of quarterly reporting for small firms. Brown and Hillegeist (2007) show that a firm's media coverage is important for the intensity with which the capital market reacts to information about it. This is because conference calls and press releases have become more relevant than quarterly reports in recent decades, suggesting that the benefits of quarterly reporting found in earlier sample periods, such as in the US from 1951 to 1973 (Fu et al., 2012), may no longer hold in current market environments. While Kajüter et al. (2019) find that large firms in Singapore experience informational benefits of quarterly reporting, they also find evidence that quarterly reporting constitutes a net burden for small firms, which reduces firm value. In contrast, 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 term resulting from decreased quarterly reporting.

Following the assumption that lower quarterly disclosure leads to worse information provision and increases private information in the market, we expect that for firms operating in an inferior information environment, the marginal effect of quarterly reporting is higher because of the low information flow through alternative information channels. We therefore hypothesize:

**H2: The increase in information asymmetry and the reduction in firm value are stronger for firms operating in a poor information environment.**

## **4. Data and Method**

### **4.1. 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.<sup>4</sup> To investigate firms' quarterly reporting level, we hand-collected quarterly reports from firm websites. For our analysis of firms' information environment, we collected yearly information of index listings.<sup>5</sup> Our final sample consists of

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<sup>4</sup> We use XETRA as a basis for price information.

<sup>5</sup> Historical index listings are adopted from [www.dax-indices.de](http://www.dax-indices.de).

361 firms over the period 2012 to 2019, resulting in 2,005 firm-year observations.<sup>6</sup> 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.<sup>7</sup>

## **4.2. Variables**

### **4.2.1. Dependent Variables**

We test Hypothesis 1 by analyzing the effect of lower quarterly disclosures on information asymmetry (H1A) and firm value (H1B). Hypothesis 1A 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  $((ask-bid)/(ask+bid)/2)$ .<sup>8</sup> 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 Hypothesis 1B 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 higher willingness of investors to provide funds for shares, thereby suggesting a higher firm value.

We test Hypothesis 2 using our liquidity and firm valuation measures as dependent variables to identify possible differences in quarterly reporting levels for different information environments.

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<sup>6</sup> Overall, 256 observations were dropped because of missing observations in the dependent or explanatory variables.

<sup>7</sup> Missing observations reduced the sample size to 1,822 observations.

<sup>8</sup> 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.

#### 4.2.2. Explanatory Variables

To test Hypotheses 1A and 1B, we have classified quarterly reports of firms listed in the FSE Prime Standard into four categories using the variable *QLevel*, which takes the value 1 (low quarterly reporting level) to 4 (high quarterly reporting level). Figure 1 gives an overview of the precise classification of *QLevel*. Prior to 2016, the disclosure of quarterly financial reports was mandatory for all sample firms; hence, quarterly reports prior to 2016 were all classified into the highest quarterly reporting level. 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. However, firms could freely choose the content level of quarterly reporting beyond this minimum requirement and could in principle stick to the highest quarterly reporting level.

[Figure 1 About Here]

To test Hypothesis 2, we have measured firms' information environment using two different variables. First, we examined the additional listing of Prime Standard Firms in a selection index. Based on market capitalization and stock exchange turnover, Prime Standard firms are entitled to be additionally listed in a selection index such as DAX, MDAX, SDAX or TecDAX and thus benefit from higher visibility and public interest. According to Botosan (1997), the listing in a selection index constitutes a valid proxy for the quality of the overall information environment because of the corresponding higher analyst following. We therefore create the dummy variable *NoIndex*, which is coded as 1 for firms that are not part of an index and 0 otherwise. To test Hypothesis 2, we consider an interaction term of our variable of interest *QLevel* with the dummy variable *NoIndex*. Second, we measure media coverage using the information flow through press releases and newswires since the abolishment of mandatory quarterly financial reports in 2015, which allows us to test the information environment as outlined in Hypothesis 2. We count the sum of press releases and newswires for each firm from 2016 to 2019 and generate the variable *Low\_MC*, which equals 1 if the respective firm operates in a news environment with below-average media coverage and 0 otherwise. Subsequently, we examine the interaction term of *QLevel* and *Low\_MC*.

### 4.2.3. 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 Hypothesis 1A. *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 Hypothesis 1B. 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.<sup>9</sup> *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.<sup>10</sup> All of our control variables are winsorized at the top and bottom 1% to account for outliers.<sup>11</sup>

## 4.3. Method

### 4.3.1. 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.

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<sup>9</sup> Results remain unchanged if we calculate leverage following Daske et al. (2008) as the ratio of total liabilities to total assets.

<sup>10</sup> Results remain unchanged if we use asset growth as an alternative.

<sup>11</sup> Results remain unchanged if we use unwinsorized values.

#### 4.3.2. 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. 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 exactly correspond to the industry and year of the treatment observation.<sup>12</sup>

In line with Daske et al. (2008), we use a difference-in-difference approach to examine the change in information asymmetry and firm value. We compare differences between treatment and control firms that have not changed their quarterly reporting level, respectively for the period before and after the change in mandatory quarterly reporting levels. In line with Fu et al. (2012), we consider observations three years before and up to three years after the change in quarterly reporting level. Because some firms lowered their quarterly reporting level only in 2018 or 2019, the post period is not three years for all of our observation. Rather, we have three post periods for 157 firms that changed their quarterly reporting level in 2016 or 2017. In 2018, another 25 firms changed their quarterly reporting level, implying two post-treatment periods for these firms. Finally, 20 firms changed their quarterly reporting level in 2019, implying one post-treatment period for these firms.<sup>13</sup> We estimate the following difference-in-difference regression:

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

in which  $DV$  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 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.

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<sup>12</sup> Results remain unchanged when we use a kernel matching procedure to identify control group firms. Requiring the same index-year combination for our matching does not affect our results.

<sup>13</sup> The parallel trend assumption is fundamentally not testable in settings with variation in treatment timings (Callaway and Sant’Anna, 2020). Therefore, we estimate the mean of our dependent variables bid–ask spread, price impact, MTB, and Tobin’s Q for the year before the deregulation of the FSE sets in. Means of treatment and non-treatment firms are not significantly different from each other.

### 4.3.3. Interaction Effects

To investigate Hypothesis 2, we interact our variable of interest *QLevel* with the dummy variable *NoIndex*. The interaction between *QLevel* and the dummy variable *NoIndex* captures the impact of the overall information environment on the effect of information disclosure. We estimate the following regression:

$$DV_{Information\ Asymmetry/Firm\ Value\ it} = \alpha + \beta_1 QLevel_{it} + \beta_2 QLevel_{it} \times NoIndex + \beta_3 Controls_{it} + \varepsilon_{it} \quad (3)$$

where *DV* is our dependent variable measuring information asymmetry or firm value; and *QLevel* and *NoIndex* are the variables of interest and respectively capture the quarterly reporting level and whether firms are not listed in a selection index. **Controls** is a vector of control variables.

We further test Hypothesis 2 with the interaction of *QLevel* and *Low\_MC*, which captures the impact of quarterly reporting level conditional on the extent of media coverage and press releases. We estimate the following regression:

$$DV_{Information\ Asymmetry/Firm\ Value\ it} = \alpha + \beta_1 QLevel_{it} + \beta_2 QLevel_{it} \times Low\_MC + \beta_3 Controls_{it} + \varepsilon_{it} \quad (4)$$

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

## 5. Results

### 5.1. Descriptive Statistics

Table 1 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*.

[Table 1 About Here]

Table 2 presents descriptive statistics. The mean values of our information asymmetry measures (bid–ask spread and price impact) are 1.00 and 15.04. 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 1.87 and 3.42. The mean balance sheet size (*Size*) is 5,033,659 EUR.<sup>14</sup> Our 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 3 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 2 & 3 About Here]

## 5.2. Regression Results

Table 4 presents regression results for our information asymmetry measures with bid–ask spreads as dependent variable in panel A, and price impact as 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 -0.025 to -0.038, suggesting that bid–ask spreads increase between 0.025 and 0.038 when quarterly reporting levels decrease by one level. The coefficient of *QLevel* is significant at the 5% and 1% levels for our pooled

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<sup>14</sup> To give an intuitive interpretation, we present unlogarithmised values of *Size* for the descriptive statistics.

OLS and fixed effects panel regression. In the IV regression the coefficient of *QLevel* is not significant, indicating that the increase in information asymmetry is the result of selection effects regarding firms' choice of quarterly reporting. In line with our expectation that quarterly reporting level affects bid–ask spreads negatively (Fu et al., 2012; Knappstein et al., 2021), these results provide evidence that information asymmetry increases when quarterly reporting level decreases. However, the increase in information asymmetry in the market is not the result of the deregulation *per se*, but stems from the fact that the firms that are inherently more prone to the negative effects of information asymmetries decided to report less. 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 do find some evidence in line with Hypothesis 1A—that quarterly reporting levels have a negative effect on price impact (Fu et al. 2012; Knappstein et al., 2021)—although this results from the fact that smaller firms decided to report less. All control variables show statistically significant coefficients.

Overall, with the exception of the pooled and fixed effects bid–ask spread regressions, our results in Table 4 do not indicate that a decrease in quarterly reporting level increase information asymmetry in the long-term, which might indicate that other sources of information potentially replace mandatory quarterly reporting. In contrast with theoretical predictions (Diamond, 1985; Bushman, 1991; Lundholm, 1991; Kim and Verrecchia, 2000), our findings suggest that lower quarterly reporting levels apparently do not change the amount of information acquired by investors. Thus, Hypothesis 1A is rejected.

While an increase in information asymmetry is *per se* undesirable, the question remains whether more information asymmetry effectively reduces firm value. Table 5 reports the results of our firm value models with *MTB* as dependent variable in panel A and *Tobin's Q* as 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 Tobin's Q by between 0.986 and 2.095, which corresponds to 0.070 and 0.142 standard deviations. 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 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 0.218 and 0.566, 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). Following these results, Hypothesis 1B is supported by evidence that lower quarterly reporting levels lead to lower firm values.

[Tables 4 & 5 About Here]

### 5.3. Robustness

To test for the robustness of our results and to consider possible endogeneity concerns, we adopted a matched control sample approach. Table 6, panel A reports results of our information asymmetry measures bid–ask spread and price impact. While we no longer find significant results for the interaction term in the bid–ask spread regression, we now find a significant positive coefficient for the interaction term in the 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 a higher price impact relative to control group firms, which indicates higher information asymmetries. This result provides evidence in line with Hypothesis 1A.

Table 6, panel B shows the results for our valuation measures *MTB* and *Tobin's Q*. The interaction term is not statistically significant. While this might stem from the fact that there is simply no impact of mandatory reporting levels on firm value, there are at least two further explanations. First, the matching procedure has almost halved the sample size, which negatively affects the power of our statistical analysis. Second, as argued by Fu et al. (2012), market participants perceive an increase in reporting as a permanent change, whereas a reduction in reporting is often seen only as a temporal policy measure. Nevertheless, our results provide

some evidence of higher information asymmetries among firms that reduce their quarterly reporting level (Hypothesis 1A), but do not provide additional evidence of reduced firm value (Hypothesis 1B).

[Table 6 About Here]

#### 5.4. Information Environment

In this section, we more explicitly examine whether private information is an alternative to mandatory disclosure. Table 7 reports results of regressions for our information asymmetry measures as dependent variable in panel A and firm value measures as 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 no index membership (*NoIndex*). In panel A, we find that the coefficient of *QLevel*×*NoIndex* has a negative value of -0.023 for bid–ask spreads but is not statistically significant at conventional levels. For our second measure *price impact*, we find a negative effect of quarterly reporting level on *price impact* if the firm is not part of an index. The coefficient of *QLevel*×*NoIndex* has a value of -1.690 and is significant at the 10% level. Overall, there is weak evidence supporting the assumption that non-index firms suffer more from a poor information environment and therefore show stronger effects of lower quarterly reporting on information asymmetry relative to non-index firms.

Panel B shows results for the dependent variables *MTB* and *Tobin's Q*. First, in the regression with *MTB* as dependent variable, we find a weakly significant positive coefficient of 1.218 for the interaction term *QLevel*×*NoIndex*. Our results suggest that *MTB* decreases more severely for non-index firms if quarterly reporting level declines. Regarding our second measure of firm value, regressions with *Tobin's Q* as dependent variable provide similar results. The coefficient of *QLevel*×*NoIndex* is positive and weakly significant at the 10% level, suggesting that *Tobin's Q* decreases more for non-index firms if quarterly reporting level declines. Therefore, we find that second-tier stocks that have a poorer information environment 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. We therefore do not reject Hypothesis 2.

[Table 7 About Here]

Next we examine whether private information is an alternative to mandatory disclosure. Table 8 reports results of regressions for our information asymmetry measures as dependent variable in panel A and firm value measures as 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 (*Low\_MC*). In panel A, we find that the coefficient of  $QLevel \times Low\_MC$  has a value of -0.032 for *bid-ask spread* and is statistically significant at the 5% level. For our second measure *price impact*, we find a negative effect of quarterly reporting level on *price impact* if firms have below-average media coverage. The coefficient of  $QLevel \times Low\_MC$  has a value of -1.059, but is not significant at conventional levels. Overall, this is in line with the assumption that firms with worse media coverage suffer more from a poor information environment and therefore show stronger effects of lower quarterly reporting on information asymmetry relative to firms with a high amount of media coverage.

Panel B shows results for the dependent variables *MTB* and *Tobin's Q*. First, in our regression with *MTB* as dependent variable, we find a significant positive coefficient of 1.079 for the interaction term  $QLevel \times Low\_MC$ . Our results suggest that *MTB* decreases more severely for firms with a low extent of media coverage if quarterly reporting level declines. Regarding our second measure of firm value, regressions with *Tobin's Q* as dependent variable find similar results. The coefficient of  $QLevel \times Low\_MC$  has a value of 0.266 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 low extent of media coverage that have a poorer information environment show a consistent negative effect of quarterly reporting levels on firm value. We therefore do not reject Hypothesis 2.

Overall, we find significant effects for firms operating in a poor information environment. First, the observed capital market effects of quarterly reporting levels on information asymmetries and firm valuation are stronger for non-index firms. Second, we find that firms with below-average press coverage show negative effects for reduced levels of quarterly reporting on information asymmetry and firm valuation. Consequently, we cannot reject Hypothesis 2, and find that an increase in information asymmetry and the reduction in firm value are stronger for firms operating in a relatively poor information environment.

[Table 8 About Here]

## 6. 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. The evidence shows that information asymmetry increases and firm value decreases when quarterly reporting levels decrease. However, the increase in information asymmetry in the market is not the result of the deregulation as such, but most likely stems from the fact that the firms that are inherently more prone to the negative effects of information asymmetries have not taken the opportunity to report more. The analysis of a matched control sample provides some evidence that information asymmetry also increased because of the deregulation above and beyond these selection effects. Moreover, the reduction in firm value can be directly attributed to the policy change. We also find that firms with a poor information environment drive these effects, but reducing disclosure might be irrelevant for firms in a very good information environment. This suggests that the benefits of mandatory regulation for the average firm do not extend to all market participants.

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 to be a good proxy for the information flow 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, it is precisely these firms operating in a poor information environment that suffer negative effects of lower quarterly reporting levels. From the perspective of investor protection, regular and comprehensive reporting seems to be necessary for firms after all.



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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 comprehensive income and of cashflows
Descriptive Interim Management Statement	QLevel 1	Less than a condensed statement of financial positions, of comprehensive income and of cashflows

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.

**Table 1: Quarterly Reporting of Prime Standard Firms**

<i>year</i>	<i>N</i>	<i>QLevel=1 (%)</i>	<i>QLevel=2 (%)</i>	<i>QLevel=3 (%)</i>	<i>QLevel=4 (%)</i>	<i>Mean QLevel</i>
<i>2012–2015</i>	1,005	0.00%	0.00%	0.00%	100.00%	4.00
<i>2016</i>	239	8.37%	40.17%	7.11%	44.35%	2.87
<i>2017</i>	239	13.81%	44.77%	7.11%	34.73%	2.61
<i>2018</i>	257	15.18%	52.53%	3.89%	28.40%	2.45
<i>2019</i>	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. *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 cashflows. *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 2: Descriptive Statistics**

	<i>N</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>P25</i>	<i>P50</i>	<i>P75</i>
<i>SPREAD</i>	2.005	1.0019	1.4685	0.1906	0.5244	1.4016
<i>PI</i>	2.005	15.0368	191.5106	0.0183	0.2762	4.1536
<i>MTB</i>	2.005	3.4174	14.7238	1.1188	1.7928	3.0283
<i>TobinsQ</i>	2.005	1.8721	3.3804	1.0352	1.2832	1.8165
<i>Size</i>	2.005	5,033,659	13,400,000	122,744.7	457,292.3	2,391,526
<i>LnTurnover</i>	2.005	-6.9826	1.3620	-7.8058	-6.7855	-5.9747
<i>LnVolatility</i>	2.005	-4.1126	0.3026	-4.3108	-4.0904	-3.8914
<i>LnLeverage</i>	2.005	-1.0222	0.7817	-1.3737	-0.8258	-0.4578
<i>ROA</i>	2.005	0.2145	0.1181	0.0072	0.0369	0.0678
<i>LnGrowth</i>	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 3: Pearson (Upper Diagonal) and Spearman (Lower Diagonal) Correlation Coefficients**

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
<i>QLevel</i> [1]	1	0.0551	0.0278	0.0037	-0.0279	-0.0843	0.0247	0.0861	0.1082	0.0398	0.0056
<i>IA Spread</i> [2]	0.0286	1	0.7256	0.0582	0.0179	-0.5537	-0.5101	0.2998	-0.0253	-0.2305	-0.1457
<i>IA PI</i> [3]	0.0616	0.9822	1	0.0348	-0.0127	-0.1151	-0.1150	0.0887	0.0421	-0.0750	-0.0880
<i>V<sub>MTB</sub></i> [4]	-0.1382	-0.0651	-0.0953	1	0.8770	0.0691	-0.1704	0.0824	-0.2691	-0.1471	-0.1644
<i>V<sub>TobinsQ</sub></i> [5]	-0.1328	-0.0389	-0.0616	0.9397	1	0.0803	-0.1926	0.0874	-0.4686	-0.1337	-0.0998
<i>LnSize</i> [6]	-0.0989	-0.8814	-0.8954	0.1375	0.0853	1	0.3778	-0.3993	0.0934	0.1500	0.0451
<i>LnTurnover</i> [7]	0.0370	-0.7338	-0.7509	-0.0320	-0.0320	0.4630	1	0.0795	0.1430	0.0772	0.0826
<i>LnVolatility</i> [8]	0.0678	0.3907	0.3543	0.0175	0.0353	-0.3899	0.0550	1	-0.1320	-0.2855	-0.1266
<i>LnLeverage</i> [9]	-0.0587	-0.1531	-0.1481	-0.5751	-0.7458	0.1164	0.1582	-0.1179	1	0.0389	0.0585
<i>ROA</i> [10]	0.0379	-0.1618	-0.1502	0.1951	0.2863	0.0866	0.0508	-0.2281	-0.3594	1	0.4663
<i>LnGrowth</i> [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 hand-collected data from firms quarterly reports). *IASpread* 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<sub>Price Impact</sub>* is price impact calculated as the yearly median of the Amihud (2002) illiquidity measure. *V<sub>MTB</sub>* 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<sub>TobinsQ</sub>* 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 *IASpread*, *IA<sub>Price Impact</sub>* are multiplied by 100 for expositional purposes.

**Table 4: Information Asymmetry Models****Panel A: Bid-Ask Spread as Dependent Variable**

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

Variable	Pooled	Fixed Effects	2SLS
<i>QLevel</i>	-0.025** (-1.96)	-0.038*** (-2.67)	-0.037 (-1.50)
<i>LnSize</i>	-0.438*** (-10.12)	-0.316*** (-10.61)	-0.441*** (-10.19)
<i>LnTurnover</i>	-0.551*** (9.00)	-0.395*** (-10.65)	-0.552*** (-9.03)
<i>LnVolatility</i>	1.147*** (7.09)	0.695*** (6.63)	1.150*** (7.13)
<i>Fixed Effects</i>	<i>Index</i>	<i>Firm</i>	<i>Index</i>
<i>R</i> <sup>2</sup> (overall)	0.506	0.436	0.506
<i>R</i> <sup>2</sup> (within)		0.234	
<i>R</i> <sup>2</sup> (between)		0.373	
F-statistic/Wald Chi <sup>2</sup>	32.95	49.60	2659.16
<i>N</i>	2005	2005	2005

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

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

Variable	Pooled	Fixed Effects	2SLS
<i>QLevel</i>	-0.106 (-0.09)	-1.131 (-1.49)	1.054 (0.44)
<i>LnSize</i>	-20.714** (-2.39)	-7.198*** (-4.58)	-20.514** (-2.39)
<i>LnTurnover</i>	-26.646** (-2.12)	-13.259*** (-2.94)	-26.597** (-2.12)
<i>LnVolatility</i>	63.731* (1.92)	32.782** (1.96)	63.450* (1.92)
<i>Fixed Effects</i>	<i>Index</i>	<i>Firm</i>	<i>Index</i>
<i>R</i> <sup>2</sup> (overall)	0.039	0.023	0.039
<i>R</i> <sup>2</sup> (within)		0.012	
<i>R</i> <sup>2</sup> (between)		0.036	
F-statistic/Wald Chi <sup>2</sup>	1.84	6.99	61.33
<i>N</i>	2005	2005	2005

The sample includes 2,005 firm–year observations for the period 2012–2019. Information asymmetry is measured by *IASpread* or *IA<sub>Price Impact</sub>* 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 hand-collected data from firms’ quarterly reports). *IASpread* 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<sub>Price Impact</sub>* 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 *IASpread*, *IA<sub>Price Impact</sub>* 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 5: Firm Value Models****Panel A: Market-to-Book Ratio as Dependent Variable**

$$V_{MTB} = \alpha + \beta_1 QLevel_{it} + \beta_2 Size_{it} + \beta_3 LnTurnover_{it} + \beta_4 ROA_{it} + \beta_5 LnGrowth_{it} + \varepsilon_i$$

Variable	<i>Pooled</i>	<i>Fixed Effects</i>	<i>2SLS</i>
<i>QLevel</i>	1.016** (1.97)	0.986* (1.83)	2.095** (2.33)
<i>LnLeverage</i>	-5.033*** (-3.84)	-9.800 (-1.59)	-5.163*** (-3.84)
<i>ROA</i>	-11.492** (-2.06)	-22.106 (-1.03)	-12.070** (-2.11)
<i>LnSize</i>	2.500*** (2.51)	2.324 (1.54)	2.689*** (2.54)
<i>LnGrowth</i>	-6.576** (-1.94)	-5.379*** (-3.39)	-6.453** (-1.94)
<i>Fixed Effects</i>	<i>Index</i>	<i>Firm</i>	<i>Index</i>
$R^2$ (overall)	0.143	0.110	0.138
$R^2$ (within)		0.132	
$R^2$ (between)		0.112	
F-statistic or Wald Chi <sup>2</sup>	10.25	3.12	55.05
<i>N</i>	2005	2005	2005

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

$$V_{Tobin's Q} = \alpha + \beta_1 QLevel_{it} + \beta_2 Size_{it} + \beta_3 LnTurnover_{it} + \beta_4 ROA_{it} + \beta_5 LnGrowth_{it} + \varepsilon_i$$

Variable	Pooled	Fixed Effects	2SLS
<i>QLevel</i>	0.218** (2.09)	0.247* (1.76)	0.566*** (2.74)
<i>LnLeverage</i>	-2.047*** (-7.72)	-2.995** (-2.18)	-2.089*** (-7.61)
<i>ROA</i>	-3.031*** (-2.96)	-4.054 (-1.10)	-3.218*** (-3.08)
<i>LnSize</i>	0.647*** (3.14)	0.646 (1.49)	0.708*** (3.17)
<i>LnGrowth</i>	-0.653 (-1.32)	-0.423 (-1.42)	-0.614 (-1.27)
<i>Fixed Effects</i>	<i>Index</i>	<i>Firm</i>	<i>Index</i>
<i>R<sup>2</sup> (overall)</i>	0.286	0.240	0.275
<i>R<sup>2</sup> (within)</i>		0.242	
<i>R<sup>2</sup> (between)</i>		0.372	
F-statistic or Wald Chi <sup>2</sup>	46.37	3.31	246.67
<i>N</i>	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 hand-collected data from firms’ quarterly reports).  $V_{MTB}$  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 6: Matching Model****Panel A: Information Asymmetry Measures**

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

Variable	$IA_{Spread}$	$IA_{PI}$
<i>Post</i>	-0.029 (-0.33)	-5.785* (-1.19)
<i>Treat</i>	-0.066 (-0.85)	-6.682** (-1.99)
<i>Post</i> × <i>Treat</i>	0.065 (0.70)	7.369** (2.03)
<i>LnSize</i>	-0.196*** (-8.56)	-2.426*** (-3.41)
<i>LnTurnover</i>	-0.358*** (-10.39)	-5.419*** (-4.51)
<i>LnVolatility</i>	0.762*** (6.40)	16.597** (3.38)
$R^2$	0.689	0.184
F-statistics	44.91	7.45
<i>N</i>	1269	1269

**Panel B: Valuation Measures**

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

Variable	$V_{MTB}$	$V_{TobinsQ}$
<i>Post</i>	-5.027 (-1.17)	-0.939 (-1.20)
<i>Treat</i>	-4.292 (-0.93)	-0.611 (-0.73)
<i>Post</i> × <i>Treat</i>	2.968 (0.91)	0.502 (0.83)
<i>LnSize</i>	2.022 (1.37)	0.428* (1.67)
<i>LnLeverage</i>	-9.998* (-1.68)	-2.781* (-2.60)
<i>ROA</i>	-30.625 (-1.28)	-5.378 (-1.55)
<i>LnGrowth</i>	-20.789 (-1.32)	-2.712 (-1.20)
$R^2$	0.174	0.266
F-statistics	1.24	5.34
<i>N</i>	1269	1269

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  $IASpread$  or  $IAPrice Impact$ . 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.  $IASpread$  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.  $IAPrice Impact$  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  $IASpread$ ,  $IAPrice Impact$  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 7: Interaction Effect of Index Membership****Panel A: Information Asymmetry Measures**

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

Variable	<i>IASpread</i>	<i>IAPrice Impact</i>
<i>QLevel</i>	-0.049*** (-3.97)	-0.710 (-1.18)
<i>QLevel</i> × <i>NoIndex</i>	-0.023 (-1.23)	-1.690* (-1.63)
<i>LnSize</i>	-0.310*** (-10.24)	-7.451*** (-4.49)
<i>LnTurnover</i>	-0.388*** (-10.08)	-13.567*** (-2.93)
<i>LnVolatility</i>	0.696*** (6.66)	32.71* (1.96)
<i>Fixed Effects</i>	<i>Firm</i>	<i>Firm</i>
<i>R</i> <sup>2</sup> (overall)	0.437	0.023
<i>R</i> <sup>2</sup> (within)	0.236	0.013
<i>R</i> <sup>2</sup> (between)	0.372	0.037
F-statistics	50.60	15.49
<i>N</i>	2005	2005



**Panel B: Valuation Measures**

$$V_{MTB, Tobin's Q} = \alpha + \beta_1 QLevel_{it} + \beta_2 QLevel \times NoIndex \\ + \beta_3 Size_{it} + \beta_4 LnTurnover_{it} + \beta_5 ROA_{it} + \beta_6 LnGrowth_{it} + \varepsilon_i$$

Variable	$V_{MTB}$	$V_{Tobin's Q}$
<i>QLevel</i>	0.816* (1.85)	0.202* (1.81)
<i>QLevel</i> × <i>NoIndex</i>	1.218* (1.79)	0.307* (1.72)
<i>LnLeverage</i>	-9.862 (-1.60)	-3.011** (-2.18)
<i>ROA</i>	-21.688 (-1.02)	-3.945 (-1.09)
<i>LnSize</i>	2.385 (1.56)	0.662 (1.51)
<i>LnGrowth</i>	-5.382*** (-3.38)	-0.423 (-1.42)
<i>Fixed Effects</i>	<i>Firm</i>	<i>Firm</i>
$R^2$ (overall)	0.116	0.249
$R^2$ (within)	0.133	0.244
$R^2$ (between)	0.118	0.258
F-statistics	2.64	3.06
<i>N</i>	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 hand-collected data from firms' quarterly reports). The variable *NoIndex* 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 8: Interaction Effect of Media Coverage****Panel A: Information Asymmetry Measures**

$$IA_{Spread, Price Impact} = \alpha + \beta_1 QLevel_{it} + \beta_2 QLevel \times Low\_MC + \beta_3 Size_{it} + \beta_4 LnVolatility_{it} + \beta_5 LnTurnover_{it} + \varepsilon_i$$

Variable	<i>IASpread</i>	<i>IAPrice Impact</i>
<i>QLevel</i>	-0.069** (-2.25)	-1.534** (-2.03)
<i>QLevel</i> × <i>Low_MC</i>	-0.032** (-2.14)	-1.059 (-1.27)
<i>LnSize</i>	-0.318*** (-10.65)	-7.216*** (-4.60)
<i>LnTurnover</i>	-0.394*** (-10.65)	-13.249*** (-2.94)
<i>LnVolatility</i>	0.696*** (6.64)	32.794** (1.96)
<i>Fixed Effects</i>	<i>Firm</i>	<i>Firm</i>
<i>R</i> <sup>2</sup> (overall)	0.425	0.012
<i>R</i> <sup>2</sup> (within)	0.234	0.013
<i>R</i> <sup>2</sup> (between)	0.360	0.035
F-statistics	40.37	5.70
<i>N</i>	2005	2005

**Panel B: Valuation Measures**

$$V_{MTB, \text{ Tobin's } Q} = \alpha + \beta_1 QLevel_{it} + \beta_2 QLevel \times Low\_MC + \beta_3 Size_{it} + \beta_4 LnTurnover_{it} + \beta_5 ROA_{it} + \beta_6 LnGrowth_{it} + \varepsilon_i$$

Variable	$V_{MTB}$	$V_{Tobin's Q}$
<i>QLevel</i>	0.465 (0.84)	0.137 (0.84)
<i>QLevel</i> × <i>Low_MC</i>	1.079* (1.91)	2.663* (1.86)
<i>LnLeverage</i>	-9.838 (-1.60)	-3.003** (-2.19)
<i>ROA</i>	-22.307 (-1.02)	-4.096 (-1.12)
<i>LnSize</i>	2.286 (1.56)	0.638 (1.47)
<i>LnGrowth</i>	-5.364*** (-3.39)	-0.420 (-1.42)
<i>Fixed Effects</i>	<i>Firm</i>	<i>Firm</i>
$R^2$ (overall)	0.113	0.245
$R^2$ (within)	0.133	0.242
$R^2$ (between)	0.115	0.256
F-statistics	2.66	2.82
<i>N</i>	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 hand-collected data from firms' quarterly reports). The variable *Low\_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.