Synchronicity and Stock Price Informativeness: Evidence from the European Union's Transparency Directive

Michael Imhof
Barton School of Accountancy
Wichita State University,
1845 Fairmount St., Wichita, KS 67260
E-mail: michael.imhof@wichita.edu
Phone: +1 (316) 978-6021

Semih Tartaroglu*
Barton College of Business
Wichita State University,
1845 Fairmount St., Wichita, KS 67260
E-mail: semih.tartaroglu@wichita.edu
Phone: +1 (316) 978-7124

Olena Watanabe
College of Business,
Iowa State University
2167 Union Dr., Ames, IA 50011
E-mail: watanabe@iastate.edu
Phone: +1 (515) 294-7908

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Abstract: We examine changes in synchronicity surrounding the European Union's (EU) Transparency Directive (TPD), which aimed to enhance corporate transparency through more timely financial disclosures. We exploit this exogenous regulatory event, implemented by EU countries at different times between 2007 and 2009, and document a significant decrease in synchronicity following implementation of the TPD. We additionally find that the decrease in synchronicity was most pronounced in countries with strong regulatory environments. Our findings suggest that the TPD improved firm transparency, leading to greater firm-information in EU stock prices, and lend support the use of synchronicity as a measure of stock price informativeness.

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**corresponding author*

Price Informativeness, Transparency Regulation, and Stock Return Synchronicity: Evidence from the European Union's Transparency Directive

1. Introduction

The relative amount of firm-specific and market-wide information impounded into stock prices affects the extent to which prices move together, and measures of return synchronicity (i.e., the co-movement of stock returns with market returns, as measured by R^2) have been employed widely in research examining the role of firm transparency and financial development on stock price informativeness (e.g., Roll 1988; Durnev et al. 2003; Jin and Myers, 2006). The conventional view suggests that low synchronicity reflects greater amounts of firm-specific information in stock prices, and is supported by past literature investigating how firms' information environments and country-level institutions impact price informativeness. For instance, Morck, Yeung, and Yu (2000) attribute country-level differences in synchronicity to the degree to which regulations promote arbitrage that capitalizes on firm-specific information. Li *et al*. (2004) find that capital market openness relates to lower synchronicity. Alternatively, Jin and Myers (2006) attribute differences in cross-country synchronicity to variations in the lack of transparency between managers and investors. Other studies document a negative association between synchronicity and disclosure/transparency (e.g., Ferreira and Laux, 2007; Gul, Kim, and Qui, 2010; Gul, Srinidhi, and Ng, 2011; Kim and Shi, 2012), earnings management (Hutton, Marcus, and Tehranian, 2009), and analyst following (Piotroski and Roulstone, 2004; Chan and Hameed, 2006; Crawford, Roulstone, and So, 2012).

Despite the widespread use of synchronicity as a measure of the informativeness of stock prices, other studies find that low synchronicity is associated with firm characteristics indicative of a poor information environment. For example, low synchronicity has been found to be associated with greater information asymmetry, lower liquidity, and lower earnings quality (e.g.,

Teoh, Yang, and Zhang, 2009; Li, Rajgopal, and Vekatachalam, 2014; Kelly, 2014). Thus, there exists a lack of consensus among academic researchers regarding the appropriateness of relating stock price synchronicity to stock price informativeness (Gassen, Skaife, and Veenman, 2016).

Our study seeks to contribute to the debate of whether market model R2s are adequate proxies for measuring stock price informativeness. To do so, we examine changes in synchronicity surrounding a key piece of financial reporting legislation in the European Union (EU), known as the Transparency Directive (TPD). The TPD, which was passed into law in 2004 and implemented by EU member states at different times between 2007 and 2009, was adopted as a normative initiative aimed at enhancing investor protection and transparency across EU capital markets.[1] To accomplish its goals, the TPD imposed new disclosure requirements, harmonized enforcement of existing disclosure requirements, and facilitated the dissemination of financial reports (Christensen, Hail, and Leuz, 2016). The heterogeneous country-level implementation and progressive nature of the TPD presents a unique and exogenous setting in which to examine the relation between synchronicity and stock price informativeness. In a recent paper, Christensen, et al. (2016) document improved liquidity for EU public companies post-TPD, suggesting that the TPD's transparency goals were at least partially realized. Given their findings, we expect that the TPD will be associated with decreased synchronicity post-implementation, which would lend weight to arguments in prior studies linking low synchronicity to more informative stock prices.

To assess changes in synchronicity and surrounding the TPD, we analyze a sample of 5,205 unique firms from 25 EU countries over the 2001–13 period. We find that synchronicity in EU capital markets generally declined following implementation of the TPD. The decrease in

[1] Although TPD was adopted by the European Commission in 2004, it was implemented by the regulatory authorities of the EU member countries at various dates between 2007 and 2009. We use the terms "adoption," "implementation," and "entry into force" interchangeably to refer to the latter.

synchronicity is significant even after controlling for the strength of country-specific securities law prior to implementation, though we find, in line with prior research, that the TPD was associated with a greater decrease in synchronicity in countries with stronger securities laws.[2] The results of our synchronicity tests are robust to several sensitivity tests. These include the exclusion of UK firms, which account for the largest number of observations in our sample; the use of a post–International Financial Reporting Standards (IFRS), post–Market Abuse Directive (MAD) period restriction; the inclusion of firm fixed effects in our empirical models; the inclusion of a control for the degree of reporting opacity (accrual quality), which has been found to be associated with greater stock price informativeness (Hutton, Marcus, and Tehranian, 2009); and to controlling for firm liquidity, which Gassen et al. (2016) suggest can confound tests associating low synchronicity to higher firm-specific information in securities prices.

In an additional test of synchronicity, we expand our sample period to 2015 and examine whether a 2013 amendment to the TPD, which removed quarterly reporting requirements, significantly affected synchronicity after it was adopted. We document a significant increase in synchronicity after 2014, suggesting that the decision by the EU to remove quarterly reporting requirements may have been premature from the public information-flow perspective. We infer that lower synchronicity post-TPD is representative of more informative stock prices.

We contribute to several areas of research. First, our study provides evidence supporting the use of synchronicity as a measure of stock price informativeness. Market model R^2s have been used extensively as a proxy for measuring relative amounts of firm and market information in stock prices (e.g., Roll, 1988; Morck, Yeung, and Yu, 2000; Durnev, Morck, and Yeung, 2004; Jin and Myers, 2006). However, low synchronicity has also been shown to be associated with

[2] Institutional factors have been shown to influence the efficacy of securities and financial regulations (La Porta, Lopez-de-Silanes, and Shleifer, 2006; Christensen, Hail, and Leuz, 2013).

common measures of opacity, such as low disclosure and poor earnings quality (e.g., Bartram, Brown, and Stultz, 2009; Teoh, Yang, and Zhang, 2009). Our results support the view that low synchronicity represents greater firm-specific information in stock prices.

Second, we contribute to empirical research highlighting a negative association between changes in accounting standards and synchronicity. Kim and Shi (2012) and Barth *et al*. (2013), for example, document decreased synchronicity after voluntary adoption of IFRS. Their findings, however, may not generalize to scenarios where transparency regulations are mandated, since the voluntary adoption of IFRS can be viewed as a strategic decision by management wanting to improve firm transparency. Furthermore, firms that stand to benefit from adoption are the most likely to change standards, which can introduce selection bias into statistical tests (Kim and Shi, 2012). Wang and Yu (2015) investigate the relation between both voluntary and mandatory adoption of IFRS and synchronicity, and they find that synchronicity generally improves post-adoption but only so in countries with strong legal environments prior to adoption.

Relatedly, we improve on prior research investigating the role of transparency laws in the dissemination of corporate financial information. Leuz and Wysocki (2016) argue that a potential shortcoming of prior studies investigating the information effects of transparency regulations is the difficulty of ascribing changes in firms' financial information environments to the regulations of interest, as concurrent regulations or other institutional or economic developments may confound causal inferences (Daske *et al*., 2008; Christensen, Hail, and Leuz, 2016). Changes in synchronicity surrounding implementation of the TPD are not likely to have been caused by unrelated, homogenous shocks to capital markets, and should be considered exogenous, as it was enacted several years prior to formal implementation (Christensen et al., 2016). Moreover, while the window of time in which the TPD entered into force was relatively short, each country

undertook its own, sometimes lengthy, legislative processes necessary to ensure effective application of the TPD's provisions. These processes led to staggered implementation across EU financial markets (Christensen et al., 2016).

Third, our study complements research suggesting that financial reporting and disclosure laws can improve informational efficiencies in financial markets. Securities regulations are integral to efficient capital markets and are the channel through which financial reporting and disclosure improve corporate information flows (Coffee, 1984; Levitt, 1998; Bushee and Leuz, 2005). Supporters of transparency regulations argue that proprietary costs, the costs of information production, and agency costs, entice managers to report financial information voluntarily only to a partial extent, and they often strategically bias their disclosures (e.g., Coffee, 1984; Shin, 2003; Zingales, 2009; Goto, Watanbe, and Xu, 2009).[3] Consequently, without transparency regulations, financial markets will not function efficiently (Hart, 2009; Honigsberg, Jackson, and Wong, 2015). Our findings lend support to this position, as we provide empirical evidence that the TPD resulted in greater price informativeness for EU public companies.

The remainder of the paper is arranged as follows. In the next section, we discuss specific elements of the TPD, briefly expand on our discussion of prior research identifying regulatory determinants of stock price informativeness, and develop our testable hypotheses. In Section 3, we describe our data sources and sample construction. In Section 4, we outline our research design and present our empirical models. In Section 5, we discuss our main results and the results of additional analyses, and in Section 6, we conclude the paper.

[3] Extant theory argues that there is a firm-specific optimal level of voluntary disclosure due to the costs of information production and dissemination (Admati and Pfleiderer, 2000) and proprietary costs of competition (Verrecchia, 1983). Managers may also limit voluntary disclosure in order to conceal consumption of firm resources for personal benefit (Hope and Thomas, 2008). Importantly, voluntary disclosure does not maintain a level of credibility comparable to mandatory disclosure (Gigler *et al*., 2014).

2. Background and Hypotheses Development

2.1 Synchronicity and Stock Price Informativeness

[synthesize Gassen et al. and FM paper]-make sure to mention liquidity issue…

2.2. Transparency Regulation, Financial Reporting, and Stock Price Informativeness

Financial reporting and disclosure mandates have been increasingly adopted worldwide in an effort to "incentivize desirable behaviors and discourage undesirable ones" (Leuz and Wysocki, 2016, p. 527). The case for transparency regulation generally follows the logic that mandated reporting and disclosure can limit market failure by reducing information asymmetries between informed and uninformed investors (e.g., Coffee, 1984; Honigsberg, Jackson, and Wong, 2015). These arguments are based on the premise that corporate information is a social good that, if provided abundantly, reduces financial information production and acquisition costs (e.g., Coffee, 1984; Lambert, Leuz, and Verrecchia, 2007; Hart, 2009; Bushman and Landsman, 2010).[4] However, supporters of transparency regulation often do not explicitly consider its costs, and there exists a lack of consensus among researchers on the benefits of expanding mandatory reporting and disclosure (see Bushman and Landsman, 2010; Lenkey, 2014; Leuz and Wysocki, 2016). Opponents argue that transparency regulations may be unnecessary, as forces of competition incentivize managers to disclose fully and voluntarily all financial information (see, e.g., Grossman and Hart, 1980; Milgrom 1981; Easterbrook and Fischel, 1984). However, disclosure can reveal proprietary information to competitors, which may dissuade some firms from voluntarily disclosing altogether (Verrecchia, 1983).[5]

To date, empirical evidence suggests that transparency regulations can significantly improve market efficiencies (e.g., Chow, 1983; Jarrell, 1981; Simon, 1989). For example, prior

[4] While voluntary disclosure may also provide such benefits, extant theory argues that there is a firm-specific optimal level of voluntary disclosure that, due to the costs of information production and dissemination as well as the costs of divulging propriety information to competitors, may vary widely across firms and not adequately protect less-informed investors or ensure efficient financial markets (Verrecchia, 1993; Admati and Pfleiderer, 2000).

[5] Highlighting the role of proprietary costs, prior research documents considerable variation in voluntary disclosure policies (e.g., Lang and Lundholm, 1996). Additionally, disclosure has been found to be lacking for firms facing intense product market competition and those in high-litigation industries (Bamber and Cheon, 1998; Seavey, Imhof, and Watanabe, 2017).

research documents a decline in bid-ask spreads and increased investor trading following implementation of Reg FD, which prohibited selective dissemination of financial information in the US (e.g., Bushee, Matsumoto, and Miller, 2004; Eleswarapu, Thompson, and Venkataraman, 2004). Other studies document information benefits such as a decline in earnings management and an increase in accounting conservatism following adoption of the Sarbanes-Oxley Act (SOX) in 2002 (e.g., Lobo and Zhou, 2006; Cohen, Dey, and Lys, 2008).[6] Outside the US, a handful of studies examine how the adoption of IFRS impacted information-related attributes such as cost of capital and liquidity (e.g., Li, 2010; Christensen, Hail, and Leuz, 2013), while Christensen, Hail, and Leuz (2016) examine the effects of the TPD on liquidity. However, we are aware of only two studies that directly assess stock price informativeness following changes in transparency regulation, and these focus only on mandatory adoption of IFRS. Beuselinck *et al*. (2009) document an initial decrease in synchronicity after adoption of IFRS and a subsequent increase in synchronicity in later years. They interpret these findings as an indication that IFRS reduced uncertainty surrounding future disclosures, a reasonable assertion given the finding by Wang (2014) that mandatory IFRS adoption increased comparability of financial reports. Wang and Yu (2015) also provide evidence that mandatory adoption of IFRS resulted in a significant decrease in synchronicity, but only in countries where securities laws and enforcement mechanisms were already strong.

Prior research offers several reasons why transparency regulations may affect the co-movement of stock prices. Grossman and Stiglitz (1980) present a theory of imperfect markets under the condition of costly information acquisition. Because investors incur costs for *acquiring*

[6] The US is generally viewed as having a nearly frictionless financial market, with relatively higher quality of disclosures, and therefore it is not clear if the findings of research using only US data generalize to countries with heterogeneous regulatory and legal systems.

corporate information, absent regulations mandating financial reporting and disclosure, stock prices may not reflect all relevant information, and private information acquirers will benefit at the expense of less-informed investors. Improvements in firms' information environments, such as would be expected from effective financial reporting and disclosure regulation, decrease the costs of information acquisition and improve the information sets of less-informed investors. The result is an increased availability of firm-specific information, leading to better resource allocation (and, conceivably, lower synchronicity).

Similarly, when the costs of *producing* financial information are high, the availability of corporate information may also be limited. For example, Coffee (1984) suggests that in a limited-disclosure environment, analysts will not enjoy the "full economic value" of their research because it will eventually be leaked to non-paying investors. Knowing this, Veldkamp (2006) predicts that analysts will be selective in their research, producing reports based primarily on market information, which can lead to greater co-movement of prices. Her reasoning suggests that transparency laws that force all firms to provide information (assuming it is credible) reduce the costs of information production, incentivizing analysts to provide more firm-specific information. We infer from her arguments that transparency regulation can improve price efficiencies in capital markets and thus reduce co-movements in stock returns.

2.3. Transparency Directive

The TPD is one of four core directives aimed at enhancing financial transparency across European financial markets, following the Financial Services Action Plan of 1999 and the implementation of the Lamfalussy Process, which oversees the formation of securities laws in the EU. Adopted in May of 2004, the TPD revises and replaces Directive 2000/34/EC, which governed

the admission of securities to official stock exchange listings.[7] One of the objectives of the TPD is to clarify and facilitate enforcement of existing requirements for the disclosure of periodic and ongoing information by public companies trading on EU exchanges. In the view of the European Commission:

> The disclosure of accurate, comprehensive and timely information about security issuers builds sustained investor confidence and allows an informed assessment of their business performance and assets. This enhances both investor protection and market efficiency[.] . . . To that end, security issuers should ensure appropriate transparency for investors through a regular flow of information. (Directive 2004/109/EC, 2004, paras. 1, 2)

To accomplish its goals, the TPD outlines annual reporting requirements, which had previously been guided either by country law or specific EU regulations, and introduces additional quarterly disclosures in the form of an interim management statement, which complements semi-annual and annual financial reports (PwC, 2007). The interim reports, issued within six weeks of the end of the first and third fiscal quarters, must explain "material events and transactions that have taken place during the relevant period and their impact on the financial position of the issuer" as well as "a general description of the financial position and performance by the issuer . . . during the relevant period" (Directive 2004/109/EC, 2004, Article 6.1). Importantly, for annual and semi-annual reporting, the TPD requires that "persons responsible" must make a statement that financial reports "give a true and fair view of assets, liabilities, financial position and profit or loss of the issuer . . . together with a description of principal risks and uncertainties that they face" (Directive

[7] There are three other regulations, which were passed in the EU following the initiation of the Financial Services Action Plan of 1999 that became the core Lamfalussy Directives related to securities regulation (see Financial Services, 1999). The MAD deals with insider trading and market manipulations. We control for the MAD in our multivariate analyses. The Prospectus Directive (PD) was adopted in 2005 and concerns issues of securities. Member states of the EU had to implement the PD into national law by July 1, 2005. As a sensitivity test, we examine the effect of the TPD on stock price synchronicity in the period from 2006 to 2010, effectively excluding the pre-PD period. Our results are not affected by this alternative sample. Finally, the Markets in Financial Instruments Directive was passed in 2007 with the purpose of increasing competition and consumer protection in the investment services industry. This regulation seems of little relevance to the firms in our study, as we remove financial-industry firms from our sample.

2004/109/EC, 2004, Articles 4[c] and 5[c]). These assessments are reminiscent of similar requirements for US firms required by the SOX.

The TPD also revises disclosure requirements for the release of information on major holdings of voting rights. Other notable changes in financial reporting include a statement by company executives or directors about the fairness of financial information presented in their reports, and the release of a company's annual report no later than four months after its fiscal-year end (FYE) (Directive 2004/109/EC, 2004). Additionally, the TPD harmonizes enforcement of financial reporting and disclosures by specifying that a competent and independent authority be created in each country to supervise compliance with the directive's provisions (Directive 2004/109/EC, 2004). Finally, to aid in the dissemination of corporate financial information, the TPD calls for the development and maintenance of an EDGAR-like portal through which investors can easily access financial reports (Christensen, Hail, and Leuz, 2016). Overall, the TPD represents a significant shift in the transparency requirements for public companies in the EU.

2.3. Hypotheses

Given that the goal of the TPD is to improve the dissemination of firm information and improve investor protection in EU financial markets, and motivated by theory suggesting that improvements in firm transparency will result in higher price informativeness (measured as low synchronicity), we predict that stock price informativeness (return synchronicity) will be significantly higher (lower) post-TPD. We state our first hypothesis, in alternative form:

> H1: Stock return synchronicity will be significantly lower in EU financial markets following implementation of the Transparency Directive.

H1 assumes that low synchronicity represents greater stock price informativeness, and thus constitutes a dual hypothesis.

Prior studies suggest that institutional factors, such as the degree to which legal systems protect minority shareholders (Morck, Yeung, and Yu, 2000; Ball, Kothari, and Robin, 2000; La Porta, Lopez-de-Silanes, and Shleifer, 2006) and the strength of existing securities laws (Bhattacharya and Daouk, 2009; Li, 2010; Hail and Leuz, 2006), facilitate implementation of new transparency initiatives. We therefore additionally consider the strength of each member state's regulatory environment in determining the efficacy of the TPD after implementation. Our expectation is that decreases in synchronicity associated with the TPD will be more pronounced in countries with stronger regulatory environments. We present our second hypothesis, in alternative form, below. As with H1, H2 constitutes a dual hypothesis.

> H2: Stock return synchronicity will be significantly lower in EU financial markets following implementation of the Transparency Directive, more so in countries with strong securities regulations than in countries with weak securities regulations.

3. Data, Sample, and Research Design

3.1. Data Sources and Sample Construction

Our sample spans the years 2001–13 and consists of all EU firms for which synchronicity can be computed using quarterly stock return data from the Compustat Global Daily Security files.[8] We merge firms with data necessary to calculate synchronicity with firms in the Compustat Global Annual file that have non-missing and positive data for assets, revenues, and owners' equity. We extract analysts' forecast data from I/B/E/S and macroeconomic indicators from the World Bank.[9]

Similar to prior studies, we exclude firms with market values of equity less than US $1 million (see, e.g., Fernandes and Ferreira, 2008; Christensen, Hail, and Leuz, 2016).[10] Further, we

[8] Our sample includes Iceland and Norway, which are not EU countries but which have agreed to adopt the TPD in order to gain access to the single European Market.
[9] Various economic indicators are publicly available at http://data.worldbank.org/topic.
[10] Size restriction helps us to reduce the likelihood that smaller firms trading on unregulated markets affect our results. Christensen, Hail, and Leuz (2016) remove firms with a market value of equity less than $5 million. Our results are not affected by this alternative restriction.

delete observations with missing control variables and firm-quarter observations from financial industries (SIC 6000 to 6999). Because they are subject to stringent reporting requirements in the US, we follow prior studies and remove American depositary receipt (ADR) firms from our sample (see Coffee, 2002; Karolyi, 2006; Jin and Myers, 2006).[11] We require at least four observations per unique firm, similar to Christensen, Hail, and Leuz (2016). Our final sample consists of 131,641 firm-quarter observations relating to 5,205 unique firms from 25 EU countries during 2001–13. In an additional test, we use a sub-period of years, 2014–15, to examine the effects of an amendment to the TPD that, starting in 2014, stipulated that firms were no longer required to file quarterly management reports (see Directive 2013/50/EU, 2013).

Table 1, Panel A, reports our sample composition by country, including country-specific entry-into-force dates. The number of firm-quarter observations in the final dataset ranges from 39 in the Czech Republic to 38,385 in the UK. Table 1, Panel B, shows that although there is a higher coverage of firms in the sub-sample period of 2007 through 2013, the number of firms by year is generally consistent over the 2001–13 period. The number of firms by quarter is also relatively consistent. The Czech Republic, Estonia, and Iceland have the smallest representations in our sample, while the UK, France, and Germany have the largest.

[Insert Table 1 here]

3.2. Empirical Model for Tests of H1 and H2

To examine the relation between implementation of the TPD and firm stock price informativeness (H1), we estimate the following model:

$$Synch = \beta_0 + \beta_1 TPD + \sum \beta_j Controls_j + \sum \beta_k Fixed\ Effects_i + \varepsilon \quad (1)$$

[11] We collect ADR firms from the BNY Mellon Depositary Receipts public database. This database provides ADR records from BNY Mellon, Citibank, Computershare Trust Co., and J.P. Morgan Chase at http://www.adrbnymellon.com/dr_directory.jsp.

In Equation (1), the dependent variable *Synch* is based on the R^2 from a market model of firm returns on industry and market returns. *TPD* is an indicator variable for each country's TPD adoption date, defined below. $Controls_j$ is a vector of control variables, which we discuss below in detail. $Fixed\ Effects_i$ represents country, industry, and quarter-year fixed effects, meant to capture time-invariant heterogeneity across countries and industries (SIC two-digit) and to control for economic shocks that may confound our causal inferences. Fixed effects also control for correlated omitted variables, which do not vary across countries, industries, or time, respectively. In all regressions, we report robust standard errors clustered at the firm level, to account for correlation of residuals across quarter-years by firm (Petersen, 2009).[12] H1 predicts that stock price informativeness will be significantly higher following implementation of the TPD. Thus, we expect β_1 to be statistically significant and less than zero.

To examine the relation between implementation of the TPD and stock price informativeness conditional on the strength of country-level securities regulations prior to implementation (H2), we estimate the following model:

$$Synch = \beta_0 + \beta_1 TPD + \beta_2 Reg\_strong + \beta_3 TPD \times Reg\_strong + \sum \beta_j Controls_j + \sum \beta_k Fixed\ Effects_i + \varepsilon \quad (2)$$

In Equation (2), all variables are defined as above, and *Reg_strong* is a measure of the strength of a country's securities regulations prior to implementation of the TPD, relative to other EU countries (detailed below). H2 predicts that stock price informativeness will be highest post-TPD for firms trading in countries with strong securities laws. Thus, we expect β_3 to be statistically significant and less than zero.

[12] Although there may also be a time effect present in our dataset, Petersen (2009, p. 460) states that the consistency of the clustered standard error depends on having a sufficient number of clusters: "When there are only a few clusters in one dimension, clustering by the more frequent cluster yields results that are almost identical to clustering by both firm and time." Similar reasoning applies to our preference for clustering on the firm level instead of the country level.

3.3. Synchronicity Measure

To measure stock return synchronicity, we follow previous studies (e.g., Durnev *et al*., 2003; Hutton, Marcus, and Tehranian, 2009). Specifically, we use two alternative specifications of synchronicity, calculated quarterly. First, we regress daily firm returns on the current and lagged value-weighted daily market return as follows:

$$Ret_{i,t} = \alpha_0 + \alpha_1 Mkt\_Ret_t + \alpha_2 Mkt\_Ret_{t-1} + \varepsilon_{i,t} \quad (3)$$

In Equation (3), *t* refers to trading day, and *Ret* is the daily return for firm *i*, adjusted for cash distributions and reinvestment of dividends. For each firm *i*, we require at least 20 daily returns per quarter to maximize observations from smaller EU countries. *Mkt_Ret* is the daily value-weighted market return, computed using all firms in the market, excluding firm *i*. For our second measure, we expand Equation (3) to include industry returns, as follows:

$$Ret_{i,t} = \alpha_0 + \alpha_1 Mkt\_Ret_t + \alpha_2 Mkt\_Ret_{t-1} + \alpha_3 Ind\_Ret_t + \alpha_4 Ind\_Ret_{t-1} + \varepsilon_{i,t} \quad (4)$$

In Equation (4), *Ret* and *Mkt_Ret* are as previously defined, and *Ind_Ret* is the daily value-weighted industry return, calculated for all firms in firm *i*'s two-digit industry, excluding firm *i*.[13]

Stock return synchronicity is represented by the coefficients of determination R^2_1 (*Rsq1*) and R^2_2 (*Rsq2*), obtained by estimating Equations (3) and (4), respectively. Following prior studies, we calculate our dependent variables *Synch1* and *Synch2* as $ln\left(\frac{Rsq1}{1-Rsq1}\right)$ and $ln\left(\frac{Rsq2}{1-Rsq2}\right)$. Natural logarithm transformation changes the measures, which are bounded between zero and one, into continuous and more normally distributed variables (Morck, Yeung, and Yu, 2000). Higher values of both *Synch1* and *Synch2* imply greater co-movement of returns and therefore lower firm-specific information in stock prices.

[13] The exclusion of firm *i* from market- and industry-wide returns prevents spurious correlations between firm returns and market or industry returns (Durnev *et al*., 2003). We include lagged *Mkt_Ret* and *Ind_Ret* following Piotroski and Roulstone (2004), who argue that firm information may be incorporated into prices with a delay.

In Table 2, we present the average values of *Synch1*, *Synch2*, *Rsq1*, and *Rsq2*, by country. Focusing on *Rsq2* and *Synch2*, values of *Rsq2* are generally consistent with prior literature (e.g., Durnev, Morck, and Yeung, 2004). For instance, the highest mean values of *Rsq2* are exhibited by Iceland (0.34), the Czech Republic (0.33), and Luxembourg (0.28), while the lowest mean values of *Rsq2* are exhibited by Germany and the UK (0.12), followed by France and Ireland (0.13). Mean *Synch2* values range from a high of –0.75 for the Czech Republic to a low of –2.44 for Germany. Of note, overall, mean (median) values of *Synch1* and *Synch2* are close, suggesting a low degree of skewness in our dependent variables.

[Insert Table 2 here]

3.4. TPD Test Variable

TPD is a binary indicator variable coded one if the FYE date for a firm is on or after the quarter during which the TPD comes into force in its country, zero otherwise. While the TPD was adopted in 2004, its implementation dates were staggered across EU member states. The dates vary from January 2007 (Germany, Bulgaria, Romania, and the UK) to August 2009 (Italy and the Czech Republic). Table 1, Panel C, reports frequencies of quarterly adoption dates during the TPD implementation phase. Nearly half, that is, 47.2%, of adoptions took place within the first quarter of 2007, while the remaining adoptions spanned the rest of 2007, 2008, and 2009.

Differences in implementation dates allow us to isolate the TPD's effect from other regulations with a common adoption date. They also help control for economic events affecting all or most EU member countries simultaneously, such as the financial crisis of 2008. We obtain TPD entry-into-force dates from Christensen, Hail, and Leuz (2016) and use the firm FYE date as a cutoff, as quarterly reporting in the EU was not mandatory before the TPD. This allows sufficient

time for changes in firm information to be reflected in financial reports.[14] Figure 1 provides the example of *TPD* variable coding for German companies. Depending on a given firm's FYE, the *TPD* indicator is assigned a value of one on and after either March 30th, June 30th, or December 31st of 2007.

[Insert Figure 1 here]

3.5. Regulatory Strength Variables

To test H2, we draw on Christensen, Hail, and Leuz (2016) and use three measures to estimate the strength of country-level securities regulations in place prior to TPD adoption. The first measure is the *Regulatory_quality* index from Kaufmann, Kraay, and Mastruzzi (2009). Regulatory quality measures the "ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development" (Kaufmann, Kraay, and Mastruzzi, 2009, p. 6). The second measure is *Supervisory_staff*, which captures the number of full-time employees working for the supervisory authority in charge of securities regulation, scaled by the number of listed companies in a given country.[15] Jackson and Roe (2009, p. 210) argue that "greater staffing allows the regulator to examine the allegations of wrongdoing, to write its rules carefully, to conduct market surveillance and review filings, and to act more often to remedy, prevent, and punish wrongdoing." Thus, a larger supervisory staff implies a stronger intensity of public enforcement of securities regulation. The third measure of regulatory quality, *Staff_growth*, is the percentage change in full-time employees working for the country's securities regulator from 2004 to 2009. Each regulatory quality measure is defined as a binary variable coded

[14] In untabulated tests, we re-estimate the effect of the TPD on synchronicity using an alternative specification of *TPD*, which is coded one starting at the end of the calendar quarter that the directive goes into effect. Our results are similar to those reported in Section 5.

[15] Dubois, Fresard, and Dumontier (2014) utilize a similar measure of regulation in their investigation of analyst recommendations surrounding implementation of the MAD.

one if the country is above the full sample median, zero otherwise. To obtain an overall measure of regulatory quality, we sum the scores of the three regulatory quality dummies and code *Reg_strong* one if the total score is two or three, zero otherwise.[16] Table 1, Panel A, lists values of the regulatory quality dummies and *Reg_strong*, by country.

3.6. Control Variables

We include an extensive set of control variables shown in prior literature to explain the co-movement of stock prices with the market. Following Chan and Hameed (2006), we control for firm size (*ln_Mkt_value*), calculated as price per share in US dollars, multiplied by the number of shares outstanding at the end of the given quarter-year. Because market-wide returns are value weighted, market capitalization of a company determines its weight in the market index. For countries with a lower number of stocks, large companies will dominate market movements. Therefore, we expect a positive coefficient on *ln_Mkt_value*.

Actively traded stocks have faster price adjustment, react to market information on a timely basis, and thus may have higher stock price synchronicity (Chan and Hameed, 2006). To control for the effect of trading activity on synchronicity, we include quarterly share turnover (*Turnover*) as a proxy for liquidity.[17] Firm-quarter turnover is calculated as the natural logarithm of the median daily trading volume over the quarter, scaled by total common shares outstanding. In concentrated industries, firm returns are more likely to be interdependent, leading to higher synchronicity (Piotroski and Roulstone, 2004). To control for industry concentration, we include the Herfindahl

[16] We take this approach because some countries have scores of zero in one regulatory measure and scores of one in another. For example, Austria is coded one for *Regulatory_quality* and *Staff_growth* but zero for *Supervisory_staff* in 2003, while Norway is coded zero for *Supervisory_staff* but is coded one for *Regulatory_quality* and for *Staff_growth*. Rather than interpreting separately three different regressions, we code both Austria and Norway as having strong regulatory quality.

[17] Gassen, Skaife, and Veenman (2016) indicate that tests of stock price informativeness using synchronicity can produce spurious results when liquidity is low. Thus, it is important to control for this characteristic.

index (*Herfindahl_index*), measured annually by two-digit SIC industry, based on firm sales. We expect the coefficient on *Herfindahl_index* to be positive.

Financial analysts can produce industry-specific information through intra-industry transfers (Piotroski and Roulstone, 2004). Following Chan and Hameed (2006), we include the number of analysts (*Analysts*) preparing annual earnings forecasts for firm *i* during the year. We expect that analyst coverage positively relates to synchronicity. However, we depend on I/B/E/S firm coverage for our *Analysts* variable. Since a missing firm in I/B/E/S may imply that the firm has either zero analyst coverage, or alternatively is not covered by I/B/E/S, we include a dummy variable *Analysts_dummy*, which is coded one if the firm is missing in I/B/E/S/, zero otherwise. We predict a positive and significant coefficient on *Analysts* but do not predict a sign for the coefficient on *Analysts_dummy*.

Dasgupta, Gan, and Gao (2010) argue that because the market learns more about a firm as it becomes older, age should be positively related to synchronicity. Therefore, we use the first year that a firm is covered in Compustat Global to calculate firm age and include it as a control (*Age*). Following Hutton, Marcus, and Tehranian (2009) and Ferreira and Laux (2007), we control for leverage (*Leverage*) as the ratio of total liabilities to total assets, and the ratio of the market value of equity to the book value of equity (*MTB*). Because such firms would exhibit higher innate risk, we expect a negative coefficient on both *Leverage* and *MTB*. Following Dasgupta, Gan, and Gao (2010), we also include the standard deviation of daily returns during the quarter to control for the market's assessment of risk (σ*Return*). Following Hutton, Marcus, and Tehranian (2009) and Fernandes and Ferreira (2008), we include a control for return on equity (*ROE*), as high performance firms may drive the market and are likely to increase investor attention (Bessembinder, 2017).

We follow Jin and Myers (2006) and Hutton, Marcus, and Tehranian (2009) and include quarterly measures of kurtosis (*Kurtosis*) and skewness (*Skewness*) of the daily returns used to calculate synchronicity. Jin and Meyers (2006) note that lower skewness means that there are a large number of negative outliers in the distribution of returns, and they show that skewness negatively relates to synchronicity. Therefore, we expect a negative coefficient on *Skewness*. Higher kurtosis can be interpreted as a result of infrequent extreme deviations. Hutton, Marcus, and Tehranian (2009, p. 79) argue that such "jump events would tend to weaken the link between firm returns and market returns," leading to a positive relation between kurtosis and stock price informativeness and, therefore, a negative relation between kurtosis and synchronicity. Therefore, we expect a negative coefficient on *Kurtosis*.

To account for differences in the country sample sizes used to estimate synchronicity, we also control for the number of listed firms in the market by country-year, *Num_firm_state*, as well as the number of firms in each two-digit industry used to calculate *Synch2* (*Num_firm_industry*). Prior literature argues that insider trading may impact the collection of private information by outsiders (i.e., Fishman and Hagerty, 1989; Carlton and Fischel, 2007), and Fernandes and Ferreira (2009) find that first-time implementation of insider trading regulation reduces stock price synchronicity. Therefore, we control for MAD, which was adopted in the EU in 2003, to restrict insider dealings and market abuse (Directive 2003/6/EC, 2003). Specifically, we include an indicator variable *MAD*, coded one if a firm's FYE falls in or after the quarter in which the MAD was implemented, zero otherwise.

Immediately following the financial crisis of 2008, the Eurozone experienced significant credit shortage, bank deleveraging, and the threat of a European sovereign debt crisis.[18] To control

[18] The euro € is the official currency of 17 out of the 27 members of the EU. Known as the Eurozone, this group consists of Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg,

for these developments, we include an indicator variable *Euro*, set to one if a firm reports in the euro €, zero otherwise. Finally, we include the log of GDP in US$ billions (*ln_GDP*), percent GDP per capita growth (*GDP_growth*) and percentage inflation (*Inflation*), to capture macroeconomic conditions that may not be controlled for by country or quarter fixed effects.[19]

5. Empirical Results

5.1. Descriptive Statistics

Table 3 presents descriptive statistics for all variables used in our multivariate tests. Continuous variables are winsorized at 1% and 99% to reduce the statistical effects of extreme outliers. Mean and median values of *Synch1* (*Rsq1*) are lower than the mean and median values of *Synch2* (*Rsq2*), suggesting that industry-adjusted models explain more variation in quarterly returns. The summary statistics for *Synch1* and *Synch2* are similar to those reported in prior studies (e.g., Beuselinck *et al*., 2009; Piotroski and Roulstone, 2004). Turning to the *TPD* indicator, on average, 54% of firm-quarters belong to the post-TPD period. *Reg_strong* has a mean value of 0.72, indicating that nearly three quarters of our sample covers countries considered to have strong regulatory quality before implementation of the TPD.[20]

The mean (median) market value of our sample firms is US $424.22 ($64.95) million. These values, lower than those reported by Christensen, Hail, and Leuz (2016), are likely driven

Malta, the Netherlands, Portugal, Slovakia, Slovenia, and Spain. See http://www.consilium.europa.eu/policies/the-eurogroup/about-the-eurogroup?lang=en.

[19] One caveat to our sample is that the immediate post-TPD period largely coincides with the recent financial crisis. It is possible that a negative coefficient on *TPD* will be driven by the crisis period, when stocks reflect lower synchronicity due to noise. However, Brockman, Liebenberg, and Schutte (2010) find that stock co-movement is counter-cyclical in relation to the business cycle: when aggregate economic activity is low, co-movement is high. Therefore, our results are unlikely to be driven by the recent financial crisis. Nonetheless, we control for GDP per capita growth in an attempt to control for fluctuations in stock price co-movements potentially caused by bad economic conditions.

[20] Recall, that in order to flag a given country as "strong" based on existing regulations, it has to have been flagged as having above median regulatory strength in at least two out of three dimensions: *Regulatory_quality*, *Staff_growth*, and *Supervisory_staff*.

by the exclusion of ADR firms.[21] Mean and median *ln_Mkt_value* is 18.07 and 18.05, respectively. Share turnover, de-logged, has a mean and median value of zero (up to three decimals). The mean (median) value of the Herfindahl index is 0.34 (0.28), and the mean (median) number of firms in each two-digit SIC industry is 38.63 (15.00).[22] These values are comparable to those reported by Beuselinck *et al*. (2009) for a similar EU sample.

[Insert Table 3 here]

The mean (median) number of analysts issuing one-year-ahead earnings per share forecasts is 1.04 (0.00). The low value is due to incomplete coverage of our sample firms in I/B/E/S, as well as the exclusion of ADR firms, which have higher analyst coverage. For example, based on the mean value of *Analysts_dummy*, 70% of our firm-quarter observations are not covered by I/B/E/S. We note, however, that for firms that are followed by at least one analyst, mean analyst coverage is 3.44 with a range of 1 to 17 analysts (untabulated). The mean (median) age of firms in our sample is 10.57 (10.00) years, with 5% of firms younger than 4 years and 5% of firms older than 210 years.[23] Mean (median) leverage is 0.18 (0.16), and the mean (median) market-to-book ratio is 1.53 (0.81). On average, firms have negative return on equity (ROE). However, this value may be driven by outliers, as the median ROE is 3%. Mean and median values of return variability are reported as log values of –3.73 and –3.72, respectively. Reversing the log, mean and median values are both 0.024. In each quarter, there are approximately 873 firms listed in the market, but the *Num_firm_state* variable is skewed, as is evident from its standard deviation of 695. There are approximately 39 firms in each industry.

[21] Mean (median) market capitalization for ADR firms during our sample period is US $3,847 ($1,641) million.
[22] In untabulated tests, we estimate Equation (1) with a restriction of at least 5 (and at least 10) firms per industry. The results are qualitatively similar to those reported in Section 5 for both restrictions.
[23] In untabulated tests, we estimate Equation (1) with a requirement that every firm has at least 20 consecutive firm-quarter observations. Our results are not affected by this restriction.

Table 3 also includes summary statistics for our country-level macroeconomic variables. The average GDP is U.S. billion $1,771, the average annual GDP per capita growth is just under 1%, and mean inflation is 2.12%. Mean *Euro* is 0.51, indicating that approximately half of our sample belongs to the Eurozone.

5.2. Correlations

Table 4 presents Pearson pairwise correlations among regression variables. *Synch1* and *Synch2* are correlated at 65%, suggesting that about 35% of the unexplained relationship relates to industry-specific returns. *Synch1* and *Synch2* are negatively correlated with *TPD* at –0.04 and –0.05, respectively, providing some support for H1. Consistent with prior research (e.g., Dasgupta, Gan, and Gao, 2010; Chan and Hameed, 2006), *Synch1* and *Synch2* are positively correlated with size, the Herfindahl index, analyst coverage, and share turnover. The number of firms listed in a country exhibits a negative correlation with *Synch1* of –0.13 and *Synch2* of –0.17, indicating that in more concentrated markets, prices exhibit greater co-movement. The growth in the GDP per capita has a strong negative correlation (–0.38) with *TPD*. This is likely due to the fact that immediately following the TPD, there was an economic downturn in the EU. At the same time, *Synch1* and *Synch2* are positively correlated with growth in GDP per capita, which is counter to the suggestion by Brockman, Liebenberg, and Schutte (2010) that synchronicity increases during economic downturns.[24] We also note that levels of GDP (*Ln_GDP*) are negatively correlated with

[24] This positive correlation could be driven by less developed countries with lower GDP (e.g., Morck, Yeung, and Yu [2000] show that developing countries have more synchronous stock price movements) yet higher levels of GDP growth, or by countries that experienced GDP decline during the sample period (in which negative correlation conforms to findings by Brockman, Liebenberg, and Schutte [2010]). In untabulated analysis, we observe that seven countries (Estonia, Lithuania, Latvia, Hungary, Poland, the Czech Republic, and Slovenia) have median GDP growth ranging from 2.78% to 8%, which is above the 75th percentile of GDP growth for our sample. At the same time, these countries have median *Ln_GDP* ranging from 2.98 to 6.17, which is at or below the bottom 25th percentile of our sample. In addition, two countries, Greece and Cyprus, report negative median GDP growth of –0.60 and –1.30, respectively. When we remove these nine countries from our sample and re-estimate correlation coefficients, the correlation coefficients between GDP per capita growth and our synchronicity variables are statistically insignificant.

Synch1 and *Synch2* (–0.12 and –0.19), consistent with Morck, Yeung, and Yu (2000), who observe a negative relation between synchronicity and per capita GDP.

[Insert Table 4 here]

5.3. Multivariate Tests of H1

In Table 5, Panels A and B, we report the regression results for Equation (1). In both panels, the first column presents the basic model. In the second column, we include the *MAD* indicator variable. In the third column, we add macroeconomic controls. In all columns of Panels A and B, the adjusted R^2 is 0.30, indicating that Equation (1) explains at least 30% of the variation in synchronicity for our sample.

Given that *Synch2* is calculated by regressing firm returns on both industry and market returns, we focus our discussion of multivariate results on Panel B. As expected, the coefficient on *TPD* is negative and statistically significant in all three models, ranging from –0.170 (*t-stat* –5.99) in column I, to –0.184 (*t-stat* –6.44) in column III. Consistent with H1, these results suggest that after adoption of the TPD, stock price informativeness increased for the average EU firm. The effects are economically significant as well. For instance, the coefficient on *TPD* in column III indicates a decline in synchronicity of over 18% after implementation.[25]

The coefficients on most control variables, in both Panels A and B of Table 5, are statistically significant and in the direction predicted. For instance, larger, older, and more profitable firms, as well as firms with greater share turnover, tend to have higher synchronicity. These results are not indicative of lower firm-specific information in stock prices for firms with these characteristics. Rather, larger and more profitable firms by and large drive market returns and are thus more likely to co–move with one another (Bessembinder, 2017). Synchronicity is also

[25] Column III of Table 4, Panel A, reports a *TPD* coefficient of –0.183 (*t-stat* –7.61), implying a 18.3% decline in *Synch1* post-TPD.

relatively higher in concentrated industries and for firms with higher analyst coverage. Kurtosis is negatively related to synchronicity, consistent with the findings by Crawford, Roulstone, and So (2012) and Hutton, Marcus, and Tehranian (2009). Skewness is negatively related to synchronicity, consistent with Jin and Myers (2006) and Hutton, Marcus, and Tehranian (2009). In columns I and II of Panel A and column II of Panel B, the coefficient on the *MAD* indicator variable has a negative and significant coefficient (two-tailed test); this result supports literature suggesting that anti-insider trading regulation reduces stock return synchronicity (e.g., Fernandes and Ferreira, 2009). Overall, the results reported in Table 5 suggest that the implementation of the TPD resulted in a significant increase in stock price informativeness, controlling for firm-specific and country-level characteristics known to influence synchronicity of returns.

[Insert Table 5 here]

5.4. Multivariate Tests of H2

In Table 6, we report the regression results from estimation of Equation (2). The coefficient on *TPD* is negative and statistically significant when *Synch2* (column II) is the dependent variable (–0.113, *t-stat* –2.87). The sum of the coefficients for *Reg_strong* and *TPD*×*Reg_strong* are significant in both columns I and II (untabulated *F-stats* are 134.59 and 14.76, respectively), suggesting that synchronicity is, on average, lower in European countries with strong securities regulations. This finding is consistent with evidence in prior literature that associates lower synchronicity with strong regulations, such as property rights and investor protection (e.g., Morck, Yeung, and Yu, 2000). In both columns, the interaction term *TPD*×*Reg_strong* exhibits a negative and statistically significant coefficient (–0.152, *t-stat* –5.77 and –0.088 *t-stat* –2.73, respectively), suggesting that the decline in synchronicity following implementation of the TPD is more pronounced in countries with strong regulations. Coefficients on control variables are similar to those reported for tests of H1. Overall, our tests of H2 extend prior evidence suggesting that

transparency laws are more effective in improving price informativeness in countries with already strong securities regulations (e.g., Christensen, Hail, and Leuz, 2013, 2016; Wang and Yu, 2015).

[Insert Table 6 here]

5.5. Robustness Tests

We report the results of several robustness tests in Table 7. For each test, we estimate Equation (1) with all control variables and fixed effects (as in column III of Table 5), but we report only the coefficient on *TPD*, for brevity. First, to better isolate the effects of the TPD, we estimate Equation (1) for the sub-period 2006–13. This shorter period begins after the Prospectus Directive and mandatory IFRS adoption. Additionally, all of the countries in our sample had adopted the MAD by the end of 2006. Our results are robust using the restricted sample period, though the magnitude of the coefficient on *TPD* declines slightly to –0.153 (*t-stat* –5.12) (*Synch2*). In a second test, we re-estimate Equation (1) without UK firms, as they constitute a significant portion of our sample and may bias the generalizability of our results to other EU countries. Our inferences remain unchanged. Third, because we code the *TPD* indicator one, relative to the entry-into-force quarter, firms with earlier FYEs relative to the calendar year end receive a coding of one relatively sooner. Therefore, we re-estimate Equation (1) retaining only firms with December 31st FYEs. Our results hold for this restriction as well, but notably we obtain the highest magnitude coefficient on *TPD* (–0.217, *t-stat* –5.85) when *Synch2* is the dependent variable.

We also estimate Equation (1) using one-digit SIC industry fixed effects, and separately with firm fixed effects. Again, our inferences are unchanged. Although we winsorize our sample at 1% and 99%, we perform an additional test to check that our analysis is not driven by outliers. Specifically, we remove studentized residuals greater than 3 and less than –3, and re-estimate Equation (1). Though we lose approximately 1% of observations, the relationship between

synchronicity and *TPD* remains significantly negative at the 1% level. In an alternative outlier adjustment (untabulated), we re-estimate Equation (1) after truncating the top and bottom 5% of firms based on market value of equity. Our reasoning is that, for small firms, which are generally less liquid, low synchronicity may capture noise, biasing our tests of H1. Conversely, large firms may drive market returns and thus exhibit high synchronicity, even though their prices are comparatively informative.[26] Ordinary least squares results using the truncated sample are virtually identical to our full-sample estimations.

We also re-estimate Equation (1), controlling for accrual quality, as accrual quality may indicate the extent to which managers manage earnings, and thus impact the pricing of firm-specific information. Hutton, Marcus, and Tehranian (2009) proxy for opaqueness in financial reporting using a measure of discretionary accruals and find that synchronicity is lower when accrual quality is higher. We include discretionary accruals, calculated using the method outlined in Francis and Wang (2008), as an additional control variable. However, since we cannot reliably estimate quarterly discretionary accruals (most firms reported only semi-annually before the TPD), we use annual discretionary accruals. Controlling for annual accrual quality does not alter our results. Notably, if we also include squared discretionary accruals in the model, we observe the same non-linearity (untabulated) in the discretionary accruals-synchronicity relation as documented by Hutton, Marcus, and Tehranian (2009). Overall, our robustness tests provide strong evidence that synchronicity significantly declined across EU financial markets following implementation of the TPD.

[26] Though we remove each firm *i* from the right-hand side of our synchronicity estimations (Equations [2] and [3]), it is likely that industry and market returns still imbed firm *i*'s information and thus exhibit co-movement, as market returns are generally driven by a handful of, generally large, market makers (see Bessembinder, 2017). We recognize that the removal of ADR firms from our primary test sample may accomplish a similar task. However, ADR firms are not necessarily the largest; thus full truncation provides the more restrictive condition.

5.6. Amendment of the Transparency Directive

We initially limit our sample period to 2013 because the EU amended the TPD's quarterly reporting requirements in that year, effective 2014. In an additional test, we employ a sub-period, 2012–15, to estimate the impact of the amendment, which occurred in October 2013. At that time the TPD was amended so that listed companies no longer had to report financial information quarterly (see Directive 2013/50/EU, 2013).[27] The modification was intended to reduce administrative burden, specifically for small- and medium-sized firms, and to limit the focus of managers on short-term results (Directive 2013/50/EU, 2013). The EU's decision aligns with theoretical arguments by Gigler *et al*. (2014, p. 361) that shareholder impatience, coupled with frequent reporting, can amplify managers' desire to focus on "quick bottom line results." However, Gigler *et al*. (2014) also recognize that there are multiple benefits, and few costs, to frequent reporting because it disciplines managers against investment in negative net-present-value projects. We test this latter conjecture by estimating Equation (1) over the 2012–15 period, where we include a post-amendment indicator, *Post_amend*, coded one for years 2014–15 and zero for years 2012–13. We report the results in Table 8. Notably, the coefficient on *Post_amend* is positive and statistically significant for both measures of synchronicity (*Synch1*: 0.226, *t-stat* 10.36; *Synch2*: 0.113, *t-stat* 5.21), suggesting that stock price informativeness significantly decreased after the TPD amendment.

[Insert Table 8 here]

6. Conclusion

This paper examines the link between stock return synchronicity and stock price informativeness in the context of the EU's recently implemented TPD, which governs financial

[27] The official entry into force of the amendment was November 6, 2013, when the amendment was published in the *Official Journal of the European Union*.

reporting requirements for issuers of public securities in the EU. We predict that the TPD's provisions, which included new disclosure requirements, better enforcement of existing reporting and disclosure requirements, and enhanced dissemination of financial information following adoption of the TPD, resulted in more informative securities prices for EU public companies.

Using a sample of 5,205 unique firms in 25 EU countries from 2001 to 2013, we find that stock price synchronicity generally declined following the implementation of the TPD, more so in countries with strong regulatory environments. We conduct several sensitivity tests to validate our findings. Our estimations are robust to the inclusion of macroeconomic controls and to the inclusion of firm fixed effects. They are robust as well to the exclusion of UK firms from our test sample, to the use of alternative definitions of outliers, and to inclusion of a control for accrual quality in our empirical models. Further, we examine a recent amendment to the TPD, which removed quarterly reporting requirements after 2013, and find that synchronicity increased post-amendment, suggesting that more frequent reporting originally mandated by the TPD provided more firm-specific information upon which investors made their trading decisions.

We contribute to the ongoing debate about the appropriateness of using stock price synchronicity to gauge the amount of firm-specific information in stock prices. Our results suggest that stock price informativeness significantly improved post-TPD. As we document a decrease in synchronicity following implementation, our findings also stand as one piece of evidence supporting the use of synchronicity to measure stock price informativeness. Our study also complements and extends prior research examining the information benefits of transparency regulations, as well as research examining transnational determinants of stock price synchronicity. Specifically, we extend a recent study by Christensen, Hail, and Leuz (2016), which documents increased liquidity after the TPD. It is possible that the capital-market effects documented in their

study relate to improvements in stock price informativeness, which lower the costs of private information acquisition by market participants. Our tests and inferences should be viewed in conjunction with their study, as their findings support the conclusion that low synchronicity post-TPD represents more informative stock prices.

To our knowledge, we also present the first evidence that stock price informativeness decreased following the 2013 amendment to the TPD, which removed quarterly reporting requirements. While many European policy makers argued that semi–annual reporting is sufficient to keep investors informed, our finding suggests that the removal of quarterly management reports may have been mistaken.

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Appendix A
Variable definitions

Variable	Description
Rsq1	R-squared from regressing quarterly firm returns on quarterly market returns
Rsq2	R-squared from regressing quarterly firm returns on quarterly market and industry returns
Synch1	Synchronicity measure calculated using *Rsq1*, ln(*Rsq1*/1–*Rsq1*)
Synch2	Synchronicity measure calculated using *Rsq2*, ln(*Rsq2*/1–*Rsq2*)
TPD	Indicator variable for Transparency Directive implementation, coded one if quarter-year falls after TPD entry-into-force date, zero otherwise
Regulatory_quality	Indicator variable for regulatory quality index from Kaufman, Kraay, and Mastruzzi (2009), coded one if value is above full sample median, zero otherwise
Supervisory_staff	Indicator variable for the number of full-time employees working for a country's supervisory authority in 2003, coded one if value is above full sample median, zero otherwise
Staff_growth	Indicator variable for percent change in full-time employees working for a country's securities regulator, 2004–09, coded one if value is above full sample median, zero otherwise
Reg_strong	Indicator variable coded one if the sum of indicator variables *Regulatory_quality*, *Supervisory_staff*, and *Staff_growth* equals two or three, zero otherwise
ln_Mkt_value	Natural logarithm of the market value of equity in US$, ln(PRCCD*CSHOC)
Turnover	Natural logarithm of the median of daily trading volume to common shares outstanding, ln(CSHTRD/CSHOC)
Herfindahl_index	Sales-based Herfindahl index calculated for each two-digit SIC industry, $\sum_{i=1}^{n}\left(\frac{SALE_i}{\sum_{i=1}^{n} SALE_i}\right)^2$
Num_analysts	Average number of analysts providing forecasts for a firm during the year
Analysts_dummy	Indicator variable coded one if analyst information is missing in I/B/E/S for a given firm in the sample, zero otherwise
Age	Age of the firm at the end of the year
MTB	Ratio of market value of assets to book value of assets, lagged by year, (AT+CSHOC*PRCCD–CEQ–TXDB)/AT
ROE	Return on equity, IB/(AT–DLC–DLTT)
σ*Return*	Standard deviation of daily firm returns over a quarter
Leverage	Ratio of total assets to total liabilities, (DLT+DLCC)/AT
Kurtosis	Firm-quarter kurtosis of the daily returns distribution used to calculate synchronicity measures
Skewness	Firm-quarter skewness of the daily returns distribution used to calculate synchronicity measures
Num_firm_state	Number of firms listed in a given EU country
Num_firm_industry	Number of firms per two-digit industry-quarter used to calculate *Synch2*

MAD	Indicator variable for Market Abuse Directive implementation, coded one if quarter-year falls after MAD entry-into-force date, zero otherwise

Appendix A (continued)

GDP_growth	GDP per capita growth, %, from World Bank economic indicators, US$
ln_GDP	log of GDP, US$
Inflation	Annual inflation rate %, from World Bank economic indicators
Euro	Indicator variable coded one if firm reports in the euro €, zero otherwise
Post_amend	Indicator variable coded one if year is 2014 or 2015; zero if year is 2012 or 2013

Figure 1
Timeline for Defining Pre- vs. Post-TPD Implementation

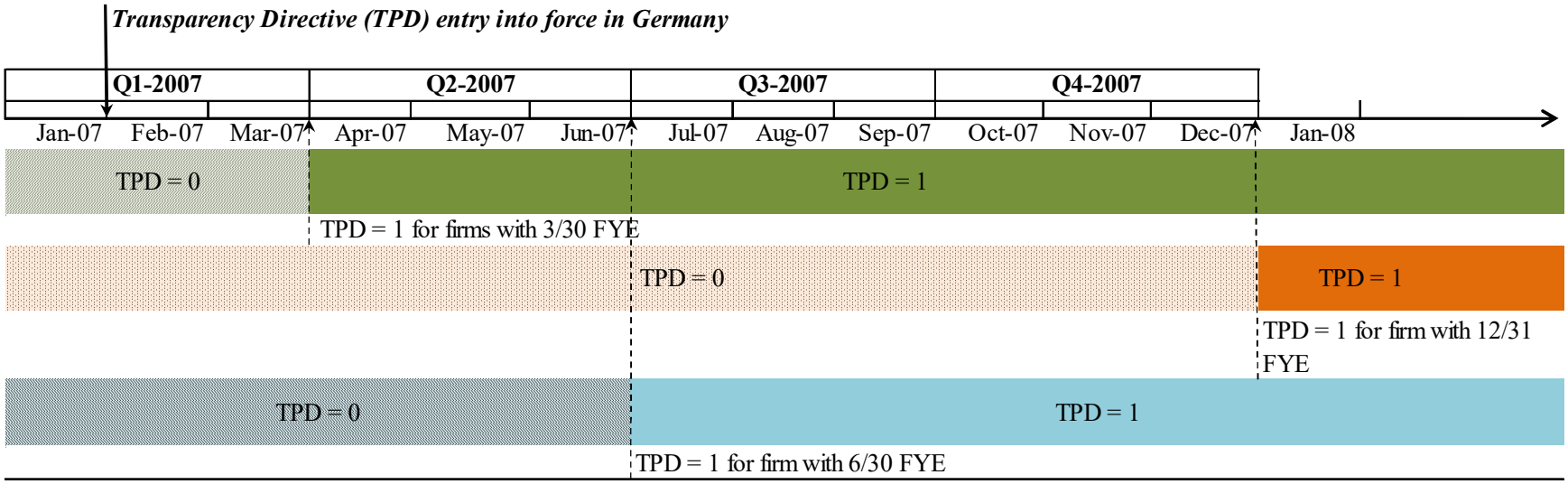

TABLE 1
Sample Composition and Summary Statistics by Country

Panel A. Sample composition, entry-into-force dates, and institutional variables

				Prior Regulation			
Country	***N***	*TPD entry-into-force date*	*TPD quarter date*	*Regulatory quality*	*Supervisory staff*	*Supervisory staff growth*	*Reg_strong*
Austria	1,392	7-Apr	6/30/2007	1	0	1	1
Belgium	2,467	8-Aug	9/30/2008	1	0	0	0
Cyprus	862	8-Mar	3/31/2008	0	0	0	0
Czech Republic	39	9-Aug	9/30/2009	0	1	1	1
Denmark	2,737	7-Jun	6/30/2007	1	0	0	0
Estonia	147	7-Dec	12/31/2007	1	1	0	1
Finland	3,200	7-Feb	3/31/2007	1	0	0	0
France	18,505	7-Dec	12/31/2007	0	1	0	0
Germany	19,830	7-Jan	3/31/2007	1	1	1	1
Greece	6,826	7-Jul	9/30/2007	0	1	0	0
Hungary	415	7-Dec	12/31/2007	0	1	0	0
Iceland	116	7-Nov	12/31/2007	1	0	1	1
Ireland	980	7-Jun	6/30/2007	1	1	1	1
Italy	6,493	9-Aug	9/30/2009	0	1	1	1
Latvia	272	7-Apr	6/30/2007	0	0	1	0
Lithuania	682	7-Feb	3/31/2007	0	1	0	0
Luxembourg	426	8-Jan	3/31/2008	1	1	1	1
Netherlands	3,689	9-Jan	3/31/2009	1	1	1	1
Norway	3,905	8-Jan	3/31/2008	1	0	1	1
Poland	7,156	9-Mar	3/31/2009	0	1	1	1
Portugal	810	7-Nov	12/31/2007	0	1	0	0
Slovenia	261	7-Sep	9/30/2007	0	0	1	0
Spain	2,970	7-Dec	12/31/2007	1	0	1	1
Sweden	9,076	7-Jul	9/30/2007	1	0	1	1
UK	38,385	7-Jan	3/31/2007	1	1	1	1

Table 1 (continued)

Panel B. Sample composition by year and calendar quarter

Year	N	%	Quarter	N	%
2001	8,164	6.2%	**I**	31,862	24.2%
2002	9,257	7.0%	**II**	32,679	24.8%
2003	9,065	6.9%	**III**	33,345	25.3%
2004	9,297	7.1%	**IV**	33,755	25.6%
2005	9,584	7.3%		131,641	100.00%
2006	10,177	7.7%			
2007	10,823	8.2%			
2008	10,906	8.3%			
2009	10,631	8.1%			
2010	11,271	8.6%			
2011	11,057	8.4%			
2012	10,766	8.2%			
2013	10,643	8.1%			
	131,641	100.0%			

Panel C. Frequency of quarterly adoption dates in the sample

TPD quarter date	N	%
3/31/2007	62,097	47.2%
6/30/2007	5,381	4.1%
9/30/2007	16,163	12.3%
12/31/2007	22,963	17.4%
3/31/2008	5,193	3.9%
9/30/2008	2,467	1.9%
3/31/2009	10,845	8.2%
9/30/2009	6,532	5.0%
	131,641	100.0%

Table 2
Synchronicity and R^2 by Country

Country	N	*Synch1* Mean	Median	*Synch2* Mean	Median	*Rsq1* Mean	Median	*Rsq2* Mean	Median
Austria	1,392	–3.27	–3.14	–2.00	–2.29	0.07	0.04	0.17	0.09
Belgium	2,467	–3.08	–2.96	–2.03	–2.24	0.08	0.05	0.16	0.10
Cyprus	862	–3.32	–3.20	–1.97	–2.26	0.07	0.04	0.17	0.09
Czech Republic	39	–1.98	–1.45	–0.85	–0.75	0.19	0.19	0.33	0.32
Denmark	2,737	–2.97	–2.83	–1.95	–2.14	0.09	0.06	0.17	0.11
Estonia	147	–2.90	–2.84	–1.73	–1.82	0.10	0.05	0.19	0.14
Finland	3,200	–2.64	–2.46	–1.60	–1.85	0.12	0.08	0.21	0.14
France	18,505	–3.04	–2.93	–2.26	–2.29	0.09	0.05	0.13	0.09
Germany	19,830	–3.27	–3.16	–2.40	–2.44	0.07	0.04	0.12	0.08
Greece	6,826	–2.04	–1.84	–1.38	–1.45	0.19	0.14	0.25	0.19
Hungary	415	–2.67	–2.57	–1.88	–1.85	0.11	0.07	0.18	0.14
Iceland	116	–2.57	–2.59	–0.56	–1.48	0.12	0.07	0.34	0.18
Ireland	980	–3.34	–3.22	–2.29	–2.34	0.06	0.04	0.13	0.09
Italy	6,493	–2.33	–2.16	–1.68	–1.73	0.14	0.10	0.20	0.15
Latvia	272	–3.75	–3.56	–2.11	–2.42	0.05	0.03	0.17	0.08
Lithuania	682	–2.81	–2.76	–1.53	–1.80	0.10	0.06	0.22	0.14
Luxembourg	426	–3.34	–3.26	–1.18	–2.01	0.06	0.04	0.28	0.12
Netherlands	3,689	–2.59	–2.46	–1.75	–1.90	0.13	0.08	0.20	0.13
Norway	3,905	–2.61	–2.48	–1.57	–1.79	0.12	0.08	0.22	0.14
Poland	7,156	–2.71	–2.56	–1.96	–2.04	0.11	0.07	0.17	0.12
Portugal	810	–2.85	–2.70	–1.72	–1.91	0.11	0.06	0.20	0.13
Slovenia	261	–2.68	–2.68	–1.39	–2.00	0.14	0.06	0.26	0.12
Spain	2,970	–2.45	–2.30	–1.41	–1.69	0.14	0.09	0.24	0.16
Sweden	9,076	–2.79	–2.64	–2.00	–2.06	0.11	0.07	0.16	0.11
UK	38,385	–3.19	–3.07	–2.37	–2.36	0.08	0.04	0.12	0.09

All variables are defined in Appendix A.

Table 3
Descriptive Statistics

Variable	Mean	STD	5%	25%	Median	75%	95%
Synchronicity Variables							
Synch1	–2.95	1.52	–5.60	–3.84	–2.84	–1.93	–0.66
Synch2	–2.10	1.36	–3.98	–2.89	–2.19	–1.48	–0.14
Rsq1	0.10	0.11	0.00	0.02	0.05	0.13	0.34
Rsq2	0.15	0.17	0.02	0.05	0.10	0.19	0.46
Explanatory Variable							
TPD	0.54	0.50	0.00	0.00	1.00	1.00	1.00
Regulatory Strength Variables							
Regulatory_quality	0.68	0.47	0.00	0.00	1.00	1.00	1.00
Supervisory_staff	0.79	0.41	0.00	1.00	1.00	1.00	1.00
Staff_growh	0.72	0.45	0.00	0.00	1.00	1.00	1.00
Reg_strong	0.72	0.45	0.00	0.00	1.00	1.00	1.00
Main Control Variables							
$ln\_Mkt\_value_{t-4}$	18.07	1.89	14.98	16.84	18.05	19.31	21.17
Market Value, Millions $	424.22	2,817.18	4.96	21.96	64.95	219.32	1,406.01
Turnover	–7.74	1.54	–10.47	–8.62	–7.66	–6.72	–5.39
Herfindahl_index	0.34	0.25	0.05	0.16	0.28	0.47	0.89
Analysts	1.04	2.59	0.00	0.00	0.00	1.00	6.00
Analysts_dummy	0.70	0.46	0.00	0.00	1.00	1.00	1.00
Age	10.57	4.95	4.00	7.00	10.00	14.00	20.00
$Leverage_{t-4}$	0.18	0.17	0.00	0.02	0.16	0.30	0.51
MTB_{t-4}	1.53	12.71	0.17	0.46	0.81	1.45	3.90
ROE	–0.05	0.41	–0.51	–0.05	0.03	0.07	0.16
σReturn	–3.73	0.52	–4.58	–4.06	–3.72	–3.38	–2.89
Kurtosis	0.08	0.14	0.01	0.02	0.04	0.08	0.28
Skewness	0.47	1.49	–1.85	–0.16	0.40	1.09	2.99
Num_firm_state	873.30	695.46	110.00	260.00	745.00	1574.00	2104.00
Num_firm_industry	38.63	54.96	2.00	6.00	15.00	44.00	174.00
MAD	0.71	0.46	0.00	0.00	1.00	1.00	1.00
Macroeconomic Control Variables							
GDP, Billions $	1,771.24	1,139.27	201.92	488.38	2,072.82	2,678.28	3,439.95
ln_GDP	7.08	1.09	5.31	6.19	7.64	7.89	8.14
GDP_growth	0.86	2.62	–5.05	–0.17	1.30	2.21	4.24
Inflation	2.12	1.14	0.31	1.36	2.08	2.74	4.16
Euro	0.51	0.50	0.00	0.00	1.00	1.00	1.00

This table presents descriptive statistics for variables used in the ordinary least squares models. N = 131,196 firm-quarter observations. All variables are defined in Appendix A.

Table 4
Correlations

Panel A. Correlations between dependent variables, test variables, and all main control variables

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	*Synch1*	1.00																					
2	*Synch2*	**0.65**	1.00																				
3	*TPD*	**–0.04**	**–0.05**	1.00																			
4	*ln_Mkt_value*	**0.25**	**0.18**	**–0.08**	1.00																		
5	*Turnover*	**0.28**	**0.20**	**–0.15**	**0.07**	1.00																	
6	*Herfindahl_index*	**0.03**	**0.25**	**0.01**	**–0.02**	**–0.07**	1.00																
7	*Analysts*	**0.17**	**0.13**	**0.13**	**0.36**	**0.16**	0.00	1.00															
8	*Analysts_dummy*	**–0.03**	0.00	**–0.22**	**–0.22**	**–0.06**	**0.05**	**–0.61**	1.00														
9	*Age*	0.00	0.00	**0.33**	**0.25**	**–0.11**	**0.07**	**0.16**	**–0.15**	1.00													
10	*Leverage*	**0.07**	**0.10**	**–0.01**	**0.10**	**–0.05**	**0.18**	**0.05**	0.00	**0.07**	1.00												
11	*MTB*	**0.03**	**0.03**	**–0.02**	**0.03**	**0.03**	**0.01**	**–0.01**	**0.01**	**–0.04**	0.00	1.00											
12	*ROE*	**0.05**	**0.05**	**–0.01**	**0.16**	**–0.09**	**0.03**	**0.06**	**–0.05**	**0.12**	**0.05**	**–0.01**	1.00										
13	*σReturn*	**0.05**	**0.07**	**0.07**	**–0.35**	**0.18**	**–0.01**	**–0.10**	**0.12**	**–0.22**	**–0.02**	**0.01**	**–0.22**	1.00									
14	*Kurtosis*	**–0.05**	**–0.03**	**0.07**	**–0.27**	**0.11**	**–0.01**	**–0.08**	**0.09**	**–0.14**	**–0.02**	0.00	**–0.23**	**0.60**	1.00								
15	*Skewness*	**–0.07**	**–0.06**	**0.01**	**–0.08**	**0.08**	0.00	**–0.02**	0.00	**–0.01**	**–0.02**	**–0.01**	**–0.01**	**0.11**	**0.18**	1.00							
16	*Num_firm_state*	**–0.13**	**–0.17**	**–0.04**	**0.14**	**0.13**	**–0.40**	**0.04**	**–0.14**	**0.04**	**–0.21**	**–0.01**	**–0.08**	**–0.06**	**0.01**	0.00	1.00						
17	*Num_firm_industry*	**–0.07**	**–0.12**	**0.03**	**–0.03**	**0.09**	**–0.54**	**–0.01**	**–0.06**	**–0.10**	**–0.26**	0.00	**–0.08**	**0.05**	**0.05**	**0.02**	**0.44**	1.00					
18	*MAD*	**–0.01**	**–0.02**	**0.70**	0.00	**–0.06**	**0.01**	**0.05**	**–0.09**	**0.30**	**–0.01**	**–0.01**	**0.03**	**–0.02**	0.00	**0.01**	**–0.07**	**0.01**	1.00				
19	*ln_GDP*	**–0.12**	**–0.19**	**0.09**	**0.25**	**0.06**	**–0.35**	**0.07**	**–0.14**	**0.17**	**–0.17**	**–0.05**	**–0.03**	**–0.08**	**–0.02**	**0.03**	**0.64**	**0.36**	**0.08**	1.00			
20	*GDP_growth*	**0.03**	**0.03**	**–0.38**	0.00	**0.12**	**–0.02**	**–0.11**	**0.16**	**–0.12**	**–0.08**	**0.03**	**0.05**	**–0.15**	**–0.11**	**–0.02**	**0.04**	**0.01**	**–0.21**	**–0.07**	1.00		
21	*Inflation*	**0.10**	**0.08**	**0.14**	**0.03**	**–0.01**	**–0.02**	**–0.04**	**0.07**	**–0.03**	0.00	**0.04**	**0.01**	**–0.01**	**–0.03**	**–0.04**	**0.02**	**–0.01**	**0.15**	**–0.13**	**0.13**	1.00	
22	*Euro*	**0.05**	**0.05**	**–0.02**	**0.27**	**–0.17**	**0.14**	**0.03**	**0.05**	**0.04**	**0.17**	**–0.01**	**0.08**	**–0.01**	**–0.04**	0.00	**–0.49**	**–0.16**	**0.01**	**0.08**	**–0.16**	**–0.13**	1.00

Table 4 (continued)

Panel B: Correlations between dependent variables, test variable, and regulatory strength dummies.

		1	2	3	4	5	6	7
1	***Synch1***	1.00						
2	***Synch2***	**0.65**	1.00					
3	***TPD***	**–0.04**	**–0.05**	1.00				
4	***Regulatory_quality***	**–0.11**	**–0.08**	**–0.01**	1.00			
5	***Supervisory_staff***	**–0.05**	**–0.11**	**–0.04**	**–0.30**	1.00		
6	***Staff_growth***	**–0.06**	**–0.07**	**–0.03**	**0.59**	**0.07**	1.00	
7	***Reg_strong***	**–0.06**	**–0.07**	**–0.03**	**0.60**	**0.09**	**0.99**	1.00

Panels A and B present Pearson correlation coefficients. Bolded numbers indicate a correlation with a p-value of 10% or less. All variables are defined in Appendix A.

TABLE 5
The Effect of the TPD on Stock Price Informativeness

Panel A. Estimation of Equation (1), where *Synch1* is the dependent variable

Y = Synch1		I			II			III		
Variable	**Pred. Sign**	**Coef.**	**t-stat**		**Coef.**	**t-stat**		**Coef.**	**t-stat**	
Intercept	+/–	–4.186	–26.54	***	–4.058	–25.22	***	–3.821	–6.95	***
TPD	–	–0.173	–7.41	***	–0.175	–7.46	***	–0.183	–7.61	***
ln_Mkt_value$_{t-4}$	+	0.240	45.43	***	0.240	45.41	***	0.238	45.60	***
Turnover	+	0.264	53.70	***	0.264	53.73	***	0.267	55.26	***
Herfindahl_index	+	0.034	0.96		0.034	0.97		0.040	1.12	
Analysts	+	0.038	12.34	***	0.038	12.34	***	0.038	12.27	***
Analysts_dummy	+/–	0.104	7.23	***	0.105	7.35	***	0.111	7.75	***
Age	+	0.008	5.34	***	0.008	5.33	***	0.008	5.26	***
Leverage$_{t-4}$	+/–	0.068	1.81	*	0.067	1.79	*	0.086	2.29	**
MTB$_{t-4}$	–	0.001	1.88	*	0.001	1.87	*	0.000	1.60	
ROE	+	0.073	5.97	***	0.073	5.97	***	0.065	5.57	***
σReturn	–	0.170	11.54	***	0.170	11.54	***	0.095	8.09	***
Kurtosis	–	–0.428	–7.98	***	–0.429	–7.99	***	–0.205	–5.11	***
Skewness	–	–0.026	–9.56	***	–0.026	–9.56	***	–0.026	–9.36	***
Num_firm_state	–	0.000	2.29		0.000	2.13	***	0.000	3.72	***
MAD	–				–0.122	–3.82	***	–0.114	–3.59	***
ln_GDP	–							–0.086	–1.00	
GDP_growth	–							0.020	5.59	***
Inflation	+/–							0.023	3.51	***
Euro	+/–							–0.248	–4.58	***
Adj. R^2		0.30			0.30			0.30		
N		131,641			131,641			131,641		
Industry Fixed Effects		Yes			Yes			Yes		
Quarter-year Fixed Effects		Yes			Yes			Yes		
Country Fixed Effects		Yes			Yes			Yes		
Cluster by Firm (5,205)		Yes			Yes			Yes		

Table 5 (Continued)

Panel B. Estimation of Equation (1), where *Synch2* is the dependent variable

Y = Synch2	Pred.	I			II			III		
Variable	**Sign**	**Coef.**	**t-stat**		**Coef.**	**t-stat**		**Coef.**	**t-stat**	
Intercept	+/–	–3.509	–17.10	***	–3.448	–16.51	***	–2.336	–3.07	***
TPD	–	–0.170	–5.99	***	–0.170	–6.00	***	–0.184	–6.44	***
ln_Mkt_value$_{t-4}$	+	0.166	25.81	***	0.166	25.80	***	0.168	26.23	***
Turnover	+	0.166	26.45	***	0.166	26.45	***	0.164	26.11	***
Herfindahl_index	+	1.342	13.62	***	1.343	13.63	***	1.344	13.60	***
Analysts	+	0.036	9.64	***	0.036	9.64	***	0.036	9.60	***
Analysts_dummy	+/–	0.106	5.83	***	0.106	5.87	***	0.110	6.05	***
Age	+	0.006	2.78	***	0.006	2.78	***	0.006	2.78	**
Leverage$_{t-4}$	+/–	0.117	2.09	**	0.117	2.08	**	0.124	2.21	**
MTB$_{t-4}$	–	0.000	0.08		0.000	0.08		0.000	–0.17	
ROE	+	0.055	4.94	***	0.055	4.94	***	0.053	4.79	***
σReturn	–	0.218	14.15	***	0.219	14.15	***	0.225	14.76	***
Kurtosis	–	–0.318	–6.93	***	–0.319	–6.94	***	–0.313	–6.91	***
Skewness	–	–0.025	–10.86	***	–0.025	–10.86	***	–0.026	–11.17	***
Num_firm_state	–	0.000	0.48		0.000	0.41		0.000	2.74	***
Num_firm_industry	+/–	0.003	8.86	***	0.003	8.85	***	0.003	8.87	***
MAD	–				–0.059	–1.67	*	–0.051	–1.46	
ln_GDP	–							–0.189	–1.57	
GDP_growth	–							0.019	4.56	***
Inflation	+/–							0.026	3.34	***
Euro	+/–							–0.189	–2.41	**
Adj. R^2		0.29			0.29			0.29		
N		131,641			131,641			131,641		
Industry Fixed Effects		Yes			Yes			Yes		
Quarter-year Fixed Effects		Yes			Yes			Yes		
Country Fixed Effects		Yes			Yes			Yes		
Cluster by Firm (5,205)		Yes			Yes			Yes		

***, **, and * denote significance at the 1%, 5% and 10% levels (two-tailed), respectively.
P-values are based on robust standard errors clustered at the firm level. *Synch1* is a synchronicity measure represented by a natural logarithm of R^2 from the regression of daily returns on market returns. *Synch2* is a synchronicity measure represented by a natural logarithm of R^2 from the regression of daily returns on market-wide and industry-wide returns. *TPD* is an indicator variable coded one for firm-quarters after TPD implementation, zero otherwise. All variables are defined in Appendix A.

Table 6
The Effect of the TPD on Stock Price Informativeness, Controlling for Prior Regulatory Strength

		Y = Synch1			*Y = Synch2*		
	Pred.	I			II		
Variable	**Sign**	**Coef.**	**t-stat**		**Coef.**	**t-stat**	
Intercept	+/–	–2.919	–13.71	***	–2.240	–8.59	***
TPD	–	–0.043	–1.33		–0.113	–2.87	***
Reg_strong	–	–0.123	–4.86	***	–0.039	–1.13	
TPD×Reg_strong	–	–0.152	–5.77	***	–0.088	–2.73	***
$ln\_Mkt\_value_{t-4}$	+	0.218	40.52	***	0.161	26.00	***
Turnover	+	0.273	53.81	***	0.174	27.39	***
Herfindahl_index	+	–0.221	–5.32	***	1.141	11.73	***
Analysts	+	0.039	11.16	***	0.036	9.11	***
Analysts_dummy	+/–	0.128	7.92	***	0.136	7.08	***
Age	+	0.000	0.29		0.000	–0.10	
$Leverage_{t-4}$	+/–	0.155	3.55	***	0.219	3.69	***
ROE	+	0.001	3.22	***	0.001	1.33	
MTB_{t-4}	–	0.089	6.59	***	0.060	5.13	***
σReturn	–	0.194	12.65	***	0.225	14.00	***
Kurtosis	–	–0.541	–9.83	***	–0.395	–8.38	***
Skewness	–	–0.029	–10.21	***	–0.026	–11.06	***
Num_firm_state	–	0.000	–19.53	***	0.000	–7.04	***
Num_firm_industry	+/–				0.003	8.99	***
MAD	–	–0.037	–1.11		–0.012	–0.31	
ln_GDP	–	–0.043	–2.69	***	–0.120	–4.94	***
GDP_growth	–	0.013	3.90	***	0.010	2.39	***
Inflation	+/–	0.038	5.70	***	0.049	5.73	***
Euro	+/–	–0.364	–11.95	***	–0.177	–3.92	***
Adj. R^2		0.27			0.27		
N		131,641			131,641		
Industry Fixed Effects		Yes			Yes		
Quarter-year Fixed Effects		Yes			Yes		
Country Fixed Effects		No			No		
Cluster by Firm (5,205)		Yes			Yes		

***, **, and * denote significance at the 1%, 5% and 10% levels (two-tailed), respectively.
P-values are based on robust standard errors clustered at the firm level. *Synch1* is a synchronicity measure represented by a natural logarithm of R^2 from the regression of daily returns on market returns. *Synch2* is a synchronicity measure represented by a natural logarithm of R^2 from the regression of daily returns on market-wide and industry-wide returns. *TPD* is an indicator variable coded one for firm-quarters after TPD implementation, zero otherwise. *Reg_strong* is an indicator variable coded one for countries with high relative securities regulatory strength prior to the TPD implementation, zero otherwise. All variables are defined in Appendix A.

Table 7
Sensitivity Analysis

	Y = Synch1			*Y = Synch2*		
Variable	**Coef.**	**t-stat**		**Coef.**	**t-stat**	
1) Years 2006–13 (post-IFRS)						
TPD	–0.138	–5.66	***	–0.153	–5.12	***
Adj. R^2	0.33			0.33		
N	86,274			86,274		
2) Exclude UK firms						
TPD	–0.161	–5.92	***	–0.202	–5.79	***
Adj. R^2	0.33			0.32		
N	93,256			93,256		
3) Retain firms with 12/31 FYE only						
TPD	–0.172	–6.08	***	–0.217	–5.85	***
Adj. R^2	0.32			0.31		
N	98,135			98,135		
4) SIC1 Industry Fixed Effects						
TPD	–0.169	–6.57	***	–0.177	–6.08	***
Adj. R^2	0.30			0.26		
N	131,641			131,641		
5) Firm Fixed Effects						
TPD	–0.164	–6.57	***	–0.128	–5.07	***
Adj. R^2	0.34			0.52		
N	131,641			131,641		
6) Studentized Residuals between –3 and 3						
TPD	–0.166	–7.35	***	–0.155	–7.84	***
R^2	0.34			0.34		
N	130,136			129,553		
7) Control for Accrual Quality						
TPD	–0.177	–6.88	***	–0.180	–5.80	***
Adj. R^2	0.30			0.30		
N	112,384			112,384		

***, **, and * denote significance at the 1%, 5% and 10% levels (two-tailed), respectively. All models, except firm fixed effects, include country, quarter-year and industry fixed effects. *P*-values are based on robust standard errors clustered at the firm level. All control variables are included in the analysis, but omitted for brevity. *Synch1* is a synchronicity measure represented by a natural logarithm of R^2 from the regression of daily returns on market returns. *Synch2* is a synchronicity measure represented by a natural logarithm of R^2 from the regression of daily returns on market-wide and industry-wide returns. *TPD* is an indicator variable coded one for firm-quarters after the TPD implementation, zero otherwise. All variables are defined in Appendix A.

Table 8
The Impact of the 2013 TPD Quarterly Reporting Amendment on Stock Price Informativeness

		Years 2012, 2013 vs. 2014, 2015					
		Y = Synch 1			*Y = Synch 2*		
	Pred.	**I**			**II**		
Variable	**Sign**	**Coef.**	**t-stat**		**Coef.**	**t-stat**	
Intercept	+/–	–0.609	–0.81		–0.109	–0.14	
Post_amend	+	0.226	10.36	***	0.113	5.21	***
ln_Mkt_value$_{t-4}$	+	0.232	27.52	***	0.153	14.45	***
Turnover	+	0.219	30.14	***	0.122	12.95	***
Herfindahl_index	+	–0.022	–0.40		1.631	10.35	***
Analysts	+	0.053	9.74	***	0.044	6.61	***
Analysts_dummy	+/–	0.023	1.03		0.011	0.34	
Age	+	0.009	4.72	***	0.006	2.29	**
Leverage$_{t-4}$	+/–	0.212	3.40	***	0.255	2.55	**
MTB$_{t-4}$	–	–0.005	–3.31	***	–0.011	–3.55	***
ROE	+	0.028	1.46		0.031	2.00	**
σReturn	–	0.076	4.08	***	0.153	6.47	**
Kurtosis	–	-0.005	-0.58		-0.052	-3.00	***
Skewness	–	–0.029	–6.90	***	–0.024	–6.57	***
Num_firm_state	–	0.000	1.62		0.000	–0.39	
Num_firm_industry	+/–				0.006	8.98	***
ln_GDP	–	–0.647	–5.87	***	–0.551	–5.03	***
GDP_growth	–	–0.001	–0.15		0.010	1.50	
Inflation	+/–	0.064	6.58	***	0.017	1.76	*
Euro	+/–	–0.117	–1.68	*	0.155	1.31	
Adj. R^2		0.21			0.21		
N		41,736			41,736		
Industry Fixed Effects		Yes			Yes		
Quarter-year Fixed Effects		No			No		
Country Fixed Effects		Yes			Yes		
Cluster by Firm (3,200)		Yes			Yes		

***, **, and * denote significance at the 1%, 5% and 10% levels (two-tailed), respectively.
P-values are based on robust standard errors clustered at the firm level. *Synch1* is a synchronicity measure represented by a natural logarithm of R^2 from the regression of daily returns on market returns. *Synch2* is a synchronicity measure represented by a natural logarithm of R^2 from the regression of daily returns on market-wide and industry-wide returns. *Post_amend* is coded one if year is 2014 or 2015 and zero if year is 2012 or 2013.
All variables are defined in Appendix A.