The Effects of MiFID II on Sell-Side Analysts, Buy-Side Analysts, and Firms

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Abstract

This paper provides early but comprehensive empirical evidence on a major new investor protection regulation in Europe, MiFID II, which requires investment firms to unbundle the costs they charge to clients. Specifically, MiFID II requires asset managers and broker-dealers to unbundle the cost of investment research and advisory services from other services they provide. We examine the effects of this new regulation in difference-in-differences matched-sample research designs with firm fixed effects and test for numerous potential outcomes. We find a decrease in the number of sell-side analysts covering European firms after MiFID II implementation. For example, 334 firms *completely lose* their analyst coverage. On average, the analysts who dropped coverage have higher lifetime forecast errors, higher forecast optimism, less experience on the job, and less experience covering the firm dropped. We do not find significant changes in consensus forecast errors or dispersion. However, the remaining analysts are more likely to make sell or hold stock recommendations, their recommendation revisions garner greater market reactions, and their recommendations are more profitable. In addition, sell-side analysts seem to cater more to the buy-side after MiFID II by providing industry recommendations along with stock recommendations. Importantly, we find evidence that buy-side investment firms turn to more in-house research after MiFID II implementation. Especially interesting, buy-side analysts increase their participation and engagement in earnings conference calls compared to the control group. Finally, we find some evidence that stock-market liquidity decreases post-MiFID II (after taking into account firms' disclosure responses and changes in analyst coverage). Our findings have implications beyond Europe, as investors are currently pressuring the U.S. Securities and Exchange Commission to adopt a similar regulation.

Key words: MiFID II, regulation, financial services, sell-side analysts, buy-side research, disclosure, liquidity, Europe

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1. Introduction

The Markets in Financial Instruments Directive II (MiFID II) is a financial services directive that became effective in the European Union on January 3, 2018.[1] MiFID II applies to the 31 countries of the European Economic Area (EEA), which comprises the 28 EU members plus Iceland, Liechtenstein, and Norway. One of the important changes set forth by MiFID II is the requirement for asset managers and broker-dealers to *unbundle* the cost of investment *research* and advisory services from the cost of trade execution. In other words, the information on all costs and associated charges presented to the client must separately and transparently show the different costs, including any third-party payments. In this study, we provide early – but comprehensive – empirical evidence on the effects of this sweeping new regulation on sell-side analyst research, buy-side research, as well as firm disclosure responses and stock-market liquidity.

MiFID II represents a shake-up of traditional business practices whereby brokers bundle research and execution services provided to asset managers, otherwise known as "soft dollars." Soft dollars are a way of paying brokerage firms for their services through commission revenues rather than through hard dollars. Instead of paying the service providers with cash (i.e., hard dollars), the asset manager pays by passing on business to the brokerage (i.e., soft dollars). The disclosure of these bundled soft-dollar commissions is more opaque than expensing the cost of non-execution services (Erzurumlu and Kotomin 2016). Some argue that the lack of transparency of soft-dollar commissions can exacerbate agency conflicts and result in less efficient fund operations (Edelen, Evans, and Kadlec 2012).

[1] A directive is a legislative act that sets out a goal that all EU countries must achieve. Each individual member country devises its own laws on how to reach these goals (https://europa.eu/european-union/eu-law/legal-acts_en).

The CFA Institute (2017) conducted a survey of its European members in September 2017 to gauge the expectations of buy-side professionals regarding the pricing of research and the allocation of costs. They found that most asset management firms intend to absorb research costs rather than charge clients because clients do not want to pay for equity research given its public goods characteristics. The CFA Institute (2017) further notes that 78 percent of 330 investment firms expect to source relatively less research from the sell-side under MiFID II, while sourcing more research in-house (a view expressed by 44 percent of respondents). Major U.S. buy-side participants such as JPMorgan, Vanguard, and T Rowe Price, along with European asset managers such as Jupiter, M&G, and Aberdeen, announced in late 2017 that they will absorb the cost of research internally and have been working on building their own internal research capabilities (Thompson 2017).

In the same CFA Institute survey, investment professionals expressed concerns over unintended consequences of MiFID II, including a decrease in the availability of research and a reduction in research coverage. However, independent research providers may compete on a more even playing field given that research consumers can compare prices and quality across products and service levels. If these changes materialize, investors may potentially stand to benefit from an increase in research quality and thus more informed investment decision-making (CFA Institute 2017).

MiFID II has polarized practitioners with some criticizing MiFID II virulently. For instance, in an interview with CNBC, Erste Bank CEO Andreas Treichl said that the introduction of MiFID was “incredibly patronizing” and was treating both banks and clients “like little kids

who don't know what they're doing."[2] Others believe that "a cull in the quantity of maintenance research is not a bad thing and we may even see a return to deeper, fundamental research and a focus on longer-term, industry-thematic analysis" (IR Magazine 2018 citing Nicky Stewart, director of institutional marketing at Edison). The CFA Institute (2017) expressed the view that the "transition to the new paradigm may be disruptive, but it promises to deliver a more efficient market in the long run." A survey by Greenwich Associates cited by the Financial Times, found that European fund managers had cut their 2018 equities research budgets by 20%, or $300 million, compared with the previous year (Murphy 2018).

We examine *sell-side*, *buy-side*, and *firm* consequences of MiFID II. In our first set of analyses, we test for multiple sell-side analyst outcomes. Using both pure pre-post regulation tests with a number of control variables motivated by prior research and *firm fixed effects* that control for time-invariant firm characteristics, and a difference-in-differences (DiD) matched-sample design (using North American firms as control firms), we document that the sell-side analyst coverage drops significantly following the regulation. Perhaps most tellingly, 334 firms completely lose their sell-side analyst coverage. We investigate the details of which analysts "disappear" and conclude that the dropped analysts exhibit higher lifetime (i.e. pre-MiFID II) forecast errors, higher forecast optimism, less experience on the job, and less experience covering the dropped firm.

We next consider analyst earnings forecast accuracy and forecast dispersion and do not detect any consistent effects of MiFID II. More importantly, we examine the informativeness and profitability of sell-side analyst research. Our results suggest that stock-rating revisions for European firms are incrementally more informative after the implementation of MiFID II.

[2] https://www.cnbc.com/video/2017/11/03/mfid-ii-treats-both-banks-and-clients-like-kids-erste-bank-ceo.html (last accessed April 4, 2019).

Similarly, we find that three and six-month buy-and-hold abnormal returns are higher for buy recommendations following the regulation. We also show that the percentage of sell and hold recommendations increases and that stock recommendations are more likely to be accompanied by industry recommendations following MiFID II.

Given the observed drop in sell-side analyst coverage and the idea expressed by practitioners that the buy-side is likely to increase its in-house research capabilities following the new regulation, it is perhaps especially interesting to investigate the response from the buy-side. However, given that buy-side data are hard to obtain, to gain insight into the buy-side response, we follow a unique approach. Specifically, we obtain data on individuals employed as buy-side security analysts or associate analysts from Thomson Reuters and sum up the number of individuals employed by each buy-side firm. We find strong evidence that the number of buy-side analysts increases following MiFID II, suggesting that European investment firms turn to more in-house research after the implementation of the new regulation.

We further explore a setting in which the activities of buy-side analysts can be observed directly: conference-call participation. We identify buy-side analysts using conference-call transcripts downloaded from FactSet and measure the extent to which they interact with management during the calls. We find that buy-side analysts are more likely to participate in conference calls and have more interactions with management for European firms after MiFID II, relative to North American firms. The evidence further corroborates the finding that investment firms turn to more in-house research in the post-MiFID II world.

Finally, we examine how firms respond to the new regulation in terms of disclosure choices and whether their stock-market liquidity is affected. We show that firms engage in somewhat more disclosure events (particularly, broker-hosted conferences) after MiFID II. After

controlling for these disclosure activities, we find a decrease in stock liquidity for European firms in the period that follows MiFID II, relative to the control group.

Most importantly, this study contributes by providing early evidence on a sweeping new regulation that is starting to affect firms and investors around the world. Our comprehensive empirical evidence should be of interest to asset managers, brokerage firms, investors, and importantly to regulators who are contemplating similar regulations.

Our research also adds to the extant sell-side analyst literature by examining the effects of a new regulation that de facto reduces the supply of analyst research. Relative to the large sell-side literature, there is limited evidence on the buy-side, and we propose and implement new ways of gauging buy-side research activities.

2. Institutional Setting and Empirical Predictions

2.1 Further Background on MiFID II

Under MiFID II, asset management firms can either pass the cost of research on to clients via pre-agreed research-payment accounts or absorb the cost of research themselves against the firm's profit and loss.[3] Sell-side firms need to provide clients the unbundled costs of trading by separately identifying and charging for execution, research, and other advisory services. Buy-side firms have to make explicit payments for research and also demonstrate that the research contributes to better investment decisions so that it is not considered an inducement (PwC 2016).

The new regulations apply directly to financial-market players that are based in any of the EEA member states as well as to a European branch location of any company headquartered outside of the EEA. Branches of European firms operating in non-EEA countries also need to

[3] The relevant articles are 23, 24(4)(c), and 24(7)(b).

comply with MiFID II requirements related to payment for research. Non-EEA companies with no branch location in Europe may still be impacted based on certain types of interactions with MiFID-regulated counterparties.[4]

Through the requirement that non-European investment firms operating in Europe must comply with MiFID II, and due to the globalization of many investment firms, this directive has ripple effects well beyond Europe. In the U.S., MiFID II's model of hard dollars contrasts with the Securities and Exchange Commission's (SEC) model of soft dollars. Under current U.S. rules, brokers who get paid with hard dollars must register as an investment adviser, which is a more onerous status that involves increased compliance and oversight. To appease this conflict, on October 26, 2017, the SEC issued three no-action letters that gave U.S. investment firms 30 months to abide by MiFID II without being in violation of U.S. regulations (SEC 2017). Practitioners remarked that, in the short term, the SEC's stance means "business as usual" but, over the long term, it opens the way for MiFID II to become a global standard as pressure for cost transparency or lower costs is mounting from investors (Holt 2019; Riding 2019a).

Large asset managers such as Capital Group ($1.87 trillion) have recently declared that they will start to absorb the cost of third-party investment research across their *global* business rather than solely in relation to their European operations (Riding 2019a). This comes as U.S. clients having noticed that transaction fees and commission costs have dropped for their European counterparts (i.e., due to investment firms absorbing the cost of research) are becoming concerned that "they may be subsidizing European clients" (Riding 2019a citing Amy McGarrity, chief

[4] For example, MiFID II has an indirect impact on asset managers without a physical presence in the EEA that provide sub-advisory services to MiFID II-regulated investment firms (i.e., partnering between investment firms such that funds are managed by another management team or firm than where the assets are held), that have an EU sub-advisor, trade in EU securities on a regulated EU market, or have an EU affiliate (Hopfensperger 2018). The non-EEA investment firms will also need to comply with MiFID II transparency and reporting obligations since "these requirements will be very difficult for a MiFID firm to comply with without the assistance of its asset manager delegate" (Christian and Frase 2016).

investment officer, Public Employees' Retirement Association of Colorado). As a result, the Council of Institutional Investors has been lobbying the SEC to adopt regulations similar to MiFID II in the U.S. (Riding 2019b).

Of particular interest to accounting and finance researchers is the fact that analyst forecast data in IBES Detail have changed due to MiFID II. Thomson Reuters, the owner of IBES, issued a Product Change Notification on September 12, 2018, announcing that the contributor and analyst names of 88 pre-approval contributors to IBES will be *anonymized* for all clients, regardless of individual client entitlements.[5] The IBES Summary History file does not change, and consensus estimates will continue to include all pre-approval brokers (as well as UBS Equities).

2.2 Effects on Sell-Side Analysts, Buy-Side Analysts, and Firms

2.2.1 Sell-Side Response

Kelly and Ljungqvist (2012, 1378) note that "the fundamental challenge for equity research is a public goods problem: because research is hard to keep private, clients are reluctant to pay for it, and hence it is provided for free." As they and others have noted, equity research is a commodity and it is difficult for firms to remain profitable due to the fact that research is a cost center. The researchers emphasize that brokerage firms have traditionally subsidized research with revenue from trading, that is, soft-dollar commissions, market-making, and investment banking. However, these revenue streams have diminished over the last decades. Soft-dollar commissions have come under attack from the SEC, European regulators, and institutional clients. In addition, concerns that analysts publish biased research to please investment banking clients (e.g., Dugar

[5] In addition, estimates from UBS Equities will be removed from the IBES Detail History file and they explicitly tie this decision with MiFID II implementation. Please see https://uk.reuters.com/article/uk-ubs-research-memo/ubs-suspends-access-to-research-data-for-some-external-providers-idUKKBN1HG2O3?fbclid=IwAR1qUmST5FHWQ4zZj2VTW_hSNcsuib1w0wsJvkKHyLkCG1_KNrWk6l6Rhr4

and Nathan 1995) have led to regulations, such as the 2003 Global Settlement, which have made it harder for brokers to use investment banking revenue to cross-subsidize research. Brokerage firms have responded to these adverse changes by downsizing or closing their research operations altogether (Kelly and Ljungqvist 2012).

Hong and Kacperczyk (2010) use brokerage house mergers as a natural experiment to examine the role of competition on bias. They find that on average, a one-analyst drop in coverage occurs when two brokerage houses that covered the same stock merge. This translates into fewer forecasts and those forecasts are more optimistic (i.e., more biased, where bias is the difference between the individual forecast and actual earnings). This effect is more significant for stocks with little initial analyst coverage or competition.

Using the same setting of brokerage house mergers, Kelly and Ljungqvist (2007) find that on announcement that a stock has lost all coverage, share prices fall, on average, by 110 basis points or $8.4 million. They conclude that reductions in coverage are followed by less efficient pricing and lower liquidity, greater earnings surprises (so higher forecast errors), more volatile trading around subsequent earnings announcements, increases in required returns, and reduced return volatility. Overall, they conclude that the information environment of those firms that lose coverage suffers.

Kelly and Ljungqvist (2012) further discuss how a brokerage closure could either increase information asymmetry or reduce the quantity of information. They argue that the eventual outcome will depend on whether the previously public signal is lost or becomes private. Specifically, they argue that for the number of signals to decline, the analyst would have to leave

the industry and institutional investors would have to refrain from replacing the lost signal in-house, which they do not believe is plausible.[6]

We examine several outcomes related to sell-side coverage. First, we test whether the number of firms that lost coverage completely is significantly higher in Europe post-MiFID II.[7] We further consider the more general expectation that sell-side coverage decreases upon MiFID II implementation. Related, we investigate characteristics of sell-side analysts who may drop coverage post-MiFID II: experience, lifetime accuracy, and lifetime optimism. It is likely that the MiFID II-induced shake-up of the investment firms and sell-side research will lead to an increased emphasis on analyst ability (Murphy 2018) and that the analysts who drop coverage of firms could be less experienced and have worse lifetime characteristics.

Second, we analyze whether the decrease in sell-side coverage reflects into consensus measures such as forecast accuracy and dispersion. If lower ability analysts are "weeded out," we expect consensus forecasts to be closer to actual (i.e., more accurate) and less dispersed.

Third, we investigate whether stock recommendations made by sell-side analysts after MiFID II are more informative and more profitable. To the extent that the sell-side profession under MiFID II is forced to compete for limited buy-side research payments and attention, economic intuition suggests that sell-side analysts may seek to increase the usefulness of their final product, that is, their stock recommendations. Therefore, we examine the stock-market reactions to sell-side revisions as well as the profitability of their stock recommendations to gauge the informativeness of sell-side research to the buy-side.

[6] The following quote is from Kelly and Ljungqvist (2012, 1380): "Few in the industry think [laid-off] analysts will have trouble getting new work. Demand for analysts is strong, but the landscape has shifted. More research dollars are flowing away from … so called "sell-side" firms that sell their research to others. Instead, "buy-side" firms such as hedge funds and other money managers are hiring in-house research staff, paying top dollar to keep those investing insights all to themselves".

[7] We also test one of the main expected implications of MiFID II that small firms will lose coverage entirely.

2.2.2 Buy-Side Response

The research that buy-side analysts produce directly influences the investment firms' decisions (Cheng, Liu, and Qian 2006; Frey and Herbst 2014; Rebello and Wei 2014). Unlike sell-side analyst research, buy-side analyst recommendations and forecasts are not available to the public, as the analyst works exclusively for the investment firm that hires her (Cheng et al. 2006). Research shows that trades triggered by the buy-side have higher returns than trades triggered by sell-side recommendations (Frey and Herbst 2014).[8]

In a survey of 344 buy-side analysts from 181 investment firms, Brown et al. (2016) find that sell-side analysts are important for buy-side analysts for two main reasons: (1) in-depth industry knowledge, and (2) access to company management especially when the investment firm is smaller. We assess two aspects related to the interaction between sell-side and buy-side and the buy-side response to MiFID II.

First, we evaluate whether the sell-side caters more to the buy-side by providing information they know the buy side uses: industry recommendations. Because MiFID II forces the buy side to reassess the sources of research they use, we expect sell-side analysts will want to make themselves useful or indispensable by producing information that the buy side values.

Second, we consider whether investment firms are relying more on their own in-house research. We start by examining whether buy-side firms hire more in-house analysts post-MiFID II to assist portfolio managers and provide in-house research. If investment firms are now required to charge clients for third-party research or pay for it with "hard cash" (i.e., incur an expense in their profit or loss), a natural reaction would be to "cut out" the third party and to strengthen their

[8] There is less danger of conflict of interest for buy-side analysts as their stock recommendations can determine their career, whereas sell-side analysts are more influenced by their employer's underwriting business, broker votes, and star rankings (Brown et al. 2016).

internal capabilities. Many investment firms announced that they will absorb the costs themselves rather than pass them on to their clients (Riding 2019a), therefore we expect that investment firms will invest in hiring more in-house research analysts.

Third, we consider whether buy-side analysts become more active in conference calls, which is part of their fundamental research and due diligence. Jung, Wong, and Zhang (2018) show that buy-side analysts are more likely to participate when a firm's information environment is poor and sell-side coverage is low. Given the potential decrease in sell-side coverage due to MiFID II, we expect more buy-side analysts to attend conference calls and that they will ask more questions in order to acquire information for their own research.

2.2.3 Firm Information Environment Effects

The potential loss of sell-side coverage may have important implications for firms. According to Elena Basova, senior analyst at Nasdaq IR Intelligence, "MiFID II is putting a lot of pressure on small and mid-cap IR teams due to the disruption the sell side has faced" (IR Magazine 2019). Anantharaman and Zhang (2011) find that when the firm loses coverage from sell-side analysts, managers increase their earnings guidance. This is especially the case when the coverage loss is driven by exogenous events that lead to reductions in brokerage firm size.

Analyst coverage increases firm visibility for investors (Merton 1987). Prior studies find a positive relation between the number of analysts covering a firm and market liquidity, suggesting that analysts improve the richness of the firm's information environment by increasing the amount of information that is publicly available about the firm (Roulstone 2003).

We test two potential effects of MiFID II on corporations' information environment. First, we consider whether corporations respond to MiFID II implementation and (potential) decreases in

sell-side coverage by increasing their disclosure efforts. Specifically, we expect that firms will look for alternatives to communicating their story to the investment community and engage in more direct communication during firm-organized analyst/investor days (Kirk and Markov 2016) or presentations at broker-hosted conferences (Bushee, Jung, and Miller 2011; Green, Jame, Markov, and Subasi 2014). Further, we assess the overall impact of MiFID II on firms' information environment by examining their stock-market liquidity.[9]

3. Data and Research Design

3.1 Sample Construction

Panel A of Table 1 reports the sample-construction process. We begin the sample construction with all public firms (i.e., corporate issuers) headquartered in the 31 European Economic Area (EEA) countries, over the time period 2015 to the latest available (currently, February 2019), with data available in Compustat Global and the IBES Summary History file. If a firm has *never* had analyst coverage during the sample period, it is excluded from the sample. If the firm has had coverage for some reporting periods during the sample period, we include it in the sample after the first time it appears covered during the sample period.[10] The full European sample is 12,340 firm-year observations, which constitutes the treated sample.

Our reliance on a European sample rests on the following assumption. MiFID II applies directly to Europe-based investment firms, their third-country subsidiaries, and non-EEA-based investment firms that operate in the EEA, without mentioning directly corporate issuers. Therefore, the corporate issuers affected by MiFID II are the corporations traded by investment

[9] For this test, we make sure to control for the effect of the firm's disclosure activities and to condition on the decrease in analyst coverage.

[10] For example, if a firm has no coverage for 2015, has coverage for 2016, and no coverage afterwards, we include it in the sample starting in 2016, with zero coverage for 2017 and 2018.

firms that fall under MiFID II.[11] This information is not publicly available; therefore, we assume that European investment firms trade in European corporate issuers and limit the treated sample to corporate issuers headquartered in Europe.[12,13]

We provide results using both a pure pre-post MiFID II for the European sample only and a matching-based DiD approach. The latter controls for time-period specific effects that might confound results.[14] Mirroring the European sample-construction steps, we gather a control group composed of U.S. and Canadian firms over the same time period. There are 11,986 (7,477) U.S. firm-year observations, and 2,629 (2,619) Canadian firm-year observations in the full (PSM matched) sample.

Panel B of Table 1 presents the distribution of the European firms in the full and matched samples by country in which the firm is headquartered. In line with the size of the country's economy, the U.K. contributes 30% of the European sample, followed by France (12%), Germany

[11] For instance, a Chinese company listed on the Hong Kong Stock Exchange is affected by MiFID II if its stock is traded by European buy-side firms.

[12] We also prepare a balanced sample in which the firm must appear with a fiscal year end before January 1, 2018 and a fiscal year end after January 1, 2018. If the firm has not reported December 2018 yet, we exclude it from the balanced sample. This process results in 10,381 firm-year observations that constitute the balanced sample. Inferences remain unchanged if we run the tests on the balanced sample (untabulated).

[13] Because our sample is composed of corporate issuers, we also prepare a sample in which we more carefully consider the timeline of the regulation as it reflects on the consensus forecasts for corporate issuers through the actions of investment firms. The actions of European investment firms are subject to the new regulation as of January 3, 2018; therefore, we expect the sell side to also be affected from this date. A clean pre-MiFID II consensus forecast is one for which all forecasts aggregated into the consensus have been made before MiFID II came into effect. From a corporate issuer's perspective, this is the case when the earnings announcement happened before January 1, 2018. Consensus forecasts for fiscal periods announced after MiFID II came into effect could be "muddied" by the possibility that some of the forecasts included in the consensus were made before January 1, 2018 and are still considered active. We can safely assume that fiscal periods beginning on or after January 1, 2018 are fully in the post-MiFID II period, and are coded as *POST* = 1. In other words, all forecasts included in the consensus are for reporting periods beginning after January 1, 2018. Figure 1 illustrates this timeline for the observations in our sample. This clean-up process results in 9,574 European firm-year observations that we denote as the "cleaner" sample. We also intersect the "cleaner" and the balanced samples, which results in 8,169 European firm-year observations. Inferences based on tests run on these samples (untabulated) are substantially similar with the ones based on the tabulated results.

[14] Clearly, it is difficult to find a "perfect control sample" in our setting (and similar settings). We employ U.S. and Canadian firms as they tend to be economically similar to European firms, but not directly regulated by the directive we examine (Mulherin 2007). However, please note again that we also provide results using only our treatment firms (i.e., our inferences are not induced by our choice of control sample).

(11%), and Sweden (9%). The fewest firm-year observations come from Liechtenstein (6 firm-years; 0.05%). Panel C of Table 1 shows the distribution of the full and matched samples by Fama-French 12 industry classification.[15] We note that financials represent 20% (17%) of the full (PSM matched) sample, followed by other 17% (19%) and business equipment 15% (15%).[16]

3.2 Pre- and Post-MiFID II

In all our analyses, we first test how the post-MiFID II period compares to the pre-MiFID II period for European firms (i.e., our treatment firms).

$$Dep\ Var = \beta_1 POST + \beta_2 SIZE + \beta_3 ROA + \beta_4 LOSS + \beta_5 BTM + Firm\ FE + \varepsilon \qquad (1)$$

where *Dep Var* is specified in each section.[17] *POST* takes the value 1 for periods after January 3, 2018 (i.e., post-MiFID II), and 0 before (i.e., pre-MiFID II). All continuous variables are winsorized at 1 and 99 percent. Importantly, the model includes *firm fixed effects* to control for time-invariant firm characteristics that could explain the level of the outcome variables. Standard errors are robust, adjusted for heteroskedasticity, and clustered by firm (Petersen 2009).

[15] https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_12_ind_port.html

[16] Our empirical analyses include firm fixed effects that control for industry. In untabulated analyses we exclude financials and inferences are unaffected.

[17] Given the MiFID II-induced changes to IBES Detail that we mention above, we use the consensus data (i.e., IBES Summary History file) rather than the detailed analyst data.

3.3 Difference-in-Differences (DiD) with Propensity-Score Matching (PSM)[18]

To further examine the effect, if any, of the implementation of MiFID II, we implement a DiD research design with PSM (Rosenbaum and Rubin 1983). The goal is to match European firms, that is, the treated group (*TREAT* = 1), with firms from Canada and the U.S., that is, the control group (*TREAT* = 0). To be considered for matching, we require a firm to appear in the sample throughout the period 2016 to 2018. We use the 2016 data to estimate the first-stage propensity score on firm size, book-to-market, return on assets, loss, and analyst coverage (i.e., the same control variables used in the second stage, following Shipman, Swanquist, and Whited 2017). We then match treated firms with the nearest neighbor control firm within the same Fama-French 12 industry group and a caliper distance of 0.03, which is 0.25 standard deviation of the propensity score (Rosenbaum and Rubin 1985), one-to-one with replacement. The PSM approach identifies a set of firms that are similar pre-MiFID II on size, return on assets, loss indicator, and analyst coverage. The matching process removes most of the differences between the two samples; the one exception is firm size, that is, after matching control firms are slightly larger than treatment firms (difference in means is significant at 5%).[19] Panel D of Table 2 shows the sample means before and after matching.

For forecast-based tests, we estimate the following model on the data containing annual forecasts.

$$Dep\ Var = \beta_1 TREAT \times POST + \beta_2 SIZE + \beta_3 ROA + \beta_4 LOSS + \beta_5 BTM + Firm\ FE + Year\ FE + \varepsilon \quad (2)$$

[18] In untabulated tests, we alternatively use entropy balancing (Hainmueller 2012; Wilde 2017; Chapman et al. 2019). Entropy balancing weights control group observations to reach covariate balancing, rather than removing non-matched observations. The entropy-balanced sample, based on balancing the first and second moments of firm size, book-to-market ratio and analyst coverage, and first, second, and third moments of firm performance, is about 12% larger than the PSM-matched sample in terms of sample size. Inferences are similar to those drawn from the tabulated results.

[19] As an additional control for firm size, in untabulated analyses we have included the square of firm size and inferences are unaffected.

where *Dep Var* is specified in each section. We implement similar research designs for all tests, where the dependent variables are market reactions to stock recommendations, disclosure events, and stock liquidity. Our focus is on *TREAT*×*POST*. β_1 captures the incremental effect associated with implementing MiFID II in Europe relative to the same time period in the U.S. and Canada. The firm fixed effects subsume the effect of the treatment, and the year fixed effects subsume the effect of the post-MiFID II period, while allowing the pre-MiFID II period to vary.

All models include controls for firm total assets (*SIZE*), firm profitability (*ROA*), indicator for loss-making firms (*LOSS*), and firm market valuation (*BTM*). We winsorize continuous variables at the 1 and 99 percent to control for the effect of outliers. Importantly, all models include *firm fixed effects* and standard errors are clustered by firm. Appendix A lists detailed variable definitions and data sources.

4. Empirical Results for Sell-Side Effects

4.1 Complete Loss of Analyst Coverage

Clearly, the most drastic outcome in terms of sell-side effects for firms would be a complete loss of analyst coverage, thus we start our empirical analyses with such an examination. We provide descriptive information for firms that *completely lose* sell-side coverage after MiFID II implementation in Table 2. Panel A shows that *334 European firms lose coverage* completely in 2018 (i.e., zero coverage in 2018 after being covered previously). Most of these firms (305 firms; 91%) have only one analyst following in 2017. Given that firm size is a major determinant of sell-side coverage (e.g., Yu 2008), this univariate result echoes concerns raised in the financial press

and by national regulators that small firms have the most to lose in terms of sell-side coverage (Flood 2018).

We present multivariate results testing the association between MiFID II and complete loss coverage in Panel B of Table 2. In Model (1), we conduct the test with a pure pre/post specification (i.e., including only European firms). The positive estimated coefficient on *POST* indicates that European firms are more likely to completely lose their sell-side coverage after the implementation of MiFID II.

Next, we introduce North American firms as a control sample and conduct the tests using a DiD design. We first perform a visual inspection of the pre-treatment trends for the control and treatment firms with regards to the likelihood of complete coverage loss and observe, in Figure 2a, that treatment firms share a similar trend of complete coverage loss compared to control firms prior to the implementation of MiFID II in 2018 (i.e., the parallel-trend assumption is satisfied). Our multivariate DiD results, reported in Models (2), based on the full sample, and (3), based on the PSM sample are consistent with those reported in the pre-post specification. Specifically, we observe that European firms, relative to North American firms, are 2.6% incrementally more likely to completely lose sell-side coverage after the MiFID II implementation using the PSM matched sample, which represents a 157% increase relative to the unconditional mean of 1.65% (343 out of 20,791 observations). The impact of MiFID II on the loss of sell-side coverage is thus economically significant, which we view as a potentially serious consequence of the new regulation.

4.2 Continuous Analyst Coverage

We next report results based on firm-level analyst coverage in Table 3. In Panels A and B, we report univariate statistics of the change in analyst coverage in the European and North American sample firms, respectively, in 2018 compared to 2017. While we see a relatively symmetric distribution of changes (losing as well as gaining) in analyst coverage for North American firms, for European firms, the distribution is skewed toward the side representing losing coverage.

In Panel C, we examine changes in analyst coverage for European firms as MiFID II is implemented, using first a pre-post specification and then a DiD design. Overall, the results show a decrease in analyst coverage following MiFID II implementation for European firms, which also suffer an incremental decrease in analyst coverage relative to North American firms. In terms of economic significance, the estimated coefficient of the *TREAT*×*POST* variable indicates that European firms lose 6.6% more analyst coverage relative to North American firms using the PSM-matched sample.

Taken together, the results in Tables 2 and 3 suggest that the concerns expressed by managers and the investment community (CFA 2017; Bloomberg 2017; IR Magazine 2017) are not just tactics to lobby regulators from implementing MiFID II. The fears that firms will suffer a loss, and sometimes a complete loss, of sell-side coverage following the implementation of MiFID II have turned into a reality. That being said, an intended objective of MiFID II is to improve sell-side independence and prior research suggests that improving sell-side independence benefits firms in terms of higher quality analyst forecasts and less biased analysts behavior (e.g., Chen and Chen 2009; Kadan et al. 2009). In the next section, we examine changes in analyst forecast

characteristics following the MiFID II implementation to provide further insight into the costs and benefits debate around MiFID II.

4.3 Analyst-Level Characteristics

Next, we turn to exploring the relation between the decision to stop covering a firm and analyst-level characteristics. In Panel D of Table 3, the dependent variable is an indicator of whether an analyst drops coverage of a firm following MiFID II. In Panel E of Table 3, the dependent variables are an analyst's lifetime relative forecast error, lifetime relative optimism, total experience, or firm-related experience, respectively.

Across both panels, there is relatively consistent evidence that analysts who have poorer performances in terms of forecast accuracy are more likely to drop their coverage of European firms (or are more likely to be let go), whereas analysts who are more senior in terms of years spent in the sell-side profession are less likely to stop covering firms. These findings are in line with the notion that the investment community adapts to the new reality of MiFID II where sell-side research comes with a price tag and is paid for by hard cash. As a consequence, brokerage firms retain better-performing and more experienced analysts to produce sell-side research, making analysts whose research is less likely to attract buy-side payments redundant.

4.4 Consensus Analyst Forecast Properties Tests: Error and Dispersion

Table 4 reports results from regressions that test consensus analyst-forecast characteristics (error and dispersion) in the post-MiFID II period. Although there is some indication that forecast dispersion has reduced when considering the treatment firms alone (Column 4), overall, the

conclusion from these analyses is that there is little effect of MiFID II on forecast errors and dispersion. We next turn to arguably more important sell-side factors.

4.5 Informativeness and Profitability of Sell-Side Analyst Research

To the extent that the sell-side profession under MiFID II is forced to compete for limited buy-side research payments and attention, economic intuition suggests that sell-side analysts may seek to increase the usefulness of their product, that is, their research. Prior studies such as Liu (2011) and Gu, Li, and Yang (2013), provide evidence that decisions taken by the sell-side analysts are driven by buy-side demand. In this section, we assess the informativeness and profitability of analyst stock recommendation to provide insight into the structural changes induced by the MiFID II implementation to sell-side research.

Table 5 shows results on the two-day market reaction to stock-recommendation revisions (i.e., 0 to +1 cumulative abnormal returns). Columns (1) and (2) show market reactions to stock-rating upgrades and downgrades before and after the implementation of MiFID II for treatment firms and control firms. If stock recommendations for European firms become more informative following MiFID II implementation compared to those for North American firms, the coefficient on *TREAT*×*POST* should be positive in column (1) and negative in column (2). Consistent with this expectation, *TREAT*×*POST* is positive and statistically significant in column (1) and negative and statistically significant in column (2) (both at the 1% level), suggesting that stock-rating revisions for European firms after the implementation of MiFID II are incrementally more informative compared to those for North American firms.

In column (3), we combine the first two columns using the full revision/reiteration sample. The variables of interest are the three-way interaction terms. Consistent with the results in the first

two columns, *TREAT×POST×UP* is positive and significant and *TREAT×POST×DOWN* is negative and significant, indicating a relatively stronger market reaction to stock-recommendation revisions for European firms following MiFID II. We include analyst, broker, and industry fixed effects, as well as a set of firm characteristics in column (4), and the inferences hold. In column (5) we specify an alternative window (i.e., −1 to +1 cumulative abnormal return), and again our conclusions are unaffected.

In Table 6, we examine the stock returns associated with buy recommendations to shed light on the profitability of sell-side analyst research. In particular, we focus on buy-and-hold abnormal returns (*BHAR*) over three months and six months after a buy recommendation. Across all specifications, the coefficient on *TREAT×POST×BUY* is positive and significant, indicating that after the implementation of MiFID II, buy recommendations for EU firms are associated with relatively higher returns than for North American firms. However, we refrain from emphasizing these results too strongly because data are not yet available to examine the standard 12-month buy-and-hold returns for most of the recommendations issued after MiFID II.

A longstanding criticism of sell-side research is that stock recommendations are overly positive, with a majority of stocks rated optimistically by analysts (e.g., Kadan et al. 2009). There is some evidence that institutional investors tend to discount stock recommendations provided by sell-side analysts when trading (Malmendier and Shanthikumar 2007). From this perspective, an opportunity to increase the usefulness of sell-side research is to correct, to some extent, the over-optimism in stock ratings. Therefore, we further investigate the percentage of sell and hold recommendations before and after MiFID II.

Using the IBES Summary History, we obtain, for each sample firm, the monthly percentage of sell and hold recommendations. Column (1) of Table 7 compares the percentage of

sell and hold recommendations before and after MiFID II for European firms. The results are consistent with European firms experiencing an *increase in sell and hold* recommendations in the months following the implementation of MiFID II. The results are consistent in the DiD specification (column 2). Introducing various fixed effects and restricting the sample to firms that are present in the sample pre- and post-MiFID II in columns (3) and (4) do not change the inferences.

In the final test of this section, we analyze the decision to include *industry recommendations* alongside stock recommendation in analyst research. According to annual surveys conducted by *Institutional Investor Magazine*, buy-side fund managers consistently rank industry knowledge as the most important sell-side research attribute (Bradshaw 2012). Kadan et al. (2012) document that industry recommendations contain information beyond that in stock recommendations, and that taking industry recommendations into account increases the profitability of stock recommendations.

We use the IBES Detail Recommendation file and the method described by Kadan et al. (2012) to determine whether a stock recommendation is accompanied by an industry recommendation and test whether stock recommendations for European firms are more likely to be accompanied by industry recommendations after MiFID II. Table 8 reports the results where the dependent variable, *Industry Recommendation*, equals 1 if a stock recommendation is accompanied by an industry recommendation, and 0 otherwise. In column (1), *TREAT*×*POST* is positive and statistically significant, albeit not strongly so (i.e., the t-statistic is 1.76). This finding indicates that, relative to North American firms, stock recommendations for European firms are more likely to be accompanied by industry recommendations after the implementation of MiFID II. This conclusion still holds after we include industry and broker fixed effects in columns (2) and

(3). Overall, the evidence is consistent with sell-side analysts increasingly providing industry recommendations, information that is incrementally useful to stock recommendations, after MiFID II.

5. Empirical Results for Buy-Side Effects

5.1 Buy-Side Interest as a Moderating Factor

The mechanics of MiFID II suggest that the sell-side's re-allocation of resources among covered firms is likely dependent on the buy-side's interest in those firms. For firms that are heavily invested by buy-side investors prior to the new regulation, they are likely to continue consuming sell-side research, and therefore the sell-side is likely to continue covering those firms. For firms that do not attract (much) buy-side attention, the sell-side is likely to re-allocate resources, including potentially dropping coverage of those firms. As our first empirical analysis focusing on the buy-side, we therefore redo the analyses in Table 2, conditioning on one-year lagged institutional ownership, and report the results in Table 9.

The dependent variable is *Complete Coverage Loss*. In column (1), we focus on European firms and introduce *Low IO* and its interaction with *POST*. *Low IO* is defined by country-year and equals 1 if one-year lagged institutional ownership is below the median, and 0 otherwise. The coefficient on the interaction is positive and significant, suggesting that after the implementation of MiFID II, European firms without much interest from the buy-side are more likely to lose sell-side coverage completely compared to European firms heavily invested by the buy-side. One potential concern for this analysis is that firms with low institutional ownership tend to have lower analyst coverage to begin with and consequently are mechanically more likely to completely lose sell-side coverage. To address this possibility, we employ matched North American firms as

control firms where pre-MiFID II sell-side coverage is part of the matching dimensions. Note that, according to Table 1, control firms and treatment firms have similar sell-side coverage after matching. Results in column (2), based on the PSM-matched sample, show that the coefficient on *POST*×*Low IO* is insignificant, suggesting that for analysts covering North American firms, the effect of buy-side interest on their decision to drop coverage does not change over the period of MiFID II implementation. In contrast, the coefficient on the three-way interaction term is positive and significant, indicating that relative to North American firms, European firms without much buy-side interest are incrementally more likely to suffer complete coverage loss after MiFID II. Taken together, the evidence in Table 9 is consistent with the notion that buy-side interest shapes how sell-side analysts covering European firms re-allocate their limited resources following the implementation of MiFID II.[20]

5.2 Effects on Buy-Side Research

Investment firms usually have at least a few in-house analysts (i.e., buy-side analysts) who perform research activities exclusively for the firm that employs them. Given that MiFID II imposes substantial financial costs on investment firms to obtain sell-side research, the implementation of the regulation could lead to structural changes in the buy-side research community. Investment firms may react to elevated costs by turning to more in-house research. While it is difficult to directly document such a potential shift due to buy-side research being proprietary and unavailable to outsiders (including to researchers), we seek to provide preliminary evidence by examining the number of buy-side analysts working in European investment firms before and after the implementation of MiFID II.

[20] We observe similar effects when we consider continuous analyst coverage (untabulated).

Using Thomson Reuters, we obtain a list of contacts in institutional investment firms on June 12, 2017 (before MiFID II), and another list on April 3, 2019 (after MiFID II). For our purpose, we keep only investment firms that appear in both lists and operate in either any of the EEA countries (treatment firms) or in the U.S. or Canada (control firms), and retain only those individuals whose current title is (buy-side) security analyst or associate analyst.[21] We then sum up the number of buy-side analysts employed by each investment firm.

Table 10 reports the results. The dependent variable is the log-transformed number of buy-side analysts. In column (1), the results are based on the full sample, with a positive and significant coefficient on the interaction that indicates an *increase* in the *number of buy-side analysts* employed by EEA investment firms relative to North American investment firms.

To account for the possibility that European investment firms are different in terms of size, we assign investment firms into five groups based on the asset size under management, and randomly match a European firm with a control firm in the same asset group. In columns (2) through (4), we employ size-matched samples. We define the size of the investment firm as a five-step categorical variable of total assets under management (*AUM*). Based on the matched sample, in column (2), we find similar evidence of an increase in the number of buy-side analysts in European investment firms relative to North American firms. We introduce firm-fixed effects in column (3) and additionally control for asset groups in column (4), and inferences remain similar.[22] Overall, the findings in Table 11 provide indirect evidence that European investment firms turn to more in-house research after the implementation of MiFID II. These are new findings

[21] We remove investment firms that operate simultaneously in EEA countries and the U.S. or Canada.

[22] Note that "assets under management" can be different financial instruments (e.g., fixed income, equity, stock options etc.). We use FactSet to obtain a comparable measure of the size of equity instruments under management for investment firms, however, the sample size decreases by about one third. When we control for assets under management in this restricted sample, statistical significance on *EUROPEAN×POST* is slightly weaker but overall inferences remain unchanged (untabulated).

to the literature and also suggest an approach to measuring buy-side interest that can be applied in other settings.

5.3 Buy-Side Analyst Participation in Conference Calls

Next, we aim to provide corroborating evidence that investment firms replace sell-side research with more in-house research by further exploring a setting in which the activities of *buy-side* analysts can be observed directly: conference-call participation. Given the pressure that MiFID II puts on the sell side, it is conceivable that we would observe greater interest from buy-side analysts to attend the conference calls. On the other hand, conference calls are clearly not the only way for the buy side to manifest their stronger presence (e.g., private communication is another option).

Following Jung et al. (2018) and Call et al. (2018), we use conference call transcripts to identify sell-side and buy-side analysts participating in conference calls. We download the conference call transcripts from FactSet, and parse the list of participants to obtain the name, job, and employer of the non-corporate participants. We implement the following procedure to identify the sell-side and buy-side analysts: (1) we match by name and employer the list of non-corporate participants with the list of sell-side analysts obtained from FactSet Contact Screening; (2) we match the remaining participants by name and employer with a list of buy-side analysts and portfolio managers obtained from FactSet Contact Screening, Thomson Reuters, and S&P Capital IQ; (3) we match the remaining participants by employer with the list of buy-side and sell-side firms from FactSet, Thomson Reuters, and S&P Capital IQ; (4) we isolate the remaining non-

matched participants and manually code them as sell-side, buy-side, or other (e.g., media) by searching for their employment information via LinkedIn, Bloomberg, and corporate websites.[23]

Table 11 reports results using the conference-call participation data. In Panel A, the focus is on buy-side participation and the extent of interaction with management in fourth-quarter earnings-conference calls.[24] We measure buy-side participation as the number of buy-side analysts attending the call (*Buy-Side Participation*). We measure the extent of buy-side analyst interaction with management by counting the number of times the name of a buy-side analyst appears in the conference call transcript aggregated over all the buy-side analysts attending the call (*Buy-Side Questions*). Ideally, we would measure the number of meaningful interactions or questions that buy-side analysts ask, therefore we truncate the count of interactions to 10 to eliminate interactions without information content (i.e., the analyst saying "Good morning," "Thank you," "I see," etc.). When missing, we set these variables to zero. The coefficient on *TREAT*×*POST* is positive and significant, indicating an increase in buy-side analyst participation and interactions with management in conference calls in the post-MiFID II period compared to the control sample.

In Panel B of Table 11, we examine how engaged the buy-side analysts attending the earnings conference calls are in the post-MiFID II period. The dependent variable is computed as the number of interactions between buy-side analysts and managers divided by the number of buy-side analysts attending the call. These tests are conditional on buy-side participation in the earnings call; therefore, the sample is much smaller and we attempt to overcome this issue by also including first, second, third, and fourth quarter earnings conference calls while controlling for quarter fixed effects. In model (1) using a sample of European firms, we find that buy-side analysts significantly increase their engagement during earnings-conference calls following MiFID

[23] We manually coded over 9,000 individuals.
[24] Results are similar if we use *all* earnings-conference calls.

II by asking about one more question (β = 0.992) per buy-side analyst. Given that the average number of questions asked by buy-side analysts before MiFID II implementation in our European sample is 5.4 questions, this increase is economically meaningful. Results based on the matched sample in model (2) provide consistent inferences. [25,26]

Overall, the results in Table 11 provide evidence that buy-side analysts increase their participation and engagement in earnings conference calls post-MiFID II in Europe compared to North America. Together with the results in Table 10, these findings indicate that investment firms increase their in-house research capabilities, in line with the statements made by most that they will absorb research costs rather than pass them on to their clients.

6. Empirical Results for Firm Effects

Finally, we further examine changes in the information environment, if any, after MiFID II implementation. Sell-side analysts as information intermediaries are often considered one of the building blocks of a firm's information environment (Healy and Palepu 2001). To the extent that firms are covered by fewer sell-side analysts post-MiFID II, one might expect firms to experience a deterioration in their information environment. However, prior research suggests that lower quality sell-side research could bring in undue noise that affects the information environment. As

[25] In untabulated analyses we also find an increase in the likelihood that the *first question* in the earnings-conference call comes from a buy-side analyst after MiFID II, compared to the control group.

[26] Abraham and Bamber (2017) suggest that conference-call participation (i.e., asking questions) provides an opportunity for sell-side analysts to make their opinions and advice appear credible to their potential buy-side clients and presents a visibility- and profile-raising opportunity. However, asking questions can be costly as doing so may reveal their private information (Mayew, Sharp, and Venkatachalam 2013). Given that sell-side analysts after MiFID II face heightened pressure to attract or retain payments from fund managers, we expect MiFID II to change the equilibrium of cost-benefit trade-offs by sell-side analysts covering European firms. We do not test sell-side participation since generally companies will not organize earnings conference calls if there is no demand from the sell-side (Frankel, Johnson, and Skinner 1999). Fewer than 1% of the conference calls in our sample are coded as having zero sell-side participants, and that is generally the case because the participant(s) are unidentified (i.e., FactSet lists them as "unverified participant"). However, we test the engagement of sell-side analysts in earnings conference calls and find a statistically significant increase in sell-side engagement. However, the economic magnitude is only about 0.1 additional questions per sell-side analyst following MiFID II implementation (untabulated).

brokerage firms are forced to increase research quality in order to compete with limited buy-side payments for sell-side research, firms' information environment could potentially improve following MiFID II implementation. Additionally, firms could respond to reduced analyst coverage by enhancing their own disclosure practices (e.g., Anantharaman and Zhang 2011).

First, we seek evidence on firms changing disclosure policies following the implementation of MiFID II, with a focus on a type of disclosure event that emphasizes the interaction between firms and the investment community, specifically, firms presenting at investor conferences organized by brokerage firms (i.e., broker-hosted conferences). Broker-hosted conferences are a cost-effective event favored by firms that try to gain investor recognition (Green, Jame, Markov, and Subasi 2014). Prior literature has not systematically investigated European firms' preferences relative to such disclosure events.

We use FactSet Calendar to identify these disclosure events. Panel A of Table 12 presents the results, after controlling for demand for such events proxied by analyst coverage and institutional ownership. The dependent variable is the number of broker-hosted investor conferences in which the firm presents in a year (*#Broker Conferences*). In column (1), the coefficient on *POST* is insignificant, indicating that European firms do not appear to alter their disclosure activities after MiFID II. We introduce year fixed effects in subsequent columns as an attempt, alongside using control firms, to mitigate the impact of potential trends in the disclosure landscape. Note that *POST* is absorbed by the year fixed effects. In columns (2) based on PSM sample, we find that European firms, relative to control firms, increase their participation at investor conferences organized by brokerage firms after MiFID II.

Overall, the findings in Panel A of Table 11 provide some evidence that European firms increase their participation in disclosure events where management interacts with the investment

community after the implementation of MiFID II, likely as a response to decreases in sell-side research available on the market.

Next, we investigate changes in the information environment after MiFID II implementation using stock liquidity to capture the firm-level information environment (e.g., Balakrishnan, Billings, Kelly, and Ljungqvist 2014). In these tests, we control for the number of disclosure events in which the firm participates as well as analyst following. Panel B of Table 12 reports the results. Using Amihud's (2002) illiquidity ratio (*Amihud Ratio*) as an inverse proxy for liquidity, we find that treatment firms experience an incremental increase in stock illiquidity following MiFID II implementation relative to control firms. Inferences are similar if we proxy for stock liquidity with the bid-ask spread or with the percentage of zero trading days (untabulated). These results provide some evidence that the information environment for European firms deteriorates following the implementation of MiFID II, and that engaging in more disclosure events does not fully counter the negative impact. In this regard, these results further echo the concern raised in various professional surveys that MiFID II could present a net cost to European companies.[27]

7. Additional Analyses

7.1 Remove U.K. Firms from the Sample

Panel B of Table 1 reveals that U.K. firms make up a third of our European sample. Consequently, one might argue that that our findings of declines in sell-side activities in Europe after MiFID II could be affected by Brexit. We therefore rerun our main analyses after excluding

[27] When we condition this test on the complete loss in analyst coverage, the results are statistically insignificant, likely due to the reduced power of the test given the effective sample of 334 firms (as per Panel A of Table 1). Therefore, it does not appear that the decrease in stock market liquidity is completely driven by the firms that completely lose their analyst coverage.

U.K. firms. The results reported in Table 13 based on continental European firms as the treatment sample provide similar inference as those reported throughout the prior tables. Hence, it is unlikely that our findings are solely driven by U.K. firms.

7.2 Effect of MiFID II on Small Firms (Untabulated)

We further test whether small firms are more affected by the MiFID II-induced changes to the sell-side. We group firms into tertiles based on total assets and classify firms in the third (smallest firms) tertile as small firms. In untabulated analyses, we find negative estimated coefficients for both large and small firms. However, in terms of proportional effect on analyst coverage the impact is greater for small firms, which is consistent with concerns raised by commentators prior to the regulation being put into effect.

8. Conclusion

MiFID II is a sweeping new regulation that affects Europe as well as the rest of the world. Due to this new regulation, equity research is no longer bundled with brokerage firms' other services. We test the implications of MiFID II on sell-side analysts, buy-side firms, and firms using a comprehensive set of outcome measures.

Regarding sell-side analysts, we document that 334 European firms completely lose their analyst coverage as a result of MiFID II. We also provide results of a significant reduction in analyst coverage as measured through a continuous measure. However, the analysts who "disappear" tend to be of lower quality based on their prior work. On the positive side, we show that stock-recommendation revisions have greater information content, buy recommendations are more profitable, and stock recommendations are more likely to be accompanied by industry

recommendations following MiFID II. We also document a higher percentage of sell and hold recommendations after MiFID II.

It is difficult for researchers to measure buy-side research activity and coverage of firms. We develop a new approach to gauge the buy-side effects by counting the number of individuals employed as buy-side analysts before and after the regulation. We find a significant increase in the number of buy-side analysts, suggesting that there is a substitution effect between loss of sell-side coverage and increased buy-side research effort. Furthermore, we document that buy-side analyst increase their participation in, and ask on average more question during, earnings-conference calls of European firms after MiFID II implementation.

We find some but very modest evidence that firms increase their disclosure activities following MiFID II. After controlling for disclosure responses and changes in analyst following, we document that stock-market liquidity has decreased.

As should not be surprising with such a large-scale regulation, the overall impact is clearly *mixed.* Whereas firms are hurt by losing analyst coverage, we also show that the analysts who disappear tend to be lower quality and that stock recommendations are of higher quality following the regulation. Also, the buy-side picks up some of the slack by investing in new in-house analysis.[28, 29]

[28] An interesting question is whether the newly hired buy-side analysts are former sell-side analysts, particularly in light of our findings that the less experienced and less accurate sell-side analysts leave research firms upon MiFID II implementation. However, the costly data collection necessary to answer this question places it beyond the scope of this paper.

[29] The goal of this study is to provide initial and timely empirical evidence on the economic consequences of MiFID II on the sell-side, buy-side, and firms. This means that we do not consider long-term consequences. For example, it is possible that a "new equilibrium" will emerge once the various market participants have adjusted to the new regulation. We leave such examination for future research.

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Figure 1: Timeline of Pre- and Post-MiFID II Effect for Corporate Issuers

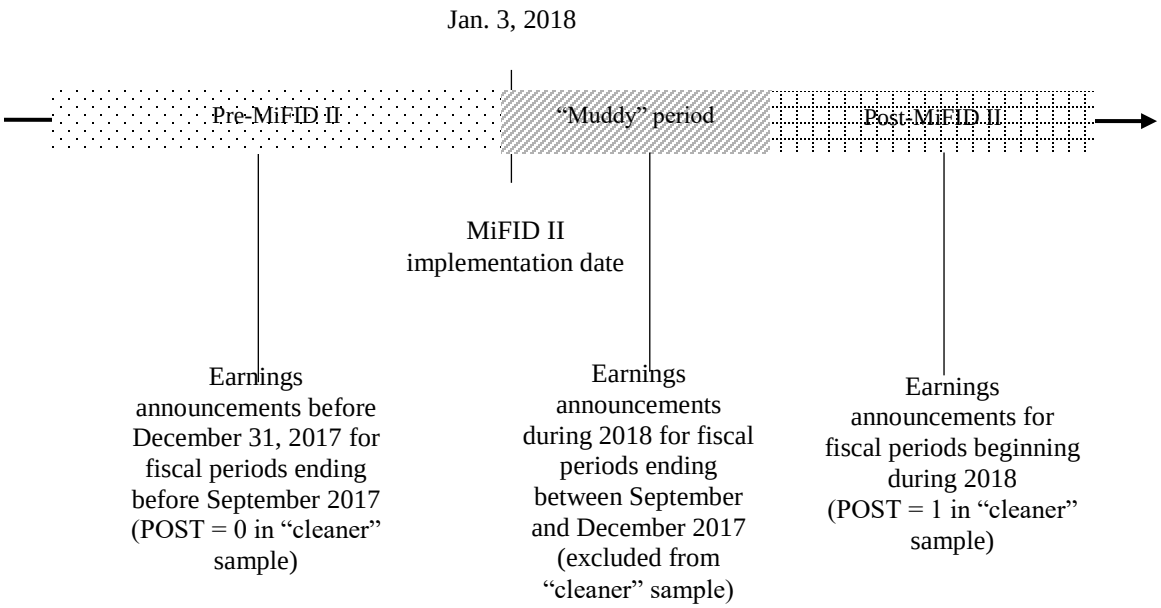


Figure 2a: Parallel Trends for Complete Loss of Coverage Based on Balanced Sample

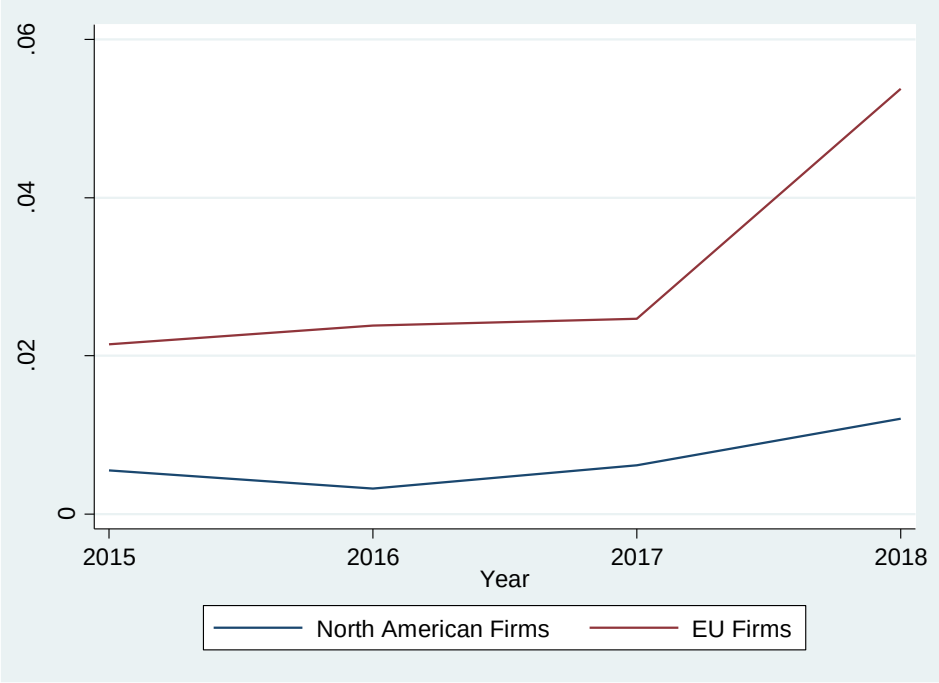
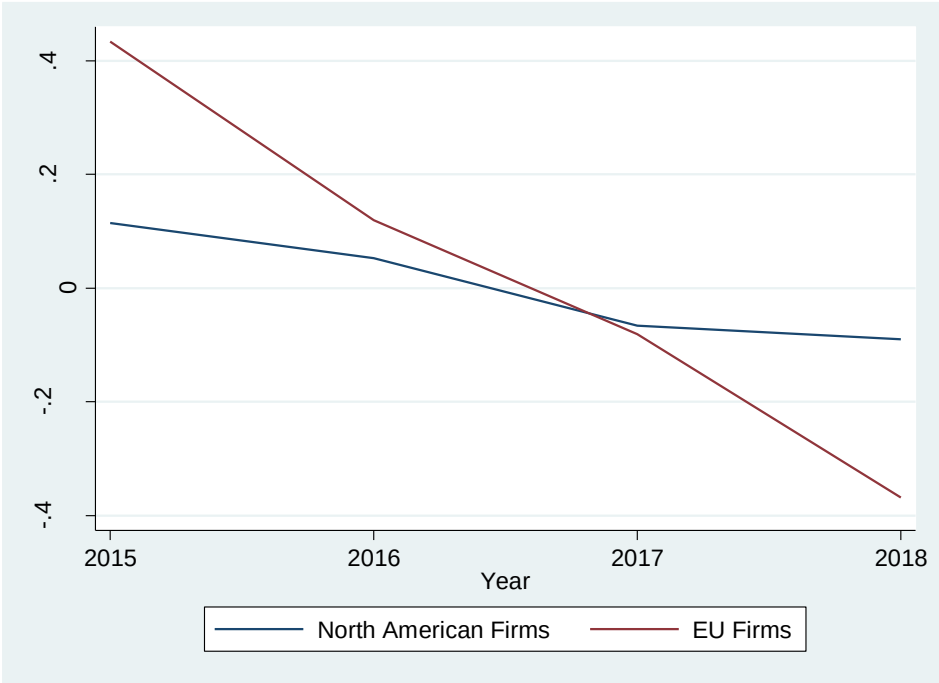


Figure 2b: Parallel Trends for Continuous Analyst Coverage (Demeaned) Based on Balanced Sample



Appendix A: Variable Definitions

Variable	Definition	Source
Variables of interest		
TREAT	Indicator variable that takes the value 1 for companies headquartered in the European Economic Area (i.e., the treatment group), and 0 otherwise (i.e., the control group). The control group includes companies from Canada and the U.S.	Compustat North America and Global
POST	Indicator variable that takes the value 1 for reporting periods that end on or after January 1, 2018, and 0 for reporting periods that end on or before December 31, 2017.	Compustat North America and Global
EUROPEAN	Indicator variable that takes the value 1 for European Economic Area investment firms, and 0 otherwise.	Thomson Reuters
Dependent variables		
Coverage	Number of analysts forecasting EPS for a firm's reporting period-end (*numest*).	IBES Summary
Complete Coverage Loss	Indicator variable that takes the value 1 if a firm loses all coverage for the fiscal reporting period, and 0 otherwise.	IBES Summary
Forecast Error	Absolute value of actual EPS (*actual*) minus median consensus (*medest*) scaled by absolute actual EPS.	IBES Summary
Dispersion	Standard deviation of the analyst forecasts included in the consensus (*stdev*).	IBES Summary
Drop Coverage	Indicator variable that takes the value 1 if analyst *j* has issued a forecast for firm *i* in year $t-1$ but has not issued a forecast for firm *i* in the year *t*, and 0 otherwise.	IBES Detail History
Buy-Side Participation	Number of buy-side analysts attending a conference call.	FactSet Transcripts
Buy-Side Questions	Number of meaningful interactions between buy-side analysts and management during a conference call. The variable is truncated at 10 to ensure that it captures meaningful interactions.	FactSet Transcripts
Buy-Side Engagement	Average per analyst number of interactions between buy-side analysts and management during a conference call.	FactSet Transcripts
#Broker Conferences	Number of broker-hosted conferences during a year.	FactSet Events Calendar
CAR (0;+1)	Cumulative abnormal returns two days around stock recommendation changes. Stock returns are adjusted using the main market index in each economy (i.e., S&P 500 for the U.S., TSX60 for Canada, STOXX Europe 600 for Europe).	Datastream
BHAR	Buy-and-hold return over three months (six months).	Datastream
%Sell or Hold	Monthly percentage of sell or hold stock recommendations.	IBES Summary History
Industry Recommendation	Indicator variable equal to 1 if a stock recommendation is accompanied by an industry recommendation, and 0 otherwise.	IBES Detail Recommendation
#BUYSIDE	Natural logarithm of the number of buy-side analysts employed by investment firms.	Thomson Reuters
Control variables		
SIZE	Natural logarithm of total assets at reporting period-end (*at*).	Compustat North America and Global

Amihud Ratio	Quarterly ratio of the daily absolute return to the monetary unit trading volume in that day, as defined by Amihud (2002).	CRSP and Datastream
ROA	Income before extraordinary items (ib) divided by total assets at reporting period-end (*at*).	Compustat North America and Global
LOSS	Indicator variable that takes the value 1 if income before extraordinary items (*ib*) is a loss, and 0 otherwise.	Compustat North America and Global
BTM	Book-to-market ratio, computed as total common equity (*seq*) divided by market capitalization (*csho* × *prcc*).	Compustat North America and Global, CRSP and Compustat Security
Lifetime Relative Error	Relative forecast error for analyst *i* compared to all analysts covering the same firm *j* for the same fiscal period end, averaged over the entire experience of analyst *i* with the firm *j*. Relative forecast error is the absolute difference between the consensus and the estimate made by analyst *i* for firm *j*, scaled by the consensus.	IBES Detail History
Lifetime Relative Optimism	Relative forecast optimism for analyst *i* compared to all analysts covering the same firm *j* for the same fiscal period end, averaged over the entire experience of analyst *i* with the firm *j*. Relative forecast optimism is the difference between the consensus and the estimate made by analyst *i* for firm *j*, scaled by the consensus.	IBES Detail History
Total Experience	Number of quarters between the first forecast made by analyst i (among all firms) and the time *t* earnings announcement by the firm.	IBES Detail History
Firm Experience	Number of quarters between the first forecast made by analyst *i* for a firm *j* and the time *t* earnings announcement by the firm.	IBES Detail History
IO	Percentage of shares in firm *i* owned by institutions in *t*−1. If missing, the variable is set to zero.	Thomson Reuters and FactSet Ownership
Low IO	Indicator variable that takes the value 1 if one-year lagged institutional ownership measured as percentage of shares in firm *i* owned by institutions is below median by country-year, and 0 otherwise.	Thomson Reuters and FactSet Ownership

Table 1: Sample and Descriptive Statistics

Panel A: Sample Construction

	Treated sample	Control sample		Total firm-year observations
Sample	EEA	U.S.	Canada	
Firm-year observations between 2015-2018	13,532	11,988	2,828	28,348
Less: Missing accounting data	(509)	(1)	(77)	
Less: Firms without coverage during sample period	(683)	(1)	(122)	
Full sample	**12,340**	**11,986**	**2,629**	**26,955**
PSM Matched Sample	**10,695**	**7,477**	**2,619**	**20,791**
Full sample less fiscal year ends between September 30 - December 31, 2017	(2,766)	(2,887)	(575)	
Cleaner sample	9,574	9,099	2,054	20,727
Full sample less unbalanced firms	(1,959)	(5,562)	(476)	
Balanced sample	10,381	6,424	2,153	18,958
Cleaner and balanced sample	8,169	5,188	1,692	15,049

Panel B: Distribution of European Sample Firms by Country

Country	Full Sample		Matched Sample	
	Frequency	Percent	Frequency	Percent
Austria	155	1.26%	144	1.35%
Belgium	308	2.50%	278	2.60%
Bulgaria	64	0.52%	48	0.45%
Croatia	39	0.32%	37	0.35%
Cyprus	59	0.48%	49	0.46%
Czech Republic	27	0.22%	26	0.24%
Denmark	233	1.89%	210	1.96%
Estonia	44	0.36%	40	0.37%
Finland	445	3.61%	399	3.73%
France	1,478	11.98%	1,335	12.48%
Germany	1,335	10.82%	1,185	11.08%
Greece	112	0.91%	102	0.95%
Hungary	27	0.22%	23	0.22%
Ireland	153	1.24%	146	1.37%
Italy	721	5.84%	622	5.82%
Latvia	11	0.09%	7	0.07%
Liechtenstein	6	0.05%	4	0.04%
Lithuania	18	0.15%	11	0.10%
Luxembourg	103	0.83%	95	0.89%
Malta	10	0.08%	10	0.09%
Netherlands	343	2.78%	319	2.98%
Norway	575	4.66%	527	4.93%
Poland	740	6.00%	533	4.98%
Portugal	87	0.71%	77	0.72%
Slovenia	33	0.27%	33	0.31%
Spain	379	3.07%	349	3.26%
Sweden	1,129	9.15%	914	8.55%
United Kingdom	3,706	30.03%	3,172	29.66%
Total	**12,340**	**100.00%**	**10,695**	**100.00%**

This table shows the European sample distribution by country, for the full sample of European firms and for the sample of European firms for which match using PSM matching is available.

Panel C: Distribution of Sample Firms by Industry

Fama-French 12 Industry Code	European Sample		Full Sample		PSM Matched Sample	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Consumer Non-Durables – Food, Tobacco, Textiles, Apparel, Leather, Toys	846	6.86%	1,398	5.19%	1,552	7.46%
Consumer Durables – Cars, TVs, Furniture, Household Appliances	272	2.20%	541	2.01%	440	2.12%
Manufacturing – Machinery, Trucks, Planes, Office Furniture, Paper, Com Printing	1,445	11.71%	2,566	9.52%	2,433	11.70%
Oil, Gas, and Coal Extraction and Products	448	3.63%	1,366	5.07%	757	3.64%
Chemicals and Allied Products	319	2.59%	615	2.28%	586	2.82%
Business Equipment – Computers, Software, and Electronic Equipment	1,882	15.25%	4,054	15.04%	3,068	14.76%
Telephone and Television Transmission	358	2.90%	645	2.39%	629	3.03%
Utilities	211	1.71%	552	2.05%	364	1.75%
Wholesale, Retail, and Some Services (Laundries, Repair Shops)	958	7.76%	2,211	8.20%	1,581	7.60%
Healthcare, Medical Equipment, and Drugs	1,122	9.09%	3,087	11.45%	1,799	8.65%
Finance	2,135	17.30%	5,432	20.15%	3,632	17.47%
Other – Mines, Construction, BldMt, Transport, Hotels, Bus Serv, Entertainment	2,344	19.00%	4,488	16.65%	3,950	19.00%
Total	**12,340**	**100%**	**26,955**	**100%**	**20,791**	**100%**

This table shows the sample distribution by industry. Industry is defined using the Fama and French (1997) 12-industry classification.

Panel D: Parallel Trend for PSM Sample

Before PSM Matching

	Mean			t-test	
Variable	Treated	Control	%bias	t	p>t
SIZE	6.204	6.931	−24.40	−9.95	0.000
ROA	0.000	-0.096	5.20	1.95	0.051
LOSS	0.228	0.346	−26.20	−10.36	0.000
BTM	0.830	0.534	10.40	4.32	0.000
Coverage	6.131	7.637	−21.50	−8.53	0.000

After PSM Matching

	Mean			t-test	
Variable	Treated	Control	%bias	t	p>t
SIZE	6.204	6.403	−6.70	−2.48	0.013
ROA	0.000	−0.081	4.40	1.07	0.285
LOSS	0.228	0.246	−4.00	−1.59	0.112
BTM	0.830	0.789	1.40	0.54	0.591
Coverage	6.131	6.256	−1.80	−0.71	0.478

Table 2: Complete Loss of Sell-Side Analyst Coverage

Panel A: Distribution of European firms *prior to the complete loss of coverage* upon MiFID II implementation, by number of analysts following

Analyst coverage in 2017 (one year prior to complete loss of coverage)	Number of firms	Percent
1	305	91.32
2	22	6.59
3	2	0.6
4	2	0.6
5	2	0.6
7	1	0.3
Total	334	100

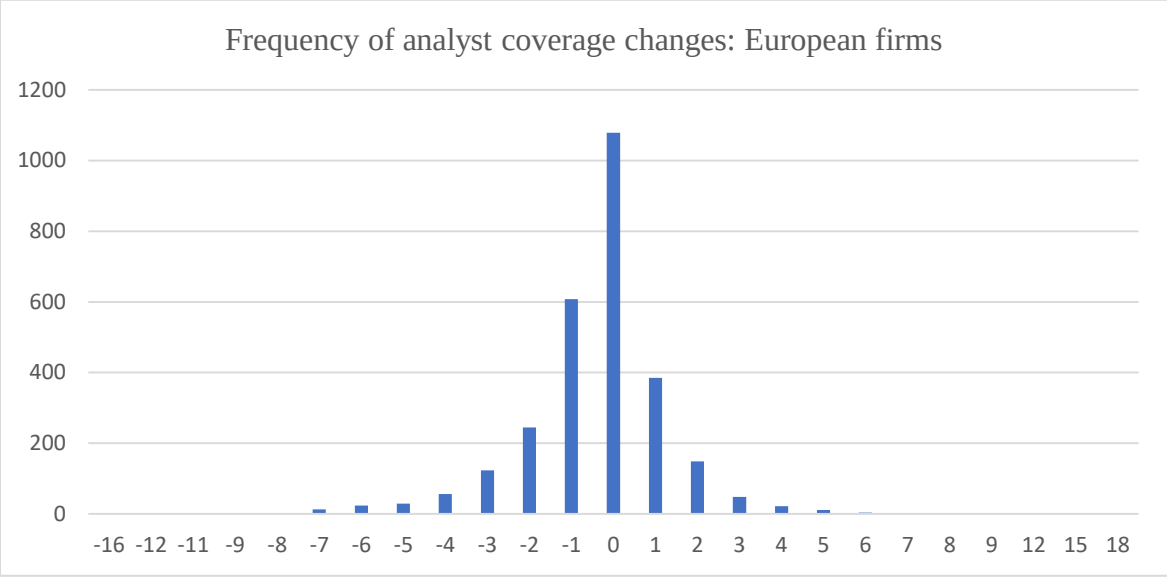
Panel B: Multivariate tests of complete loss of analyst coverage

	(1)	(2)	(3) PSM Matched
Variables	European Firms	Full sample	Sample
POST	**0.026*** **		
	(4.34)		
TREAT × POST		**0.012***	**0.026***
		(1.85)	**(1.68)**
ROA	0.027	0.024	−0.006
	(0.69)	(1.33)	(−0.29)
LOSS	0.008	0.005	0.001
	(0.69)	(0.91)	(0.25)
BTM	−0.018*	−0.012*	0.018
	(−1.65)	(−1.86)	(1.20)
SIZE	−0.013*	−0.019***	−0.011
	(−1.94)	(−3.32)	(−1.55)
Constant	0.122***	0.148***	0.074*
	(2.97)	(3.90)	(1.95)
Fixed Effects	Firm	Firm & Year	Firm & Year
Clustering	Firm	Firm	Firm
Adj. R-squared	0.110	0.117	0.117
Observations	12,340	26,955	20,791

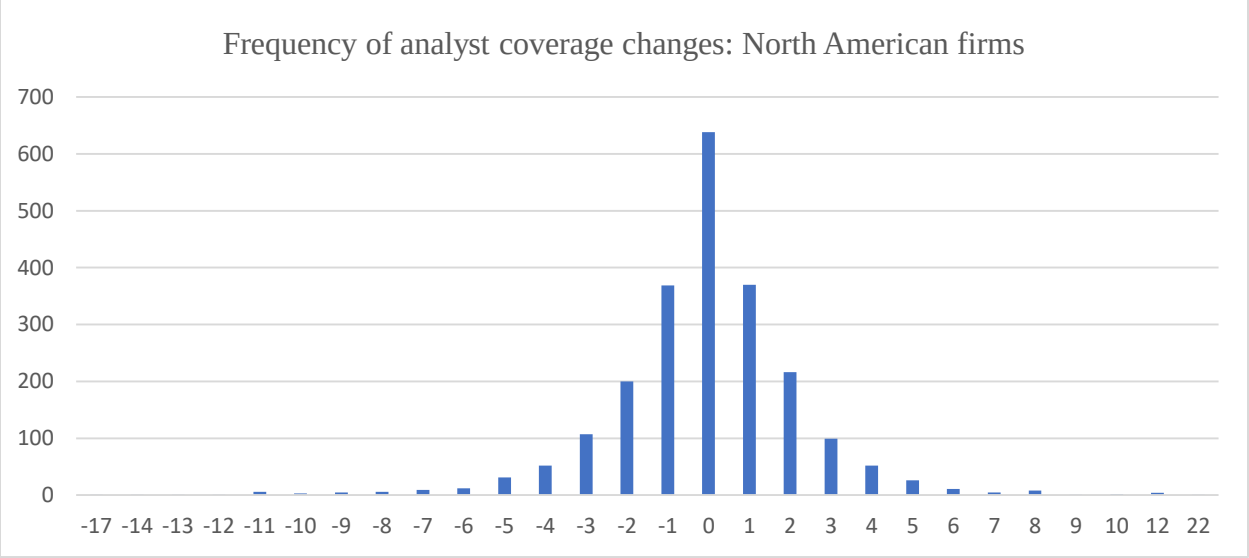
The table presents results from a pre/post model on the European sample (model 1) and DiD models on the full sample (model 2), PSM matched sample (model 3). The dependent variable is *Complete Coverage Loss*. Model (1) includes firm fixed effects. Models (2) and (3) include firm and year fixed effects. Robust standard errors are clustered by firm. All continuous variables are winsorized at 1 and 99%. All variables are defined in Appendix A. Statistical significance is based on two-tailed tests and is indicated as follows: *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Table 3: Continuous Analyst Coverage

Panel A: Change in analyst coverage for European firms, 2018 compared to 2017



Panel B: Change in analyst coverage for North American firms, 2018 compared to 2017



Panel C: Multivariate tests of continuous analyst coverage

Variables	(1) European firms	(2) PSM Matched sample
POST	**−0.052*** **	
	(−5.93)	
TREAT × POST		**−0.066***
		(−1.90)
SIZE	0.025**	0.054***
	(2.09)	(3.46)
ROA	0.023	0.054
	(0.51)	(0.92)
LOSS	−0.032**	−0.055**
	(−1.97)	(−2.48)
BTM	0.021	0.008
	(1.53)	(0.22)
Constant	1.373***	1.310***
	(19.04)	(12.22)
Observations	12,340	20,791
Fixed Effects	Firm	Firm & Year
Clustering	Firm	Firm
Adj. R-squared	0.890	0.903

The table presents results from a pre/post model on the European sample (model 1) and DiD models on the PSM matched sample (model 2). The dependent variable is *Coverage*. Model (1) includes firm fixed effects. Model (2) includes firm and year fixed effects. Robust standard errors are clustered by firm. All continuous variables are winsorized at 1 and 99%. All variables are defined in Appendix A. Statistical significance is based on two-tailed tests and is indicated as follows: *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Panel D: Characteristics of analysts who drop coverage during the sample period

	(1)	(2)	(3)
Variables	Full Sample	Treated	Control
Lifetime Relative Forecast Error	0.654***	0.469***	0.786***
	(34.47)	(15.12)	(32.69)
Lifetime Relative Optimism	−0.006	0.107***	−0.096***
	(−0.31)	(3.34)	(−3.57)
Total Experience	−0.001***	−0.001***	−0.000***
	(−13.36)	(−11.99)	(−6.75)
Firm Experience	−0.003***	−0.003***	−0.003***
	(−24.40)	(−14.85)	(-19.17)
Constant	0.265***	0.325***	0.234***
	(20.35)	(15.81)	(13.89)
Fixed Effects	Firm	Firm	Firm
Adj. R-squared	0.116	0.085	0.126
Observations	97,192	37,234	59,958

The table presents results from models that test the relation between analyst-level characteristics and coverage drop. The dependent variable is the indicator *Drop Coverage*, based on annual forecasts. Sample observations are at the analyst-firm-reporting period level. If an analyst never covers a firm, she is excluded from the sample. All specifications include firm fixed effects. Robust standard errors clustered by firm are in parentheses. All continuous variables are winsorized at 1 and 99%. All variables are defined in Appendix A. Statistical significance is based on two-tailed tests and is indicated as follows: *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Panel E: Comparison of analysts who drop coverage after MiFID II

Variables	(1) *Lifetime Relative Forecast Error*	(2) *Lifetime Relative Optimism*	(3) *Total Experience*	(4) *Firm Experience*
TREAT × POST	**0.011*** **	**0.001**	**−1.853****	**−1.152*****
	(5.23)	**(0.28)**	**(−2.53)**	**(−3.21)**
TREAT	0.025***	−0.010***	−0.391	−1.047***
	(20.72)	(−9.58)	(−0.95)	(−5.17)
POST	−0.009***	−0.001	2.540***	1.016***
	(−6.27)	(−1.09)	(5.25)	(4.28)
Constant	0.345***	0.502***	38.296***	13.104***
	(435.47)	(733.65)	(141.75)	(98.83)
Fixed Effects	Firm	Firm	Firm	Firm
Adj. R-squared	0.021	0.003	0.001	0.002
Observations	40,786	40,786	40,306	40,306

The table presents results from DiD models that compare the characteristics of analysts who drop coverage after to before MiFID II. The dependent variable is indicated below the model number. The sample contains the analysts that dropped coverage for some firms during the sample period. Sample observations are at the analyst-firm-reporting period level. If an analyst never covers a firm, she is excluded from the sample. All specifications include firm fixed effects. Robust standard errors clustered by firm are in parentheses. All continuous variables are winsorized at 1 and 99%. All variables are defined in Appendix A. Statistical significance is based on two-tailed tests and is indicated as follows: *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Table 4: Consensus Analyst Forecast Characteristics: Error and Dispersion

	(1)	(2)	(3)	(4)
	Forecast Error		*Forecast Dispersion*	
Variables	European Firms	PSM Matched sample	European Firms	PSM Matched sample
POST	**−0.065**		**−0.030****	
	(−1.35)		**(−2.42)**	
TREAT × POST		**−0.009**		**−0.016**
		(−0.14)		**(−0.79)**
ROA	0.690*	−0.104	0.254*	0.139*
	(1.71)	(−0.31)	(1.83)	(1.89)
LOSS	0.403***	0.200**	0.297***	0.194***
	(2.97)	(1.97)	(6.59)	(5.52)
BTM	0.129	0.138	0.046	0.052**
	(1.25)	(1.04)	(1.37)	(2.09)
SIZE	−0.104**	−0.061	0.002	0.006
	(−1.99)	(−1.38)	(0.22)	(0.66)
Constant	0.909***	0.688**	0.117*	0.062
	(2.75)	(2.34)	(1.81)	(0.94)
Fixed Effects	Firm	Firm & Year	Firm	Firm & Year
Clustering	Firm	Firm	Firm	Firm
Adj. R-squared	0.236	0.418	0.405	0.403
Observations	9,655	17,982	8,372	15,629

The table presents results from pre/post models on the European sample (models 1 and 3) and DiD models on the PSM matched sample (models 2 and 4). In models (1) and (2), the dependent variable is *Forecast Error*. In models (3) and (4), the dependent variable is *Forecast Dispersion*. The sample size varies due to the availability of data for the dependent variable (e.g., if only one analyst then dispersion is not defined). Models (1) and (3) include firm fixed effects, Models (2) and (4) include firm and year fixed effects. Robust standard errors clustered by firm are in parentheses. All continuous variables are winsorized at 1 and 99%. All variables are defined in Appendix A. Statistical significance is based on two-tailed tests and is indicated as follows: *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Table 5: Market Reactions to Stock-Recommendation Revisions

Variables	(1) Upgrade sample CAR(0;+1)	(2) Downgrade sample CAR(0;+1)	(3) Full Sample CAR(0;+1)	(4) Full Sample CAR(0;+1)	(5) Full Sample CAR(−1;+1)
TREAT	−0.0093***	0.0215***	0.0019***	−0.0008	−0.0005
	(−17.67)	(31.63)	(2.86)	(−0.39)	(−0.18)
POST	−0.0060***	0.0069***	0.0001	−0.0014	−0.0004
	(−6.56)	(5.19)	(0.12)	(−0.80)	(−0.18)
UP			0.0253***	0.0248***	0.0268***
			(38.87)	(21.38)	(18.60)
TREAT × UP			−0.0113***	−0.0113***	−0.0165***
			(−13.14)	(−7.80)	(−7.94)
TREAT × POST	0.0041***	−0.0092***	−0.0013	0.0000	−0.0018
	(3.73)	(−5.85)	(−0.72)	(0.01)	(−0.61)
POST × UP			−0.0061***	−0.0067***	−0.0092***
			(−4.16)	(−3.23)	(−3.48)
TREAT × POST × UP			**0.0054*** **	**0.0059** **	**0.0076** **
			(2.60)	**(2.19)**	**(2.17)**
DOWN			−0.0367***	−0.0353***	−0.0412***
			(−48.48)	(−27.76)	(−26.50)
TREAT × DOWN			0.0195***	0.0179***	0.0220***
			(20.38)	(11.66)	(10.42)
POST × DOWN			0.0068***	0.0056**	0.0061**
			(3.84)	(2.56)	(2.20)
TREAT × POST × DOWN			**-0.0079*** **	**−0.0062** **	**−0.0069* **
			(-3.38)	**(−2.17)**	**(−1.81)**
ROA				0.0254***	0.0366***
				(7.37)	(8.62)
LOSS				−0.0030***	−0.0035***
				(−3.72)	(−3.38)
SIZE				0.0010***	0.0011***
				(6.98)	(5.95)
BTM				−0.0036***	−0.0060***
				(-8.68)	(−10.68)
Constant	0.0239***	−0.0381***	−0.0014***	−0.0346***	−0.0270**
	(54.41)	(−64.95)	(−2.83)	(−3.33)	(−2.32)
Fixed Effects	No	No	No	Analyst & Broker & Industry	Analyst & Broker & Industry
Clustering	No	No	No	Analyst	Analyst
Adjusted R-squared	0.012	0.031	0.164	0.202	0.161
Observations	35,313	37,535	86,739	86,739	86,739

The table presents results from models that test the market reaction to sell-side analyst stock recommendation revisions in DiD models. Stock recommendations come from the IBES Detail Recommendation file. The sample observations are at the analyst-firm-revision date level. In model (1), the sample is conditional on an upgrade in stock recommendation (Upgrade sample). In model (2), the sample is conditional on a downgrade in stock

recommendation (Downgrade sample). Models (3) to (5) are run on the full sample. The dependent variable is the cumulative abnormal return two days around the recommendation revision *CAR(0;+1)* in models (1) through (4), and the cumulative abnormal return three days around the recommendation revision *CAR(-1;+1)* in model (5). If an analyst never covers a firm, she is excluded from the sample. Standard errors are robust and clustered by analyst in models (4) and (5). Models (1) to (3) do not include fixed effects; models (4) and (5) include analyst, broker, and industry fixed effects. All continuous variables are winsorized at 1 and 99%. All variables are defined in Appendix A. Statistical significance is based on two-tailed tests and is indicated as follows: *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Table 6: Three-Month and Six-Month Buy-and-Hold Returns of Buy Recommendations

	(1) *3-Month BHAR*	(2) *3-Month BHAR*	(3) *3-Month BHAR*	(4) *6-Month BHAR*	(5) *6-Month BHAR*	(6) *6-Month BHAR*
TREAT	0.0186**	0.0192***	0.0203***	0.0338***	0.0346***	0.0375***
	(2.49)	(2.62)	(2.80)	(2.76)	(2.84)	(3.13)
POST	0.0078**	0.0052	0.0049	0.0002	-0.0046	−0.0052
	(1.99)	(1.36)	(1.30)	(0.03)	(-0.74)	(−0.84)
BUY	0.0489***	0.0449***	0.0445***	0.0507***	0.0444***	0.0439***
	(19.44)	(17.98)	(17.77)	(14.33)	(12.65)	(12.47)
TREAT × BUY	−0.0103***	−0.0075**	−0.0067**	−0.0132***	−0.0086*	−0.0075*
	(−3.19)	(−2.33)	(−2.07)	(−2.91)	(−1.90)	(−1.66)
TREAT × POST	−0.0295***	−0.0245***	−0.0234***	−0.0551***	−0.0468***	−0.0448***
	(−6.01)	(−5.13)	(−4.91)	(−6.60)	(−5.77)	(−5.51)
POST × BUY	−0.0253***	−0.0232***	−0.0228***	−0.0386***	−0.0344***	−0.0338***
	(−5.41)	(−5.00)	(−4.90)	(−5.02)	(−4.54)	(−4.47)
TREAT × POST × BUY	**0.0132****	**0.0116***	**0.0110***	**0.0241****	**0.0212****	**0.0205****
	(2.20)	**(1.96)**	**(1.84)**	**(2.49)**	**(2.23)**	**(2.15)**
ROA		0.1223***	0.1272***		0.2122***	0.2204***
		(11.80)	(12.26)		(13.99)	(14.47)
LOSS		−0.0080***	−0.0085***		-0.0130***	−0.0138***
		(−2.68)	(−2.80)		(−2.79)	(−2.90)
SIZE		0.0018***	0.0011*		0.0023***	0.0010
		(3.32)	(1.89)		(2.73)	(1.14)
BTM		−0.0341***	−0.0356***		−0.0525***	−0.0549***
		(−19.08)	(−20.42)		(−15.64)	(−16.90)
Constant	−0.0276***	−0.0188***	−0.2091***	−0.0298***	−0.0127	−0.1749***
	(−6.69)	(−3.08)	(−6.33)	(−4.44)	(−1.29)	(−3.77)
Fixed Effects	Analyst	Analyst	Analyst & Broker & Industry	Analyst	Analyst	Analyst & Broker & Industry
Clustering	Analyst	Analyst	Analyst	Analyst	Analyst	Analyst
Adjusted R-squared	0.0619	0.0862	0.0904	0.0751	0.1041	0.1099
Observations	86,647	86,647	86,647	82,849	82,849	82,849

The table presents results from models that test the profitability of the sell-side analyst "buy" recommendations in DiD models on the full sample. Stock recommendations come from the IBES Detail Recommendation file. Sample observations are at the analyst-firm-announcement date level. *POST* is refined based on the recommendation announcement date (*anndats*) and takes the value 1 if the stock recommendation is announced after January 3, 2018, and 0 otherwise. The dependent variable is the 3-month (models 1 to 3) and 6-month (models 4 to 6) buy-and-hold return (*BHAR*). If an analyst never covers a firm, she is excluded from the sample. Standard errors are robust and clustered by analyst. Models (1), (2), (4), and (5) include analyst fixed effects; models (3) and (6) include analyst, broker, and industry fixed effects. All continuous variables are winsorized at 1 and 99%. All variables are defined in Appendix A. Statistical significance is based on two-tailed tests and is indicated as follows: *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Table 7: Percentage of Sell and Hold Recommendations

	(1)	(2)
Variables	European Firms	PSM Matched sample
POST	**1.748*** **	
	(3.58)	
TREAT × POST		**4.092*** **
		(3.39)
SIZE	−0.992***	0.904
	(−3.05)	(1.23)
ROA	−3.634	−10.706***
	(−1.11)	(−2.76)
LOSS	4.056***	2.593**
	(3.91)	(2.38)
BTM	2.680***	3.012*
	(3.19)	(1.88)
Constant	41.520***	29.925***
	(17.75)	(5.65)
Fixed Effects	Firm	Firm & Year
Clustering	Firm	Firm
Adj. R-squared	0.629	0.677
Observations	106,751	206,009

The table presents results from a pre/post model on the European sample (model 1) and DiD models on the PSM matched sample (model 2). The dependent variable is the monthly sum of the percentages of sell and hold stock recommendations. Observations are by firm and month. Model (1) includes firm fixed effects. Models (2) includes firm and year fixed effects. Robust standard errors are clustered by firm. All continuous variables are winsorized at 1 and 99%. All variables are defined in Appendix A. Statistical significance is based on two-tailed tests and is indicated as follows: *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Table 8: Industry Recommendations Accompanying Stock Recommendations

Variables	(1) *Industry Recommendation*	(2) *Industry Recommendation*	(3) *Industry Recommendation*
TREAT	−0.0012	−0.0013*	−0.0013*
	(−1.61)	(−1.66)	(−1.66)
POST	0.0028***	0.0027***	0.0027***
	(2.83)	(2.76)	(2.76)
TREAT × POST	**0.0021***	**0.0022***	**0.0022***
	(1.76)	**(1.80)**	**(1.80)**
Total Experience	−0.0027***	−0.0027***	−0.0027***
	(−2.87)	(−2.87)	(−2.87)
Firm Experience	−0.0000	−0.0000	−0.0000
	(−1.34)	(−1.42)	(−1.42)
Constant	0.0883***	0.0818***	0.0818***
	(10.89)	(9.10)	(9.13)
Fixed Effects	Analyst	Analyst & Industry	Analyst & Industry & Broker
Clustering	Analyst	Analyst	Analyst
Adjusted R-squared	0.955	0.955	0.955
Observations	99,630	99,630	99,630

The table presents results from models that test the likelihood of the sell-side analyst providing industry recommendation along with the stock recommendation post-MiFID II. The dependent variable is the indicator *Industry Recommendation*. Sample observations are at the analyst-firm-reporting period level. If an analyst never covers a firm, she is excluded from the sample. Robust standard errors clustered by analyst are in parentheses. All continuous variables are winsorized at 1 and 99%. All variables are defined in Appendix A. Statistical significance is based on two-tailed tests and is indicated as follows: *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Table 9: Loss of Analyst Coverage Conditional on Institutional Ownership

	(1)	(2)
Variables	European Sample	PSM Matched Sample
POST	0.010	
	(1.48)	
Low IO	−0.022***	0.003
	(−3.19)	(0.13)
POST × Low IO	**0.048*** **	−0.034
	(4.46)	(−0.97)
TREAT × POST		−0.004
		(−0.49)
TREAT × Low IO		−0.036*
		(−1.74)
TREAT × POST × Low IO		**0.079** **
		(2.17)
SIZE	−0.014**	−0.011
	(−2.07)	(−1.63)
ROA	0.027	−0.013
	(0.70)	(−0.53)
LOSS	0.008	0.001
	(0.69)	(0.17)
BTM	−0.020*	0.016
	(−1.83)	(1.06)
Constant	0.135***	0.078**
	(3.26)	(2.06)
Fixed Effects	Firm	Firm & Year
Clustering	Firm	Firm
Adjusted R-squared	0.114	0.123
Observations	12,340	20,791

The table presents results from a pre/post model on the European sample (model 1) and DiD models on the PSM matched sample (model 2) conditioning on an indicator variable that identifies firms with low one-year lagged percentage of institutional ownership (*Low IO*). The dependent variable is *Complete Coverage Loss*. Model (1) includes firm fixed effects. Model (2) includes firm and year fixed effects. Robust standard errors are clustered by firm. All continuous variables are winsorized at 1 and 99%. All variables are defined in Appendix A. Statistical significance is based on two-tailed tests and is indicated as follows: *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Table 10: Number of In-House Analysts Employed by the Buy Side

Variables	(1) Full sample	(2) Matched on pre-MiFID II investment firm assets group	(3) Matched on pre-MiFID II investment firm assets group	(4) Matched on pre-MiFID II investment firm assets group
TREAT × POST	**0.0290***	**0.0515****	**0.0515***	**0.0472***
	(1.76)	**(2.57)**	**(1.82)**	**(1.67)**
TREAT	−0.1638***	−0.1893***		
	(−4.54)	(−4.29)		
POST	0.0102	−0.0122	−0.0122	−0.0131
	(0.99)	(−0.79)	(−0.56)	(−0.60)
AUM				0.0673**
				(1.97)
Constant	1.0333***	1.0588***	0.9641***	0.8139***
	(50.23)	(32.37)	(136.04)	(10.63)
Fixed Effects	No	No	Firm	Firm
Clustering	Firm	Firm	Firm	Firm
Adjusted R-squared	0.005	0.007	0.898	0.898
Observations	5,814	3,436	3,436	3,436

This tables reports the results of comparing the number of buy-side analysts in European investment firms before and after the implementation of MiFID II, relative to U.S. and Canadian investment firms. The dependent variable is *#BUYSIDE*, the natural log of the number of buy-side analysts. *TREAT* is an indicator that equals one for European investment firms, and zero otherwise. *POST* is an indicator that equals 1 for post-MiFID II observations, and zero otherwise. *AUM* is a categorical variable for investment firm's asset size, with the following five categories: 1 = below $100 mil, 2 = $100 - $1,000 mil, 3 = $1,000 - $5,000 mil, 4 = $5,000 - $50,000 mil, 5 = beyond $50,000 mil. All variables are defined in Appendix A. Robust standard errors clustered by investment firms are in parentheses. Statistical significance is based on two-tailed tests and is indicated as follows: *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Table 11: Buy-Side Participation in Earnings Conference Calls

Panel A: Number of buy-side analysts and interactions with management

	(1)	(2)	(3)	(4)
	Buy-Side Participation		*Buy-Side Questions*	
Variables	Full Sample	PSM Matched Sample	Full Sample	PSM Matched Sample
TREAT × POST	**0.017****	**0.033*****	**0.126****	**0.236*****
	(2.27)	**(2.75)**	**(2.5)**	**(2.71)**
SIZE	−0.001	0.001	−0.025	−0.014
	(−0.25)	(0.13)	(−1.04)	(−0.45)
ROA	0.014	0.018	0.092	0.149
	(0.99)	(0.87)	(1.04)	(1.03)
LOSS	−0.005	−0.012	−0.042	−0.091
	(−0.74)	(−0.82)	(−0.80)	(−0.90)
BTM	−0.002	−0.001	−0.026	−0.013
	(−0.44)	(−0.14)	(−0.79)	(−0.34)
Coverage	0.005	0.011	−0.020	0.020
	(0.77)	(0.92)	(-0.43)	(0.22)
IO (log)	−0.004	−0.035	−0.058	−0.276
	(−0.17)	(−0.70)	(−0.39)	(−0.72)
Constant	0.070**	0.059	0.645***	0.587**
	(2.44)	(1.56)	(3.75)	(2.44)
Fixed Effects	Firm & Year	Firm & Year	Firm & Year	Firm & Year
Clustering	Firm	Firm	Firm	Firm
Adj. R-squared	0.263	0.316	0.278	0.333
Observations	26,955	20,791	26,955	20,791

The table presents results from DiD models that test the extent of buy-side analyst participation in earnings-conference calls. The dependent variable is *Buy-Side Participation* (models 1 and 2) and *Buy-Side Questions* (models 3 and 4), on the full and PSM-matched samples, respectively. *Buy-Side Participation* counts the number of buy-side analysts attending the earnings conference call. *Buy-Side Questions* counts the number of interactions between buy-side analysts and management; the variable is truncated at 10 questions to capture meaningful interactions. When missing, the dependent variables are set to zero. The earnings conference call date are matched with the annual firm variables using the IBES earnings announcement date (plus or minus one day). All models include firm and year fixed effects. Robust standard errors are clustered by firm. All continuous variables are winsorized at 1 and 99%. All variables are defined in Appendix A. Statistical significance is based on two-tailed tests and is indicated as follows: *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Panel B: Buy-side engagement in earnings conference calls, conditional on participation

Variables	(1) European Sample	(2) PSM Matched Sample
TREAT × POST		**1.137****
		(2.28)
POST	**0.992***	−3.700***
	(1.74)	(−4.05)
SIZE	0.544	0.600
	(0.86)	(1.51)
LOSS	−0.709	−0.166
	(−0.71)	(−0.45)
ROA	0.578	0.026
	(0.09)	(0.02)
BTM	0.092	0.066
	(0.19)	(0.18)
Coverage	0.081	−0.052
	(0.94)	(−0.59)
IO (log)	−0.282	−0.169
	(−0.12)	(−0.19)
Constant	0.328	6.456**
	(0.07)	(2.51)
Fixed Effects	Firm	Firm & Year & Quarter
Clustering	Firm	Firm
Adj. R-squared	0.273	0.470
Observations	876	4,959

The table presents results from DiD models that test the buy-side and sell-side analyst engagement in earnings conference calls before and after MiFID II, conditional on the participation of buy-side and sell-side analysts, respectively. The dependent variable is *Buy-Side Engagement* computed as the total number of interactions between buy-side participants and management during an earnings conference call divided by the number of buy-side participants in the call. Observations are at the firm-conference call level. Model (1) includes firm fixed effects, Model (2) includes firm, year, and quarter fixed effects. Robust standard errors are clustered by firm. All continuous variables are winsorized at 1 and 99%. All variables are defined in Appendix A. Statistical significance is based on two-tailed tests and is indicated as follows: *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Table 12: Firm-Level Disclosure Responses and Stock Liquidity

Panel A: Disclosure events

Variables	(1) European firms	(2) PSM Matched sample
POST	**0.056**	
	(1.50)	
TREAT × POST		**0.270*** **
		(4.36)
SIZE	−0.077***	−0.135***
	(−3.03)	(−3.28)
ROA	0.162	0.317**
	(1.55)	(1.99)
LOSS	−0.035	0.027
	(−0.66)	(0.26)
BTM	−0.012	−0.103
	(−0.45)	(−1.26)
Coverage	0.100*	0.035***
	(1.87)	(3.40)
IO	0.535*	2.131***
	(1.73)	(15.03)
Constant	0.960***	1.555***
	(5.08)	(4.81)
Fixed Effects	Firm	Firm & Year
Clustering	Firm	Firm
Adj. R-squared	0.738	0.783
Observations	11,869	25,554

The table presents results from pre/post models on the European sample (model 1) and DiD models on the PSM matched sample (model 2). All control variables are one-year lagged, which increases sample size. The dependent variable is *#Broker Conferences*, the number of broker-hosted conferences to which a firm presents during the year. Model (1) includes firm fixed effects, Model (2) includes firm and year fixed effects. Robust standard errors are clustered by firm. All continuous variables are winsorized at 1 and 99%. All variables are defined in Appendix A. Statistical significance is based on two-tailed tests and is indicated as follows: *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Panel B: Stock liquidity

Variables	(1) European firms	(2) PSM Matched sample
TREAT × POST		**0.108*** **
		(3.07)
POST	**0.068*** **	−0.142***
	(6.78)	(−3.11)
Coverage	−0.002	−0.004*
	(−0.97)	(−1.87)
#Broker Conferences	−0.007**	−0.006**
	(−2.27)	(−2.36)
SIZE	0.018*	−0.003
	(1.90)	(−0.19)
ROA	−0.212***	−0.267
	(−3.03)	(−1.60)
LOSS	0.053***	0.025
	(2.59)	(1.25)
BTM	0.062***	0.043**
	(2.99)	(2.41)
Constant	0.261***	0.340***
	(3.81)	(3.57)
Fixed Effects	Firm	Firm & Year
Clustering	Firm	Firm
Adj. R-squared	0.803	0.821
Observations	33,694	64,790

The table presents results from a pre/post model on the European sample (model 1) and DiD models on the PSM matched sample (model 2). Sample observations are by firm-quarter. The dependent variable is the natural logarithm of 1 plus the *Amihud Ratio*. Model (1) includes firm fixed effects. Model (2) includes firm and year fixed effects. Robust standard errors are clustered by firm. All continuous variables are winsorized at 1 and 99%. All variables are defined in Appendix A. Statistical significance is based on two-tailed tests and is indicated as follows: *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Table 13: Effect of MiFID II on Continental European Firms

Variables	(1) *Complete Coverage Loss*	(2) *Coverage*	(3) *Forecast Error*	(4) *Dispersion*	(5) *Buy-Side Participation*	(6) *Buy-Side Engagement*	(7) *Amihud Ratio*
TREAT × POST	**0.024*** **	**−0.082*** **	**−0.069**	**−0.028**	**0.018** **	**0.737***	**0.146*** **
	(3.08)	**(−6.29)**	**(−1.19)**	**(−1.62)**	**(2.17)**	**(1.74)**	**(8.38)**
Constant	0.231***	0.975***	−0.082	0.021	0.135***	9.062***	0.451***
	(4.83)	(8.17)	(−0.13)	(0.23)	(3.17)	(2.99)	(3.83)
Controls & Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Adj. R-squared	0.126	0.897	0.528	0.339	0.266	0.374	0.830
Observations	23,249	23,249	20,299	18,062	23,249	6,369	67,525

The table presents results from DiD models on the (unmatched) full sample that test sell-side, buy-side, and firm outcomes after MiFID II implementation in Continental European firms versus control firm. Results based on the PSM-matched sample provide substantially similar inferences. All models include firm and year fixed effects. Robust standard errors are clustered by firm. All continuous variables are winsorized at 1 and 99%. Variables are defined in Appendix A. Statistical significance is based on two-tailed tests and is indicated as follows: *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.