

# **The Impact of Performance Reporting on Investment Behavior: Evidence from Disclosure Reform in the UK\***

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## **Abstract**

I examine the effects of mandatory disclosure, which requires a subset of London Stock Exchange firms to discuss how they create value over the long-term in their annual report. Regulators and practitioners have criticized traditional performance reporting for placing excessive attention to earnings and promoting managerial myopia. They emphasize the need for firms to describe non-earnings aspects of value creation, such as business operations and strategies. Using an instrumented difference-in-differences design, I find that enhanced performance reporting, evidenced by more disclosure of non-earnings performance measures and more commentaries on business operations and strategies, promotes investment in R&D and intangibles assets. My channel analysis suggests that enhanced performance reporting promotes investments as it attracts long-term investors and reduces CEO pay sensitivity to short-term earnings.

*Keywords:* enhanced performance reporting, managerial myopia, long-term value creation, real effects of disclosure, investment

## 1. Introduction

I examine the effects of mandatory performance reporting that emphasizes how firms create value over the long-term. Traditional performance reporting centering on earnings has been criticized for placing an excessive emphasis on short-term results (Fuller and Jensen 2002; CFA Institute 2006; Kay 2012; Kotsantonis et al. 2019; Eckerle et al. 2020). A focus on earnings risks encouraging managers to make myopic decisions such as cutting investment spending and rejecting long-term projects to boost current earnings at the expense of long-term value creation (Bushee 1998; Fuller and Jensen 2002; CFA Institute 2006; Kay 2012). In response, regulators and practitioners are increasingly emphasizing the need for management to supplement traditional performance measures (earnings and its variants) with information explaining how business operations and strategies create value in the long run (CFA Institute 2006; Financial Reporting Council 2010a; European Commission 2017; International Integrated Reporting Council 2013; SEC 2016).

I use the term *enhanced performance reporting* (EPR) to refer to quantitative and qualitative information that describes the process of value creation, as opposed to the short-term results of value creation such as earnings and its variants (e.g., EPS, EBITDA, PBT). Examples of EPR include disclosures about customers (e.g., customer satisfaction, customer base), human resources (e.g., employee training, employee retention, safety), production (e.g., product quality, volume), innovation (e.g., R&D, exploration), product markets (e.g., market share, competition), and strategic partnerships (e.g., joint ventures, affiliate agreements). Proponents argue that adopting EPR helps managers look beyond short-term earnings and make decisions for the long run (PwC 2007; IIRC 2013). Skeptics, however, cite cheap talk (Forsythe et al. 1999) and decoupling (Abraham and Shrikes 2014) among the reasons why EPR may not improve long-term decision-making. For example, managers may use cheap talk and generic statements to gain legitimacy in response to pressure for

information on long-term value creation, whilst not changing their decision-making horizon (Forsythe et al. 1999). Decoupling theory predicts that managers make long-term decisions but choose not to discuss the details of long-term activities when the costs of disclosing proprietary information (i.e. business model and strategies) outweigh the benefits (Verrecchia 1983; Abraham and Shrivies 2014). The effect of EPR initiatives on performance reporting and managerial decision-making is therefore hard to predict, and empirical evidence is scarce.

To shed light on the effects of EPR, I first examine whether a reporting mandate for firms to explain long-term value creation promotes EPR. Second, I test if an exogenous growth in EPR due to the reporting mandate influences investment spending. Third, I examine the channels through which EPR effects investment. My analysis exploits a UK regulatory development that mandates commentary on strategy and value creation for a subset of firms listed on the London Stock Exchange (LSE). Responding to concerns that managers do not provide sufficient discussion of long-term value creation (FRC 2010a), the Financial Reporting Council revised the UK Corporate Governance Code (FRC 2010b) by requiring management to explain in the annual report how their business operations and strategies deliver value over the longer term. The reporting mandate applied to LSE Main Market firms with fiscal years after June 29, 2010. My tests examine changes in the performance reporting and investment behavior of LSE Main Market firms, with LSE Alternative Investment Market (AIM) firms forming a control group.

I construct two empirical measures of EPR in annual report performance commentary. My first measure captures the incidence of non-traditional performance metrics. I collect performance measures presented in key performance-focused sections of the annual report and classify them as either traditional performance reporting (TPR) metrics or EPR measures. The TPR category includes measures that capture short-run outcomes such as operating profit, profit before tax, earnings per share, operating cash flow. The EPR category includes

leading indicators that reflect business activities and strategies for value creation such as customer satisfaction, market share, number of shops, employee retention, product quality, and number of patents. I use the proportion of EPR metrics to total metrics disclosed as my first proxy for the strength of enhanced performance reporting. My second proxy captures qualitative aspects of EPR. I use topic modeling (Blei et al. 2003) to identify performance themes in management commentary. I partition these themes into TPR and EPR categories and then compute the proportion of EPR topics to total topics discussed.

My empirical tests comprise three steps. I begin by testing whether the UK Corporate Governance Code 2010 reporting mandate led to an exogenous increase in EPR. I employ a difference-in-differences (DiD) research design and document an increase in EPR for Main Market firms relative to AIM their counterparts. My results are consistent with the disclosure mandate achieving its goal of increasing the level of management commentary on longer-term. Next, I examine the impact of EPR on investment decisions. I use the instrumented DiD method (Hudson et al. 2017), which takes a Local Average Treatment Effect (LATE) approach in a DiD design, to test if the increase in the level of EPR in response to the reporting mandate (i.e. compliance with the reporting mandate) promotes investment spending. Tests confirm an incremental increase in R&D expenditure and acquisition of intangible assets only among the Main Market firms that increase EPR after the reporting mandate. It implies that the reporting mandate itself does not promote investment.

The final step in my analysis explores the channels through which EPR promotes investment. I propose two non-mutually exclusive channels: an external investor-related channel and an internal compensation-related channel. The external channel reflects the potential benefits of more dialogue between management and investors concerning the longer-term. Serafeim (2015) documents that long-term oriented reporting is positively associated with the proportion of long-term investors, while Bushee (1998) finds that

managers display a lower tendency for investment myopia in the presence of long-term institutional investors. I calculate long-term institutional ownership following Bushee and Noe (2000) and find that the exogenous growth in EPR leads to an increase in the fraction of long-term investors, and that this growth in long-term investors promotes investment spending. My results support the view that EPR promotes investment spending by attracting investors who prioritize and encourage a longer-term focus.

The internal control channel draws on the signaling view that firms use bonding mechanisms to send a convincing signal (Dhaliwal et al. 2011; Christensen 2016). Specifically, as the reporting mandate increases investor monitoring and scrutiny of management commentary on long-term value creation, management demonstrates the reliability of their EPR signal by aligning internal control system features, such as executive compensation, with EPR. For example, an increase in EPR for financial reporting purposes may lead firms to replace short-run earnings-focused metrics with more EPR measures in executive compensation plans. Consistent with this view, I document that the exogenous growth in EPR precedes a decrease in the sensitivity of CEO pay to earnings, and that this lower sensitivity of pay to earnings performance promotes investment.

I implement a series of additional tests to evaluate the robustness of my results and conclusions. First, while my results suggest that the regulatory push for EPR encourages managers to make long-term decisions, the increase in investment may represent overinvestment. I examine whether the increase in investment is characteristic of overinvestment by examining a subsample of firms with a high probability of overinvestment. I find that treatment effects are insignificant among the subsample of firms with a high likelihood of overinvestment, suggesting that the jump in investment spending does not represent overinvestment. Second, I test for confounding effects from other provisions of the UK Corporate Governance Code 2010 such as annual re-election of

executive directors and triennial evaluation of board that apply to a subset of large Main Market firms and possibly affect investment decisions. Excluding these firms does not change my inferences or conclusions concerning the effects of the reporting mandate on investment. Third, heterogeneity between Main Market firms and Alternative Investment Market firms (i.e., non-random treatment) may confound the estimation of treatment effects. I address this concern using various approaches including symmetric DiD (Chabé-Ferret 2015) with balanced panel data, parallel trends tests, placebo tests, and Coarsened Exact Matching. Results and conclusions are robust to these tests.

My study contributes to extant research in the following ways. First, I extend prior work by showing that disclosure of unstructured information beyond earnings influences managerial decision-making. Regulators and practitioners are increasingly encouraging firms to describe business operations and strategies in the belief that such disclosure not only provide useful information to investors but also encourage managers to think longer-term (FRC 2010a; EC 2017; PwC 2006). However, prior research focuses mainly on the capital market effects of such disclosures (Botosan 1997; Gu and Li 2007; Whittington et al. 2016; Athanasakou et al. 2019). The effect on managerial decisions remains unexplored while cheap talk and decoupling theories predict no effect. I extend prior research by demonstrating that enhanced performance reporting increases investment spending as regulators suggest.

Second, my study sheds light on the causal path and mechanisms through which disclosure influences real economic outcomes. Emphasizing the highly endogenous nature of disclosure, Leuz and Wysocki (2016) call for research that explores the entire causal path from the regulatory changes to corporate disclosure to real economic outcomes. I answer to this call by examining the path from the regulatory push to enhanced performance reporting to increased corporate investments. Furthermore, my analysis of external monitoring and

internal control system provides additional insights into the mechanisms underlying the relationship between the disclosure of long-term value and economic outcomes.

I also extend current understanding of the interaction between external and internal reporting. Although value-based management theory stresses the importance of aligning external reporting with internal control to deliver value and achieve long-term goals, Ittner and Larcker (2001) highlight the absence of research examining this interaction. My internal channel analysis speaks directly to this issue. My results indicate that as the balance shifts from earnings-centered reporting to more emphasis on long-term indicators of value creation, so control systems place less weight on earnings performance for CEO compensation and this rebalancing in turn promotes long-term investment spending.

## **2. Related Literature**

Although periodic performance reporting centers on measures of financial performance in general and accounting earnings in particular, theory and evidence highlight the limitations of placing excessive attention on earnings for performance measurement and business valuation (Tasker 1998; Lev and Zarowin 1999; Graham et al. 2005; Lev and Gu 2016; Edmans et al. 2018). Concern over a focus on periodic earnings performance reflects several factors. First, research demonstrates that earnings alone do not convey sufficient information about value creation in the long-term (Amir and Lev 1996; Lev and Gu 2016). Valuation theory highlights the importance of information other than earnings for forecasting future performance and estimating value (Ohlson 1995). Ball and Shivakumar (2008) show that earnings have relatively low surprise content because the construct is primarily backward-looking, while Tasker (1998) and Lev and Zarowin (1999) argue that earnings number blurs value creation in R&D intensive firms. Second, earnings-centric reporting can therefore promote dysfunctional managerial behavior including earnings management,

inefficient investment decisions, and other activities that are inconsistent with long-term value creation (Bushee 1998; Kaplan and Norton 2001; Graham et al. 2005; Roychowdhury 2006; He and Tian 2013).

Given the limitations of earnings and backward-looking accounting measures, Kaplan and Norton (1996) argue that firms should supplement financial performance measures with leading indicators that evaluate the process of value creation. For example, information on customers, operations, employees, and innovation provides useful insights on long-term value creation (Ittner and Larcker 1998; Behn and Riley 1999; Nagar and Rajan 2001).

Accordingly, regulators and financial reporting professionals are encouraging firms to disclose their approach to delivering value over the long-term using non-earnings information in the belief that such disclosure not only provides useful information to investors but also encourages managers to think longer-term and make long-term decisions (FRC 2010a; EC 2017; PwC 2006; CFA Institute 2006; International Integrated Reporting Council 2013).

Consistent with this view, the disclosure literature shows that reporting non-earnings information such as business operation and strategy provides useful information to the capital market (Botosan 1997; Athanasakou et al. 2019; Gu and Li 2007; Whittington et al. 2016).

However, prior research focuses mainly on the capital market effects, leaving the effect on managerial decision-making unexplored. To the best of my knowledge, only Barth et al. (2017) provide preliminary evidence on this issue by exploiting the Johannesburg Stock Exchange's (JSE) requirement for Integrated Report. Using proprietary measure of JSE firms' integrated reporting quality (IRQ), Barth et al. (2017) report a negative association between IRQ and investment inefficiency. Causality is nevertheless hard to establish in Barth et al.'s (2017) empirical design as observations are limited to the post-mandate period and no control group is available. Furthermore, Barth et al. (2017) do not provide evidence on the specific channel(s) through which reporting affects investment spending.

### 3. Institutional Background

#### 3.1. The Institutional Setting of the UK Corporate Disclosure

Financial Reporting Council and the House of Treasury Committee, the legislative committee in the parliament of the UK, shared a view that there was a significant gap in performance reporting as most firms did not describe how they deliver value over the long-term (FRC 2010b, paragraph 30). Accordingly, the Financial Reporting Council proposed a draft of revised Corporate Governance Code to fill the gap in the annual report: the company's strategy for generating long-term value. The UK Corporate Governance Code (2010) clearly emphasizes the importance of a long-term perspective to business reporting insofar as it requires Main Market firms to discuss business model and long-term strategy. The new code adds the word "*long-term*" to the first principle that describes the role of the board as "*Every company should be headed by an effective board which is collectively responsible for the long-term success of the company*" (A.1). The new code adds the following new provision: "*The directors should include in the annual report an explanation of the basis on which the company generates or preserves value over the longer term (the business model) and the strategy for delivering the objectives of the company*" (C.1.2).<sup>1</sup> Examples of relevant information include the description of products and services, customers, production, distribution, operating facilities, innovation, employees, and other strategic information. The FRC published the revised code in May 2010, and it applies to reporting periods beginning on or after 29 June 2010 and applies to the LSE Main Market firms.<sup>2</sup>

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<sup>1</sup> Appendix B provides detailed information on major changes in corporate governance code (2010). They are annual reelection of directors and triennial evaluation of board performance, which are additionally applied to FTSE350 firms. I conduct robust tests to control the additional requirements to FTSE350 firms.

<sup>2</sup> Due to the early announcement, the Corporate Governance Code 2010 may not be an unpredictable shock if Main Market firms adopted EPR early. However, early adoption creates a bias against significant results, making my tests more conservative. I also test the robustness of my results using 2010 as effective year.

### 3.2. Expected Impact of Enhanced Performance Reporting

While regulators and practitioners believe the explicit discussion of long-term value creation helps managers look beyond earnings and deliver value over the long-term, skeptics cite cheap talk (Forsythe et al. 1999) and decoupling (Abraham and Shrides 2014) among the reasons why enhanced performance reporting may not affect decision-making behavior.

Management may exploit cheap talk (Forsythe et al. 1999) for two reasons. First, the requirement to describe long-term value creation does not specify precisely what information management should report because firms have different business models and strategies.

Second, information on long-term value creation is inherently vague and difficult to verify.

Meanwhile, decoupling theory argues that firms are already making optimal investment decisions but do not disclose relevant information in detail because the costs of disclosing proprietary information are higher than the benefits (Abraham and Shrides 2014).

While cheap talk and decoupling predict limited effects of the reporting mandate, I propose two non-mutually exclusive channels through which EPR may influence investment decisions. Figure 1 provides a graphical illustration of the framework that includes an external (investor-related) channel and an internal (compensation-related) channel. The external channel reflects the potential benefits of an enhanced interaction between management and investors. Serafeim (2015) reports a positive association between Integrated Reporting and the proportion of long-term investors. Extending this result to performance reporting implies that EPR may also help to attract long-term investors. Since long-term investors reduce pressure on management to boost short-term earnings performance (Bushee 1998), attracting long-term investors can lower incentives for management to forgo long-term investments and promote investment spending by creating an external monitoring environment that is more conducive to delivering long-term value. The internal control

channel draws on the signaling view that firms use bonding mechanisms to send a convincing signal (Dhaliwal et al. 2011; Christensen 2016). As EPR increases investor's interests and monitoring regarding long-term value creation, management seeks to show its commitment to the long-term value creation described in EPR by aligning internal control system, such as executive compensation, with EPR disclosure. Specifically, EPR for external stakeholders promotes internal adoption of more value-based measures for CEO pay. Adoption of EPR metrics motivates long-term decision-making as CEO pay relies less on short-term earnings and more on the measures that reflect business operations and long-term value creation.

#### **4. Measurement and Data**

##### 4.1. Measuring Enhanced Performance Reporting

The primary variable of interest in my empirical tests is the degree of enhanced performance reporting. I use two approaches to measure EPR. They are performance metric-based EPR and topic-based EPR. They respectively capture the proportion of quantitative (performance metrics) and qualitative (underlying topics) information attached to EPR in annual report. I construct these two measures as firms may provide information on long-term value creation using quantitative numbers and/or qualitative commentaries. Each measure may pick up only the partial aspect of EPR.

##### 4.1.1 Performance metric-based EPR proxy

To capture quantitative aspect of EPR, I collect performance measures from the Highlights and Chair's Letter sections, which represent the most prominent discussions of periodic performance in the annual report.<sup>3</sup> I partition performance measures into traditional

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<sup>3</sup> UK annual reports broadly consist of two components: a narrative element (front part of annual report) and financial statements and other statutory information (rear part of annual report). The narrative element is not

performance reporting (TPR) and enhanced performance reporting (EPR) categories and then calculate the proportion of EPR measures. My TPR category contains popular financial statements line items that center on the result of value creation, such as earnings per share, earnings before interest and tax, profit before tax, and operating cash flow. The EPR category contains measures that evaluate operational and strategic success, such as customer satisfaction score, employee training hours, product quality, and new patents.

To set a rule for the classification of performance measures, I adjust the traditional classification of financial vs non-financial performance measures. Although financial and non-financial measures usually fit the idea of TPR and EPR, respectively, some financial measures are better classified into EPR. For example, financial measures such as R&D expenditure, license acquisition, employee training costs, sales from new brand, inventory turnover, and sales per employee evaluates operational and strategic success.

I first classify measures into financial or non-financial measure. Next, I filter some financial measures that evaluate business activities and strategies from the other financial measures. Specifically, I filter financial ratios (e.g., sales per employee, inventory days, manufacturing costs per ounce), investment and expenditure for future value creation (e.g., R&D, capital expenditure, employee training cost), and granular financial measures (e.g., key product sales, top 10 clients contract value). EPR comprises the filtered financial measures and non-financial measures, and TPR consists of the remaining financial measures (usually financial statement line items) such as EPS, EBITA, and PBT. Then, I calculate the ratio of the number of EPR measures to the number of all measures. Appendix C illustrates the

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standardized but typically contains the highlights, chairman's letter, financial review, risk management, corporate social responsibility, etc. I specifically focus on highlights and chairman's letter sections because they provide the highest-profile discussions of periodic performance and therefore reflect managerial perspective and horizon for value creation. I acknowledge that firms may provide performance measures in other parts of the annual report such as financial review section. However, financial review by its nature places much attention to earnings information regardless of whether management view is excessively centered on earnings performance. Therefore, measures appearing in the highlights and chairman's letter serve as an intuitive proxy for the overall focus of firms' performance commentary.

framework for categorizing performance metrics with an example of data collection from an annual report. For robustness check, I use an alternative measure of metric-based EPR. The grey measures (financial ratios, investments, and granular financial numbers) are classified into TPR so that the alternative classification follows the traditional classification of financial vs non-financial performance measure.

#### 4.1.2 Topic-based EPR proxy

I use Latent Dirichlet Allocation (LDA) (Blei et al. 2003) to measure the relative weight attached to EPR information given in a qualitative commentary. LDA is a computational linguistic method to identify lists of words that frequently co-occur in a large corpus. As co-occurring words contain semantically coherent words, I assign a label (topic name) to each word group. I then split identified topics into two broad topic categories: EPR and Other. The EPR category contains topics covering business operations and strategic aspects (e.g., innovation, risk management, customer, employees, outlook, etc). The Other category includes topics centering on earnings performance or financial statement items and the other topics far from the descriptions of value creation (e.g., director biography, external auditor, annual general meeting, director appointment, etc.). Appendix D provides a list of identified topics and the categorization. As topic modeling can analyze the topic composition of each document, I can calculate the proportion of EPR-related topics, which is my second proxy for EPR.

For the textual analysis, I create a corpus by aggregating the annual reports of all firms listed on the London Stock Exchange in the sample period of 2008 to 2013 to use sufficient data for machine learning and avoid overfitting. The corpus includes 14,573 annual reports from 3,433 unique firms. Then, I take steps to preprocess texts following linguistics literature such as removing stop words, numbers, non-alphabet characters, and sparse words.

I also generate a dictionary of words appearing in my corpus and manually check unique words to correct typos and remove encoding errors. Appendix E provides the details of creating corpus and preprocessing before topic modeling.

To conduct a topic model analysis, researchers need to choose the number of topics that they want the model to generate. Setting a too low number of topics may identify distinguishable topics as the same topic, and too high number of topics may identify too many indistinguishable topics. I use coherence score (Roder et al. 2015) to decide the number of topics. Coherence score evaluates the quality of identified topics by measuring the cooccurrence of topic keywords and similarity of word vectors. The coherence score of my corpus is maximized at 20 topics. I, therefore, use 20 topics for my main analysis. I also use 40 and 60 topics to create alternative measures of *TopicEPR* for robustness check.

#### 4.2. Sample and Data

As shown in Table 1 Panel A, I use a sample period from 2008 to 2013 to compare the degree of EPR before and after the revision of the Corporate Governance Code. Financial industry and utility sectors are excluded because of their idiosyncratic reporting environment. I exclude firms if any financial variable is missing within the sample period. From the remaining firms, I sample 200 firms (1200 firm-years) because I manually collect performance measures in annual report and read each unique word to filter invalid tokens such as typos and encoding errors. I select 100 firms from the LSE Main Market, with the balance drawn from the Alternative Investment Market. While the sampling is not completely random, limiting the sample pool supports symmetric DiD (Chabé-Ferret 2015) - i.e. comparing firms that are observed the same number of periods before and after the

treatment.<sup>4</sup> The symmetric approach mitigates biases generated when the treatment is not randomly assigned. It also corrects biases generated due to non-random sample attrition in unbalanced panel. For example, if poorly performing firms cut R&D expenditures and are delisted in the post-treatment period, the average value of R&D expenditures in the post period increases without any treatment. Similarly, IPO during the sample period creates an upward bias to the investment spending in the post-treatment period.

I collect financial variables from Thomson Reuters Datastream. I construct EPR metrics using annual reports sourced from Perfect Information and converted to text using the method developed by El-Haj et al. (2019). I analyze the external channel of the long-term investor using the method of Bushee and Noe (2000) that classifies the investment style of institutions.<sup>5</sup> I get quarterly investment portfolio data of institutional investors from Thomson Reuters Eikon. For the test the internal channel impact, I get CEO compensation data from BoardEx.

## **5. Research Design and Results**

### **5.1 Classical DiD and Parallel Trends**

To provide preliminary evidence on the impact of the reporting mandate for firms to discuss long-term value creation on investment decisions, I use a classical difference-in-difference design. My research exploits the institutional setting of the Corporate Governance

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<sup>4</sup> Chabé-Ferret (2015) demonstrates symmetric DiD is robust to biases generated due to a non-random treatment (e.g., entering a job training program) as long as the bias is symmetric (i.e., Ashenfelter's dip is generated and degenerated symmetrically). Even when the bias is not symmetric, symmetric DiD still outperforms propensity score matching.

<sup>5</sup> I measure the proportion of long-term institutional investors for each firm-year based on Bushee and Noe (2000) classification. They split institutional investors into three groups: dedicated investor, quasi-indexer, and transient investor. Following Bushee and Noe (2000), I construct eight variables that evaluate institution's investment behavior and reduce them to two factors: portfolio turnover and block holding. Using the two factors, I conduct three-mean cluster analysis to split investor-years into three groups: dedicated investor, quasi-indexer, and transient investor. For each firm-year, I calculate the percentage of ownership by dedicated investor and quasi-indexer as they are long-term investors, evidenced by low portfolio turnover rate.

Code (2010), which applies to Main Market (MM) firms but not to their Alternative Investment Market (AIM) counterparts.

$$y_{it} = \alpha_1 POSTMAIN_{it} + \omega' X_{it} + Firm\_FE + YEAR\_FE + c + \varepsilon_{it} \quad (1)$$

I use research and development expenditure (*R&D*), change in net intangible assets (*INTANG*), and capital expenditure (*CAPEX*) to measure investment activities. Following Edmans et al. (2018), I set missing R&D values to zero. The results are robust to erasing missing R&D firms. The explanatory variable of interest is the indicator of the post-treatment period (reporting periods ending on or after 28 June 2011) of Main Market firms (*POSTMAIN*). Control variables (*X*) include lagged variables of firm size (*SIZE*), investment opportunity proxied by Tobin's Q (*Q*), cash (*CASH*), leverage (*LEV*), loss indicator (*LOSS*), firm age (*AGE*), and capital raise (*RAISE*). As firms within my sample do not change industry over time, firm fixed effects control industry level fixed effects as well as firm level fixed effects. Year fixed effects control year level factors that are common across all firms. Table 1 provides summary statistics for dependent, independent, and control variables of my sample. Variable definitions are in Appendix A.

[Table 1 about here]

As shown in column 1 of table 2, the coefficient of *POSTMAIN* is positive and significant at the one percent level for *R&D* and *INTANG*. It implies that the reporting mandate 2010 promotes investments in R&D and intangible assets among the Main Market firms compared to Alternative Investment Market. The magnitude of estimated treatment effect is economically significant. The reporting mandate, on average, increases R&D (intangible assets) by 0.034 (0.055), which is 28 (32) percent of one standard deviation of

R&D expenditure (intangible assets). On the other hand, the treatment effect of the reporting mandate on capital expenditure is not significant. The insignificant effect on CAPEX is not surprising. Myopic managers are less likely to cut capital expenditures because cutting CAPEX is easily visible (Stein 1989) and not as effective as cutting R&D to boost earnings. Consistent with this view, majority of research on myopia typically examines the association between myopia and R&D (Graham et al. 2005; Bushee 1998; Roychowdhury 2006).

[Table 2 about here]

To check the validity of DiD research design, I examine if two groups' investment trends are parallel in the pre-treatment period and deviate only after the reporting mandate. I map out counterfactual treatment effects for each sample period using the difference in the outcome variable between the two groups in the last year (fiscal year-end 2010) of the pre-treatment period. The idea is that, after controlling pre-existing difference between two groups (i.e., the difference in the benchmark year), the remaining difference captures treatment effect. If parallel trends assumption holds, the estimated treatment effects are close to zero in the pre-treatment period.

For the estimation of counterfactual treatment effect, I add interaction terms between each year and treatment group indicator. In Figure 2, circle points are the estimated counterfactual treatment effects, which reflect the deviation of Main Market from AIM after controlling the pre-existing difference in the benchmark year. The vertical lines show confidence intervals at the 90 percent level. As shown in Figure 2, treatment effects on investment in R&D, intangible assets, and CAPEX are all insignificant. The test supports the assumption of parallel trends between Main Market and AIM firms for all three investment variables.

The estimated effects in the post-treatment period confirm significant treatment effect. Panel A and B of Figure 2 show that trends of the two groups' investment in R&D and intangible assets deviate after 2011. While Main Market firms, relative to AIM firms, started to increase investments in R&D and intangible assets in 2010, the deviation was not significant. It implies that it took a year for Main Market firms to change their investment behavior as the reporting mandate was introduced in the middle of 2010. Figure 2 panel C shows trends in CAPEX. No deviation of CAPEX in the post-treatment period suggests that the reporting mandate does not have significant treatment effects on CAPEX.

[Figure 2 about here]

For an additional check, I conduct placebo tests. Using pre-treatment period observations, I randomly assign treatment and estimate the effects of the placebo treatment. For each investment variable, I iterate the placebo test 1,000 times. Figure 3 reports the distributions of estimated treatment effects. The t-tests confirms that the effects of placebo treatment are zero.

[Figure 3 about here]

For the last step of validity check, I run the regression models in Table 2 using a matched sample. I use Coarsened Exact Matching (CEM) for matching (Blackwell et al. 2009).<sup>6</sup> It eliminates observations outside the common supports of two groups' covariate distribution to ensure that observations with similar characteristics are matched. Then, CEM generates weights that balance covariates of the remaining observations. Table 3 Panel A reports the mean values of covariates by group before and after matching. For instance, firm

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<sup>6</sup> Compared to propensity score matching (PSM), coarsened exact matching (CEM) has the following advantages (Lacus et al. 2011). (1) Increasing balance on one covariate does not increase imbalance on another covariate, which often happens in propensity score matching. (2) CEM is less sensitive to measurement error and (3) computationally efficient.

size of two groups becomes similar after matching as CEM chooses relatively large AIM firms and relatively small Main Market firms. Panel B reports the results of regression analysis using the matched sample. The results remain consistent and significant. However, the matched sample reduces statistical power of tests as the matching procedure reduces sample size from 1,200 to 228 firm-years. As I use symmetric DiD for the sample of 1,200 firm-years and it passes the parallel trends test and placebo tests, I do not use the matched sample for the rest of main analysis.

## 5.2 Instrumented Difference-in-Differences

While Table 2 shows a significant association between the reporting mandate and investment decisions, the model does not examine whether the reporting mandate impacts investments through enhanced performance reporting. I employ instrumented DiD to demonstrate the effects through changes in disclosure. The instrumented DiD uses an IV estimation approach of Imbens and Angrist's (1995) Local Average Treatment Effect within a DiD research design (Hudson et al. 2017). Unlike classical DiD that attributes any increases in investments to the reporting mandate, the instrumented DiD takes an IV estimation approach to examine the effects of the reporting mandate on investment through an increase in EPR.<sup>7</sup> The method enables the estimation of treatment effects when the treatment is not sharply defined as it takes a LATE approach to address different levels of compliance with the treatment. This approach helps the identification in my research setting as some firms

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<sup>7</sup> As the classical DiD design directly regresses an investment variable on a post-treatment indicator, the result does not show us whether a significant increase in investment is associated with a significant change in disclosure. This design is therefore susceptible to concurrent events that potentially impact investments. For example, the UK government introduced anti-takeover regulation in 2010 that applied to Main Market firms and could have affected their investment by reducing the risk of being a takeover target (Andres et al. 2019). On the other hand, an instrumented DiD design examines if investment increases due to EPR that is exogenously promoted by the reporting mandate.

may substantially enhance their performance reporting while others barely change their reporting.<sup>8</sup>

$$EPR_{it} = \beta_1 POSTMAIN_{it} + \omega'X_{it} + Firm\_FE + YEAR\_FE + c + \varepsilon_{it} \quad (2)$$

$$y_{it} = \beta_2 \widehat{EPR}_{it} + \omega'X_{it} + Firm\_FE + YEAR\_FE + c + \varepsilon_{it} \quad (3)$$

The first stage equation estimates the effect of the reporting mandate (*POSTMAIN*) on enhanced performance reporting (*EPR*), and the second stage tests if the growth in *EPR* encouraged by the reporting mandate impacts investment (*R&D*, *INTANG*, and *CAPEX*). As I employ LATE IV estimation within a DiD setting, the research design requires the exclusion assumption of IV (*POSTMAIN*) as well as parallel trends in investment. Under agency theory, the reporting mandate does not automatically translate into changes in investment behavior as it is not a mandate for long-term investment. The mandate indirectly impacts investment through an increase in *EPR* as the enhancement in disclosure attracts long-term investors and promotes internal adoption of long-term indicators for executive compensation.

As shown in Table 4, Panel A, the reporting mandate increases both measures of *MetricEPR* and *TopicEPR* by 0.068 and 0.067, respectively.<sup>9</sup> It implies that Main Market

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<sup>8</sup> The UK Corporate Governance Code takes ‘comply or explain’ approach, leaving non-compliance a possible option. However, if firms choose not to comply with the Code, they must explicitly specify which provision of the code they do not comply with and explain why they do not comply in the governance report. This requirement makes the Corporate Governance Code a de-facto regulation. I checked all annual reports of Main Market firms after 2011 in my sample and find no non-compliance with the provision C.1.2 (the disclosure of business model and strategy). Consistent with this manual check, my empirical test also confirms a significant increase in *EPR* disclosure in response to the Corporate Governance Code. Moreover, the treatment does not need to be sharply defined as I employ instrumented DiD (Hudson et al. 2017), which takes an IV estimation approach like fuzzy Regression Discontinuity Design.

<sup>9</sup> Although the dependent variables (*MetricEPR* and *TopicEPR*) vary between zero and one, I do not use a fractional logit model for the 1<sup>st</sup> stage regression of instrumented DiD for two reasons. First, a non-linear first stage model increases the danger of misspecification and inconsistent estimation whereas a linear first stage model generates consistent result (Angrist and Krueger 2001). Second, as I use fixed effects with small T (short sample period), a non-linear specification causes inconsistent estimation known as incidental parameter problem (Greene 2002; Papke and Wooldridge 2008). Thus, I opt to use standard linear fixed effects model, instead of a fractional logit model.

firms, compared to AIM firms, provide more non-earnings performance indicators and management commentary on the process of value creation in response to the reporting mandate.<sup>10</sup> The second stage regression in Panel B shows that an increase in *MetricEPR* and *TopicEPR* driven by the reporting mandate have a positive impact on *R&D* and *INTANG* but not on *CAPEX*.

The results are consistent with those of the classical DiD in Table 2. The average treatment effects of the reporting mandate on R&D expenditure of the Main Market firms through an increase in *MetricEPR* are 0.034, which is the coefficient of *POSTMAIN* of 0.068 in panel A times the coefficient of *MetricEPR* of 0.498 in panel B. The estimated average treatment effects on R&D expenditures through increase in *TopicEPR* is 0.034 ( $=0.067*0.510$ ), which is comparable to the estimated average effects of *MetricEPR*. The average treatment effects on investment in intangible assets through increase in *MetricEPR* and *TopicEPR* are 0.054 ( $=0.068*0.796$ ) and 0.055 ( $=0.067*0.815$ ), respectively.

The instrumented DiD design allows the estimation of non-average treatment effects. For example, if a Main Market firm increases *MetricEPR* by 0.01, the estimated treatment effects on *R&D* and *INTANG* are 0.005 ( $=0.01*0.498$ ) and 0.008 ( $=0.01*0.796$ ), respectively. In contrast, if a main market firm increases *MetricEPR* by 0.136, which is the twice of the average of 0.068, the estimated treatment effects on *R&D* and *INTANG* are 0.068 ( $=0.136*0.498$ ) and 0.108 ( $=0.136*0.796$ ). They are respectively 56% and 64% of one standard deviation of each variable. The increase is equivalent to a movement from the 50th percentile to the 71st (74th) percentile rank in the R&D (intangible asset) distribution.

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<sup>10</sup> Appendix F provides the DiD estimates for which the proportion of individual topic is used instead of TEPR

Treatment effects of *TopicEPR* are similar. A higher level of compliance with the reporting mandate leads to greater impacts on investment decision.<sup>11</sup>

I conduct a robustness test using alternative classifications of *MetricEPR* and *TopicEPR*. For an alternative to *MetricEPR*, I classify grey measures (granular financial information, financial ratio, and investments) into TPR category so that the classification follows the traditional classification of financial vs non-financial measure. For an alternative classification of topics, I partition topics into financial vs non-financial topics. I also create alternative measures of *TopicEPR* based on 40 topics and 60 topics for my topic modeling. Untabulated results based on alternative measures of *MetricEPR* and *TopicEPR* are significant and consistent with the results in Table 4.

[Table 4 about here]

### 5.3 Analysis of External Channel

While Table 4 shows the UK Corporate Governance Code (2010) affects investment through enhanced performance reporting, it does not show specific channels through which EPR impacts investment. To examine the effects of EPR on investment through an external channel, I test whether EPR attracts long-term investors and such an increase in long-term investor promotes investment. Following Bushee and Noe (2000), I split institutional investors into one of three types. They are dedicated investor, quasi-indexer, and transient investor. Then, I calculate the proportion of shares owned by dedicated investors or quasi-indexer for each firm-year to measure long-term investors (*LTinvestor*). The following

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<sup>11</sup> R&D expenditure and intangible assets may not linearly increase with the level of compliance with the Corporate Governance Code 2010. However, whether the effects are linearly or non-linearly increasing is beyond the research question of this study.

system of equations reflects the effects of the reporting mandate on investment decisions through the external investor-related channel.<sup>12</sup>

$$EPR_{it} = \gamma_1 POSTMAIN_{it} + \omega'X_{it} + Firm\_FE + YEAR\_FE + c + \varepsilon_{it} \quad (4)$$

$$LTinvestor_{it} = \gamma_2 \widehat{EPR}_{it} + \omega'X_{it} + Firm\_FE + YEAR\_FE + c + \varepsilon_{it} \quad (5)$$

$$y_{it} = \gamma_3 \widehat{LTinvestor}_{it} + \omega'X_{it} + Firm\_FE + YEAR\_FE + c + \varepsilon_{it} \quad (6)$$

Panel A and B in Table 5 shows the external channel analysis using *MetricEPR* and *TopicEPR*, respectively. The model reflects the following causal chain: 1<sup>st</sup>, the impact of reporting mandate (*POSTMAIN*) on performance reporting (*MetricEPR*, *TopicEPR*); 2<sup>nd</sup>, the impact of enhanced performance reporting (*MetricEPR*, *TopicEPR*) on the proportion of long-term investors (*LTinvestor*); and 3<sup>rd</sup>, the impact of long-term investors (*LTinvestor*) on investments (*R&D*, *INTANG*, *CAPEX*).

Both panels in Table 5 show positive and significant associations between *POSTMAIN* and *EPR* (Column 1), *EPR* and *LTinvestor* (Column 2), *LTinvestor* and *R&D* (Column 3), and *LTinvestor* and *INTANG* (Column 4). The average treatment effects of the Corporate Governance Code on *MetricEPR* is 0.068, which is the same as the result of first stage regression in Table 4. The estimated effects of the reporting mandate on the proportion of long-term investors among the Main Market firms with average compliance level are 0.053 (=0.068\*0.779). The estimated effects of the exogenous increase in *LTinvestor* on R&D expenditures of average Main Market firms are 0.034 (=0.068\*0.779\*0.640), which is consistent with the estimated treatment effects of 0.033 in table 4. Like the estimated effects

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<sup>12</sup> Substituting *LTinvestor* in eq (6) with eq (5) reduces the two equations to eq (3). Thus, the system of equation (4), (5) and (6) is equivalent to the system (2) and (3). Having one additional step (*LTinvestor*) between *EPR* and investments decomposes  $\beta_1$  and  $\beta_2$  into  $\gamma_1$ ,  $\gamma_2$ , and  $\gamma_3$  ( $\beta_1\beta_2 = \gamma_1\gamma_2\gamma_3$ ). This decomposition enables observing how disclosure impacts long-term investors and how a change in investors affects investment.

in the previous section, the effects of decreasing *PSE* are stronger among the firms with a higher level of compliance with the reporting mandate. The estimated treatment effects of *TopicEPR* are similar in Panel B. The results imply that the reporting mandate promotes enhanced performance reporting among the Main Market firms, that the increase in enhanced performance reporting attracts long-term investors, and that long-term investors promote long-term decision-making. Consistent with the results of previous section, the external channel does not have a significant effect on capital expenditure.

[Table 5 about here]

## 5.4 Analysis of Internal Channel

### 5.4.1. Measurement of Pay Sensitivity to Earnings

For the analysis of the internal channel, I examine pay sensitivity to earnings (*PSE*) that measures the degree of reliance on earnings for CEO pay. I regress total CEO compensation (*Compen*) on one-year shareholder return (*TSR*) and earnings performance (*Earnings*) to examine the associations between compensation and market and accounting performance. I add a decile variable of *MetricEPR* (*EPRdecile*) and take interaction terms between *EPRdecile* and the market (*TSR*) and accounting performance (*Earnings*) to test the effects of EPR on the association between performances and CEO pay.

$$Compen = \beta_1 TSR + \beta_2 EPRdecile*TSR + \beta_3 EBIT + \beta_4 EPRdecile*EBIT \quad (7)$$

As shown in column (1) of Table 6, CEO pay (*Compen*) is positively associated with total shareholder return (*TSR*). In column 2, the interaction term between *EPRdecile* and *TSR* (*TSR\*EPRdecile*) subsumes this positive association ( $\beta_1$ ) and makes the association between *TSR* and CEO pay stronger as *EPRdecile* increases. For example, the association between

TSR and compensation for firms with *EPRdecile* value of five is 0.137 ( $= -0.013 + 0.030*5$ ), which is similar to the association of 0.142 in column 1. Firms with *EPRdecile* value greater than five link their TSR to CEO pay more than average firms. The finding of stronger link between TSR and CEO pay among higher EPR firms ( $\beta_2 > 0$ ) implies that enhanced performance reporting reflects value creation better.

In column 3, CEO pay is positively associated with *Earnings*. However, the association between CEO pay and earnings is weaker among firms with high *EPRdecile* ( $\beta_4 < 0$ ). I calculate pay sensitivity to earnings (*PSE*) as  $\beta_3 + \beta_4 \textit{EPRdecile}$ . For example, *PSE* of the firms with *EPRdecile* value of five is 0.103 ( $=0.188 - 0.017*5$ ). *PSE* is only 0.018 among the firms with *EPRdecile* value of 10. The result implies that firms with higher EPR rely less on earnings performance for CEO pay. It provides the evidence that firms demonstrate the alignment between external reporting and internal control system.<sup>13</sup>

[Table 6 about here]

#### 5.4.2. Impact of the reporting mandate on PSE and Investment

For the analysis of the internal channel, I examine if the reporting mandate reduces the reliance on earnings for CEO pay and if the reduction in pay sensitivity to earnings performance (*PSE*) promotes investments.

$$PSE_{it} = \delta_1 \textit{POSTMAIN}_{it} + \omega'X_{it} + \textit{Firm\_FE} + \textit{YEAR\_FE} + c + \varepsilon_{it} \quad (8)$$

$$y_{it} = \delta_2 \widehat{PSE}_{it} + \omega'X_{it} + \textit{Firm\_FE} + \textit{YEAR\_FE} + c + \varepsilon_{it} \quad (9)$$

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<sup>13</sup> I do not consider both external and internal channels at once. Comparing the size of effects generated by external and internal channels or examining dynamic interactions between the two channels inside an instrumented DiD complicates my research design and is beyond the scope of my research question.

Table 7 reflects the following causal chain: 1<sup>st</sup>, the impact of the reporting mandate (*POSTMAIN*) on pay sensitivity to earnings (*PSE*) and 2<sup>nd</sup>, the impact of the pay sensitivity to earnings (*PSE*) on investments (*R&D*, *INTANG*, and *CAPEX*).<sup>14</sup>

In column 1 of table 7, the reporting mandate, on average, decreases pay sensitivity to earnings by 0.022 among the Main Market firms relative to Alternative Investment Market. It suggests the Corporate Governance Code induces Main Market firms to rely less on current earnings for CEO pay as they align the internal control system with enhanced performance reporting. In column 2, the decrease in *PSE* is associated with a significant increase in *R&D* and *INTANG*. The estimated average treatment effects of the reporting mandate on investment in R&D and intangible assets among Main Market firms are 0.035 (= -0.022\*-1.575) and 0.055 (= -0.022\*-2.515). The results suggest that the reporting mandate reduces pay sensitivity to earnings performance, and the reduction in pay sensitivity to earnings promotes investments. However, the effect is insignificant on capital expenditure.

[Table 7 about here]

## 6. Additional Analyses and Robustness Tests

### 6.1 Alternative Hypothesis: Over-investment

An increase in investment may not imply better decision-making if it leads to overinvestment. However, overinvestment is not a plausible explanation in my research because the increase in investment is associated with improvements in external monitoring and internal incentive system. Moreover, I do not find a significant increase in *CAPEX* while much evidence of overinvestment shows that firms tend to overinvest (Harford et al 2008; D'Mello and Miranda 2010) in the form of excessive capital expenditure (Jensen 1986;

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<sup>14</sup> As pay sensitivity to earnings performance (*PSE*) is a function of *EPRdecile* ( $PSE = \beta_3 + \beta_4 \text{EPRdecile}$ ), regressing *PSE* on *EPR* measure is redundant. The regression of *PSE* on *POSTMAIN* already implies two sequential steps: the impact of the reporting mandate on *EPR* and the impact of *EPR* on *PSE*.

Jensen and Meckling 1976). On the other hand, research finds myopic managers cut R&D expenditures to manage earnings (Bushee 1998; Lundstrum 2002; Graham et al 2005, Roychowdhury 2006; Cheng 2004; Edmans et al. 2018; Kay 2012). Theory also concludes that underinvestment in R&D is an equilibrium (Jone and Williams 1998). An increase in R&D does not represent overinvestment.

Nevertheless, I conduct a subsample analysis to examine whether the effects of the reporting mandate 2010 on investments are significant among the firms with higher likelihood of overinvestment. As firms with excess cash are more likely to overinvest despite fewer investment opportunities (Harford et al 2008; D'Mello and Miranda 2010), I identify firms with high cash and low Tobin's Q. Following prior research (Cheng et al 2013; Chen et al. 2017), I generate two decile ranks based on cash balance and negative Tobin's Q and take the average. Using the median value, I split firms into two groups: overinvestment and underinvestment likely firms. Then, I conduct a DiD analysis for each sample. Panel A and B in Table 8 shows the impact of the Corporate Governance Code (2010) for each group. Panel A shows that the effects of the reporting mandate are not significant among the firms with higher likelihood of overinvestment. On the other hand, panel B shows significant results consistent with the main analysis.

[Table 8 about here]

## 6.2. Alternative Hypothesis: Impact of other provisions

Corporate Governance Code 2010 includes two more requirements for FTSE350 firms in addition to the reporting requirement of business model and strategy. They are annual reelection of directors (provision B.6.2) and the triennial evaluation of board performance (provision B.7.1). These requirements may improve managerial decision-making. However, the additional provisions do not provide a plausible alternative explanation

as the instrumented DiD estimates the effects of the reporting mandates on investments through an increase in EPR. I nevertheless conduct a subsample analysis to rule out the alternative explanation. As provision B.6.2 and B.7.1 apply to FTSE350 firms, I exclude those firms and test whether results remain similar. As shown in Table 9, the effects of the reporting mandate are significant for *R&D* and *INTANG* but insignificant for *CAPEX*. The results are consistent with the main analysis.

[Table 9 about here]

## **7. Conclusion**

This research examines whether requiring firms to articulate their approach to long-term value creation encourages management to look beyond earnings and make long-term decisions. Using the U.K. Corporate Governance Code 2010, I document that such reporting mandate induces firms to adopt enhanced performance reporting, evidenced by more non-earnings performance measures and more descriptions of business operations and strategies. Next, I show that the increase in non-earnings focus in performance reporting leads to increases in R&D expenditure and acquisition of intangible assets. I further show that enhanced performance reporting impacts investments by attracting more long-term investors and reducing pay sensitivity to earnings performance.

It is important to note that the results of my study are subject to several limitations. First, this study does not address a question of whether the investments encouraged by the reporting mandate leads to better long-term performances. While I acknowledge the importance of actual long-term performance, it is difficult to establish causality. As long-term lead variables, such as performances in three or five years, make endogeneity issues intractable, I do not extend my research to the test of actual long-term performance. Still, my results provide meaningful evidence on the positive effects on the managerial decision-

making that is closely related to long-term value creation. Second, I use a relatively small-sized sample due to manual data collection and the validity check of unique tokens. There is no guarantee that the sample is reflective of the population. Third, the Corporate Governance Code 2010 may not be an unpredictable shock due to increasing awareness of long-term perspectives in performance reporting and decision-making. However, the increasing awareness serves to a bias against a significant result as Main Market firms, relative to AIM firms, are more likely to improve their performance reporting before the reporting requirements in 2010 and, therefore, have little room for improvements.

Limitations aside, my study extends the current understanding of the interaction between external and internal aspects of accounting. Regulators and practitioners promote enhanced performance reporting in the belief that it supports internal decisions (IIRC 2013; FRC 2010; E.C. 2017; PwC 2006). However, literature lacks causal evidence supporting this effect and the channels through which it operates. I use a disclosure innovation in the U.K. to provide novel evidence on the causal link between external reporting system and internal incentive system. The evidence speaks to directly Ittner and Larcker's (2001) appeal for further research integrating internal and external aspects of accounting. My work also contributes to the literature on managerial myopia. External financial reporting is typically viewed as a primary cause of myopic decision-making (Fuller and Jensen 2002; Cheng et al. 2005) with evidence on the mechanisms that counteract such behavior focusing on internal factors such as compensation contract (Baiman and Baldenius 2009; Ibrahim and Lloyd 2011). In a departure from prior work, I provide evidence on how financial reporting can catalyze constructive firm-level debate on sustainable value creation. Lastly, the evidence of this study in general provides useful insights to practitioners and regulators.

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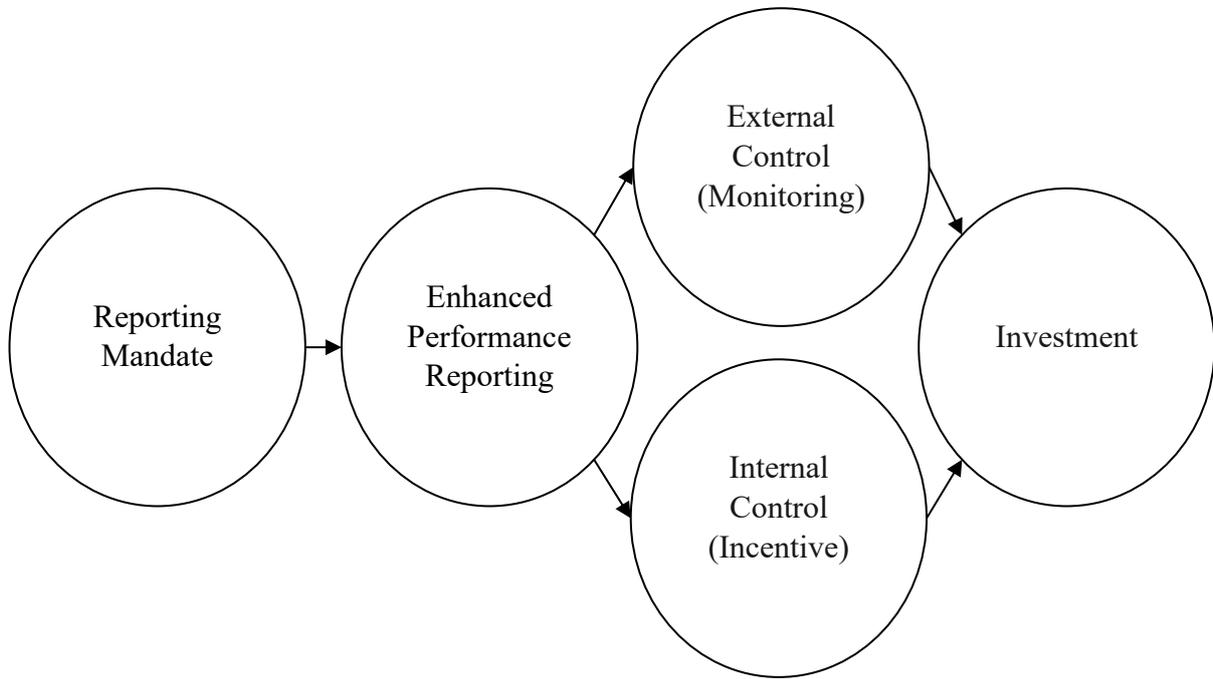
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**Figure 1. Theoretical Framework**

This figure presents theoretical framework of this study.

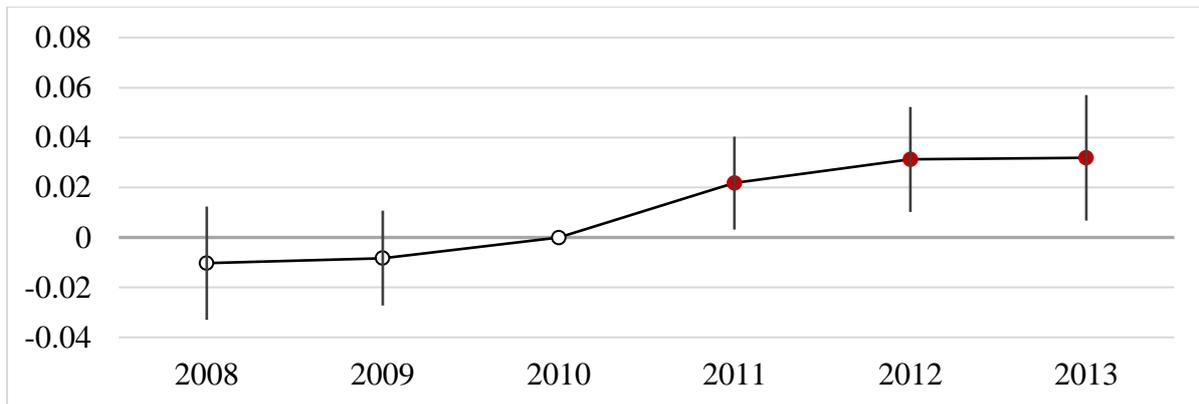


## Figure 2. Parallel trends test

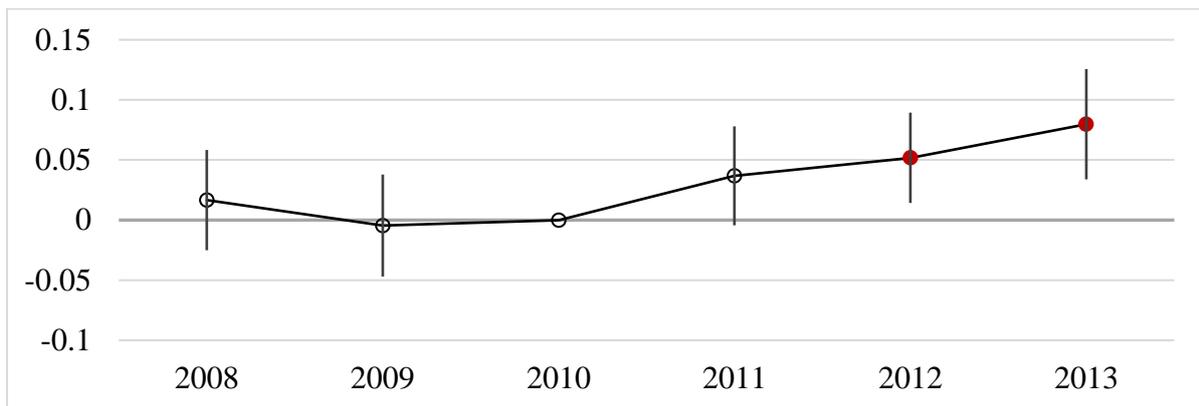
This figure reports the results of parallel trends test. Dot points represent the estimated treatment effects of the year and are colored red if the estimated effect is significant.

$$Investment = \alpha_{2008} YEAR2008 * MAIN + \alpha_{2009} YEAR2009 * MAIN + \alpha_{2011} YEAR2011 * MAIN + \alpha_{2012} YEAR2012 * MAIN + \alpha_{2013} YEAR2013 * MAIN + FIRM\_FE + YEAR\_FE$$

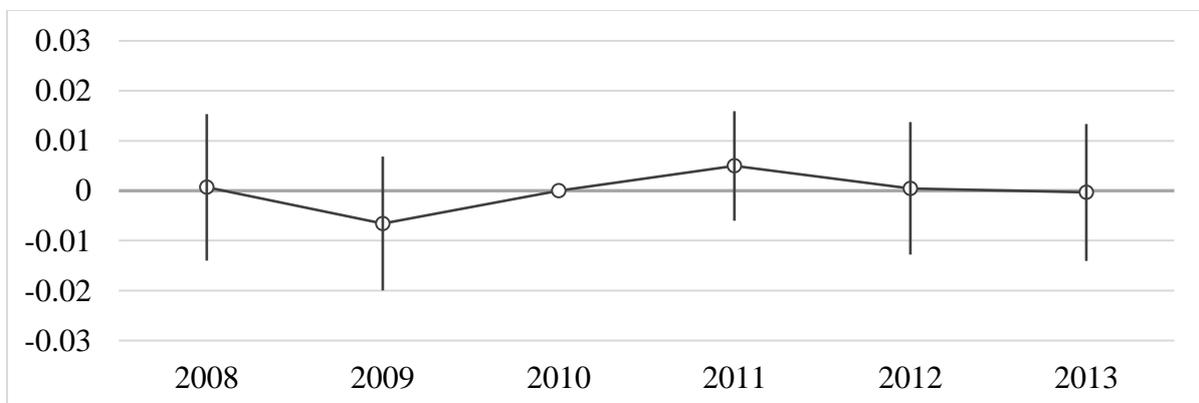
Panel A. Parallel trends in R&D expenditure



Panel B. Parallel trends in  $\Delta$ intangible assets



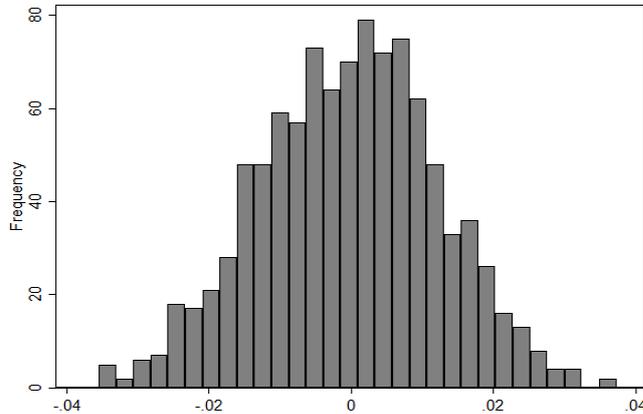
Panel C. Parallel trends in CAPEX



### Figure 3. Placebo Test

This figure presents the distribution of estimated treatment effect of 1,000 placebo tests. For each iteration of placebo test, I keep pre-treatment period observation and randomly assign treatment to the half of the observations.

#### Panel A. Placebo Treatment Effect on R&D expenditure



Iterations: 1,000

Mean: 0.000

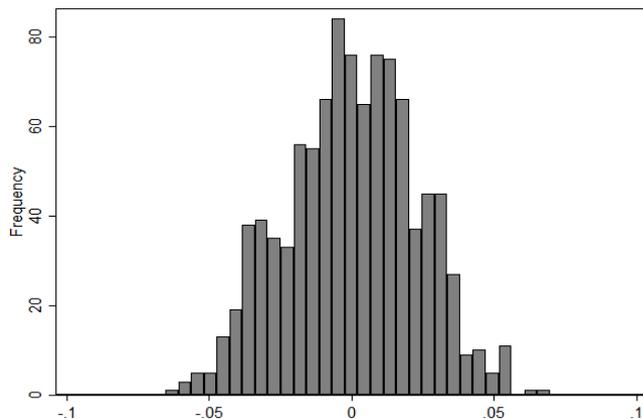
S.D: 0.013

t-test ( $H_0$ : mean = 0)

t = -0.801

p-value = 0.424

#### Panel B. Placebo Treatment Effect on Intangible Assets



Iterations: 1,000

Mean: 0.000

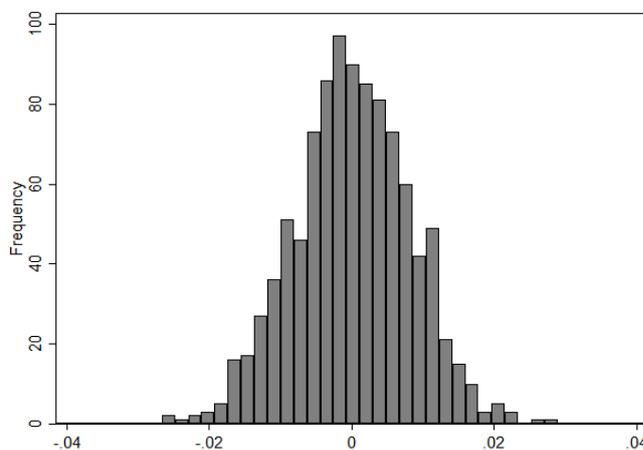
S.D: 0.023

t-test ( $H_0$ : mean = 0)

t = 0.249

p-value = 0.803

#### Panel C. Placebo Treatment Effect on Capital Expenditure



Iterations: 1,000

Mean: 0.000

S.D: 0.008

t-test ( $H_0$ : mean = 0)

t = 0.553

p-value = 0.580

**Table 1. Sample Selection and Descriptive Statistics**

This table provides summary statistics of main variables and control variables in my multivariate analysis. Continuous variables are winsorized at the 1% and 99% level. Variable definitions are in Appendix A.

## Panel A. Sample Selection

|  | <b>Firms</b> | <b>Firm-years</b> |
|--|--------------|-------------------|
| observations between 06/29/2008 and 06/28/2014               | 2,172        | 8,863             |
| (-) finance and utility sector                               | (579)        | (2,447)           |
| (-) firms with missing financial variable                    | (229)        | (956)             |
| (-) firms with missing observations within the sample period | (738)        | (1,904)           |
|  | <b>626</b>   | <b>3,756</b>      |
| Random sampling  | (426)        | (2,556)           |
| <b>Sample for tests</b>                                      | <b>200</b>   | <b>1,200</b>      |

## Panel B. Descriptive Statistics

| <b>Variable</b>                                    | <b>N</b> | <b>5%</b> | <b>Mean</b> | <b>Med</b> | <b>95%</b> | <b>SD</b> |
|--|----------|-----------|-------------|------------|------------|-----------|
| <b>Variables of Investment</b>                     |          |           |             |            |            |           |
| <i>R&amp;D</i>                                     | 1,200    | 0.00      | 0.04        | 0.00       | 0.27       | 0.12      |
| <i>INTANG</i>                                      | 1,200    | -0.05     | 0.06        | 0.01       | 0.38       | 0.17      |
| <i>CAPEX</i>                                       | 1,200    | 0.00      | 0.04        | 0.02       | 0.17       | 0.06      |
| <b>Variables of Enhanced Performance Reporting</b> |          |           |             |            |            |           |
| <i>MetricEPR</i>                                   | 1,200    | 0.00      | 0.36        | 0.36       | 0.71       | 0.21      |
| <i>TopicEPR</i>                                    | 1,200    | 0.31      | 0.69        | 0.70       | 0.82       | 0.16      |
| <b>Variables of External and Internal Control</b>  |          |           |             |            |            |           |
| <i>LTinvestor</i>                                  | 1,200    | 0.01      | 0.40        | 0.38       | 0.84       | 0.27      |
| <i>PSE</i>   | 1,200    | 0.06      | 0.12        | 0.13       | 0.18       | 0.04      |
| <b>Control Variables</b>                           |          |           |             |            |            |           |
| <i>SIZE</i>  | 1,200    | 7.85      | 11.77       | 11.81      | 15.93      | 2.45      |
| <i>Q</i>   | 1,200    | 0.55      | 2.70        | 1.67       | 7.57       | 3.73      |
| <i>LEV</i>   | 1,200    | 0.00      | 0.18        | 0.13       | 0.56       | 0.21      |
| <i>CASH</i>  | 1,200    | 0.00      | 0.14        | 0.08       | 0.52       | 0.17      |
| <i>LOSS</i>  | 1,200    | 0.00      | 0.28        | 0.00       | 1.00       | 0.45      |
| <i>AGE</i>   | 1,200    | 3.00      | 12.04       | 12.00      | 22.00      | 6.48      |
| <i>RAISE</i>                                       | 1,200    | 0.00      | 0.69        | 1.00       | 1.00       | 0.46      |

**Table 2. Baseline Result of Classical DiD**

This table reports the results from analysis of the effect of the Corporate Governance Code (2010) on R&D expenditure (*R&D*), change in net intangible assets (*INTANG*), and capital expenditure (*CAPEX*). *POSTMAIN* is an interaction between an indicator for post-treatment period (*POST*) and an indicator of treatment group (*MAIN*). All regressions include the following control variables: *SIZE*, *LEV*, *CASH*, *LOSS*, *Q*, *AGE*, and *RAISE*. Z-statistics are provided in parentheses and based on robust standard error clustered at the firm level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively.

| Dependent Variable      | (1)<br><i>R&amp;D</i> | (2)<br><i>INTANG</i>  | (3)<br><i>CAPEX</i> |
|-------------------------|-----------------------|-----------------------|---------------------|
| <i>POSTMAIN</i>         | 0.034***<br>(3.494)   | 0.055***<br>(3.486)   | 0.004<br>(0.809)    |
| <i>Q</i>                | -0.000<br>(-0.001)    | 0.008*<br>(1.884)     | 0.001<br>(1.063)    |
| <i>SIZE</i>             | -0.022**<br>(-1.993)  | -0.092***<br>(-4.589) | -0.007<br>(-1.646)  |
| <i>LEV</i>              | -0.002<br>(-0.026)    | -0.033<br>(-0.394)    | -0.020<br>(-1.119)  |
| <i>CASH</i>             | -0.078*<br>(-1.754)   | 0.038<br>(0.563)      | 0.022<br>(1.392)    |
| <i>LOSS</i>             | 0.002<br>(0.250)      | -0.012<br>(-0.681)    | 0.006<br>(1.050)    |
| <i>AGE</i>              | 0.001<br>(0.173)      | -0.021<br>(-1.126)    | -0.003<br>(-0.363)  |
| <i>RAISE</i>            | 0.014**<br>(2.132)    | 0.017<br>(1.448)      | 0.014***<br>(2.923) |
| Firm Fix                | YES                   | YES                   | YES                 |
| Year Fix                | YES                   | YES                   | YES                 |
| Observations            | 1,200                 | 1,200                 | 1,200               |
| Adjusted R <sup>2</sup> | 0.744                 | 0.513                 | 0.661               |

### Table 3. Matching Analysis

This table reports balance between treatment and control group before and after matching and the regression results with the matched sample. Panel A reports mean values of covariates for Main Market and Alternative Investment Market before and after matching. I use Coarsened Exact Matching, which eliminates observations outside the common supports of two groups' covariate distribution and assigns weights that balances covariates of remaining observations. Panel B reports the results from analysis of the effect of the Corporate Governance Code (2010) on R&D expenditure (*R&D*), change in net intangible assets (*INTANG*), and capital expenditure (*CAPEX*) using a matched sample. *POSTMAIN* is an interaction between an indicator for post-treatment period (*POST*) and an indicator of treatment group (*MAIN*). All regressions include the following control variables: *SIZE*, *LEV*, *CASH*, *LOSS*, *Q*, *AGE*, and *RAISE*. Z-statistics are provided in parentheses and based on robust standard error clustered at the firm level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively.

Panel A. Mean values of Covariates Before and After Matching

|              | Before Matching    |            |                   | After Matching     |            |                   |
|--------------|--------------------|------------|-------------------|--------------------|------------|-------------------|
|              | (1)<br>Main Market | (2)<br>AIM | (3)<br>Difference | (4)<br>Main Market | (5)<br>AIM | (6)<br>Difference |
| <i>SIZE</i>  | 13.766             | 9.899      | 3.867***          | 12.414             | 12.188     | 0.226             |
| <i>Q</i>     | 3.187              | 2.21       | 0.977***          | 1.685              | 1.316      | 0.369             |
| <i>LEV</i>   | 0.218              | 0.134      | 0.084***          | 0.186              | 0.16       | 0.026             |
| <i>CASH</i>  | 0.081              | 0.195      | -0.114***         | 0.084              | 0.086      | -0.002            |
| <i>LOSS</i>  | 0.098              | 0.479      | -0.381***         | 0.111              | 0.188      | -0.077            |
| <i>AGE</i>   | 16.148             | 9.903      | 6.245***          | 14.815             | 11.87      | 2.945             |
| <i>RAISE</i> | 0.747              | 0.632      | 0.115***          | 0.648              | 0.654      | -0.006            |
| Observations | 600                | 600        |                   | 162                | 66         |                   |

Panel B. Treatment Effects after Matching

| Dependent Variable      | (1)<br><i>R&amp;D</i> | (2)<br><i>INTANG</i> | (3)<br><i>CAPEX</i> |
|-------------------------|-----------------------|----------------------|---------------------|
| <i>POSTMAIN</i>         | 0.019*<br>(1.906)     | 0.041**<br>(2.190)   | 0.017<br>(1.574)    |
| Control                 | YES                   | YES                  | YES                 |
| Firm Fix                | YES                   | YES                  | YES                 |
| Year Fix                | YES                   | YES                  | YES                 |
| Observations            | 228                   | 228                  | 228                 |
| Adjusted R <sup>2</sup> | 0.320                 | 0.408                | 0.329               |

**Table 4. Result of Instrumented DiD**

This table reports the results from analysis of the effect of the Corporate Governance Code (2010) on *R&D*, *INTANG*, and *CAPEX* through the enhancement in performance reporting. Panel A shows the effects of the reporting mandate on performance reporting (1<sup>st</sup> stage), and Panel B presents the effects of the exogenous enhancement in performance reporting on investment (2<sup>nd</sup> stage). *POSTMAIN* is an interaction between an indicator of post-treatment period (*POST*) and an indicator of treatment group (*MAIN*). *MetricEPR* is the proportion of performance measures other than earnings and variants of earnings. *TopicEPR* is the proportion of themes in the annual report that describe non-earnings aspect of value creation. All regressions include the following control variables: *SIZE*, *LEV*, *CASH*, *LOSS*, *Q*, *AGE*, and *RAISE*. Z-statistics are provided in parentheses and based on robust standard error clustered at the firm level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively.

Panel A. Effects of the Corporate Governance Code on performance reporting (1<sup>st</sup> Stage)

| Dependent Variable      | (1)                 | (2)                 |
|-------------------------|---------------------|---------------------|
|                         | <i>MetricEPR</i>    | <i>TopicEPR</i>     |
| <i>POSTMAIN</i>         | 0.068***<br>(3.223) | 0.067***<br>(4.564) |
| Control                 | YES                 | YES                 |
| Firm Fix                | YES                 | YES                 |
| Year Fix                | YES                 | YES                 |
| Observations            | 1,200               | 1,200               |
| Adjusted R <sup>2</sup> | 0.655               | 0.766               |

Panel B. Effects of the enhancement in performance reporting on investment (2<sup>nd</sup> Stage)

| Dependent Variable      | (1)                | (2)                | (3)              | (4)                 | (5)                 | (6)              |
|-------------------------|--------------------|--------------------|------------------|---------------------|---------------------|------------------|
|                         | <i>R&amp;D</i>     | <i>INTANG</i>      | <i>CAPEX</i>     | <i>R&amp;D</i>      | <i>INTANG</i>       | <i>CAPEX</i>     |
| <i>MetricEPR</i>        | 0.498**<br>(2.307) | 0.796**<br>(2.457) | 0.059<br>(0.813) |                     |                     |                  |
| <i>TopicEPR</i>         |                    |                    |                  | 0.510***<br>(2.986) | 0.815***<br>(2.816) | 0.060<br>(0.825) |
| Control                 | YES                | YES                | YES              | YES                 | YES                 | YES              |
| Firm Fix                | YES                | YES                | YES              | YES                 | YES                 | YES              |
| Year Fix                | YES                | YES                | YES              | YES                 | YES                 | YES              |
| Observations            | 1,200              | 1,200              | 1,200            | 1,200               | 1,200               | 1,200            |
| Adjusted R <sup>2</sup> | 0.427              | 0.159              | 0.650            | 0.645               | 0.363               | 0.656            |

**Table 5. External Channel Analysis**

This table reports results from analysis of the effect of the Corporate Governance Code (2010) on *R&D*, *INTANG*, and *CAPEX* through external monitoring of investors (*LTinvestor*). Panel A (B) shows the effects of the reporting mandate on *MetricEPR* (*TopicEPR*), the effects of the exogenous increase in *MetricEPR* (*TopicEPR*) on the proportion of long-term investors *LTinvestor*, and the effects of the increase in long-term investors on investments. *POSTMAIN* is an interaction between an indicator of post-treatment period (*POST*) and an indicator of treatment group (*MAIN*). *MetricEPR* is the proportion of performance measures other than earnings and variants of earnings. *TopicEPR* is the proportion of themes in the annual report that describe non-earnings aspect of value creation. *LTinvestor* represents the proportion of quasi-indexer and dedicated investors based on Bushee and Noe (2000) approach to classifying institutional investment style. All regressions include the following control variables: *SIZE*, *LEV*, *CASH*, *LOSS*, *Q*, *AGE*, and *RAISE*. Z-statistics are provided in parentheses and based on robust standard error clustered at the firm level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively.

Panel A. Effects of the Code on Investor Pool and Investment (*MetricEPR*)

|                         | (1)                 | (2)                | (3)                | (4)                | (5)              |
|-------------------------|---------------------|--------------------|--------------------|--------------------|------------------|
|                         | 1st                 | 2nd                | 3rd                | 3rd                | 3rd              |
| Dependent Variable      | <i>MetricEPR</i>    | <i>LTinvestor</i>  | <i>R&amp;D</i>     | <i>INTANG</i>      | <i>CAPEX</i>     |
| <i>POSTMAIN</i>         | 0.068***<br>(3.545) |                    |                    |                    |                  |
| <i>MetricEPR</i>        |                     | 0.779**<br>(2.206) |                    |                    |                  |
| <i>LTinvestor</i>       |                     |                    | 0.640**<br>(2.447) | 1.022**<br>(2.403) | 0.075<br>(0.802) |
| Control                 | YES                 | YES                | YES                | YES                | YES              |
| Firm Fix                | YES                 | YES                | YES                | YES                | YES              |
| Year Fix                | YES                 | YES                | YES                | YES                | YES              |
| Observations            | 1,200               | 1,200              | 1,200              | 1,200              | 1,200            |
| Adjusted R <sup>2</sup> | 0.655               | 0.767              | 0.544              | 0.278              | 0.651            |

Panel B. Effects of the Code on Investor Pool and Investment (*TopicEPR*)

|                    | (1)                 | (2)                 | (3)                | (4)                | (5)              |
|--------------------|---------------------|---------------------|--------------------|--------------------|------------------|
|                    | 1st                 | 2nd                 | 3rd                | 3rd                | 3rd              |
| Dependent Variable | <i>TopicEPR</i>     | <i>LTinvestor</i>   | <i>R&amp;D</i>     | <i>INTANG</i>      | <i>CAPEX</i>     |
| <i>POSTMAIN</i>    | 0.067***<br>(5.019) |                     |                    |                    |                  |
| <i>TopicEPR</i>    |                     | 0.798***<br>(2.920) |                    |                    |                  |
| <i>LTinvestor</i>  |                     |                     | 0.640**<br>(2.447) | 1.022**<br>(2.403) | 0.075<br>(0.802) |

|                         |       |       |       |       |       |
|-------------------------|-------|-------|-------|-------|-------|
| Control                 | YES   | YES   | YES   | YES   | YES   |
| Firm Fix                | YES   | YES   | YES   | YES   | YES   |
| Year Fix                | YES   | YES   | YES   | YES   | YES   |
| Observations            | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 |
| Adjusted R <sup>2</sup> | 0.766 | 0.858 | 0.544 | 0.277 | 0.651 |

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**Table 6. Pay Sensitivity to Earnings (PSE)**

This table reports results from analysis of pay sensitivity to earnings performance. The outcome variable is the natural log of CEO compensation (*Compen*). *TSR* is a one-year shareholder return, and *Earnings* is earnings before interest and tax. *TSR* and *Earnings* are interacted with *EPRdecile*, a decile value from 1 to 10 based on *MetricEPR*. CEO fixed effects are included instead of firm-fixed effects for the analysis. All regressions include the following control variables: *SIZE*, *LEV*, and *LOSS*. Z-statistics are provided in parentheses and based on robust standard error clustered at the CEO level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively.

|   | (1)                 | (2)                | (3)              | (4)                  | (5)                  |
|---|---------------------|--------------------|------------------|----------------------|----------------------|
|   | <i>Compen</i>       | <i>Compen</i>      | <i>Compen</i>    | <i>Compen</i>        | <i>Compen</i>        |
| <i>TSR</i>                              | 0.142***<br>(3.916) | -0.012<br>(-0.159) |                  |                      | -0.013<br>(-0.168)   |
| <i>TSR*EPRdecile</i>                    |                     | 0.030**<br>(2.482) |                  |                      | 0.030**<br>(2.493)   |
| <i>Earnings</i> ( $\beta_3$ )           |                     |                    | 0.034<br>(0.592) | 0.182**<br>(2.112)   | 0.188**<br>(2.413)   |
| <i>Earnings*EPRdecile</i> ( $\beta_4$ ) |                     |                    |                  | -0.018**<br>(-2.095) | -0.017**<br>(-1.997) |
| <i>EPRdecile</i>                        |                     | -0.001<br>(-0.088) |                  | 0.006<br>(0.567)     | 0.001<br>(0.083)     |
| Control                                 | YES                 | YES                | YES              | YES                  | YES                  |
| CEO Fix                                 | YES                 | YES                | YES              | YES                  | YES                  |
| Year Fix                                | YES                 | YES                | YES              | YES                  | YES                  |
| Observations                            | 1,200               | 1,200              | 1,200            | 1,200                | 1,200                |
| Adjusted R <sup>2</sup>                 | 0.916               | 0.917              | 0.913            | 0.913                | 0.917                |

**Table 7. Effects of decrease in PSE on investment**

This table reports the result from analysis of the effects of the Corporate Governance Code (2010) on pay sensitivity to earnings (*PSE*) and subsequent effects on investment including *R&D*, *INTANG*, and *RDINTANG*. *PSE* is calculated as  $\beta_3 + \beta_4 * EPRdecile$  from Table 6. As *EPR* is reflected in *PSE*, the analysis of internal channel does not include a regression for the effect of the reporting mandate on *EPR*. All regressions include the following control variables: *SIZE*, *LEV*, *CASH*, *LOSS*, *Q*, *AGE*, and *RAISE*. Z-statistics are provided in parentheses and based on robust standard error clustered at the firm level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively.

|                         | (1)                   | (2)                   | (3)                   | (4)                |
|-------------------------|-----------------------|-----------------------|-----------------------|--------------------|
|                         | 1st                   | 2nd                   | 2nd                   | 2nd                |
|                         | <i>PSE</i>            | <i>R&amp;D</i>        | <i>INTANG</i>         | <i>CAPEX</i>       |
| <i>POSTMAIN</i>         | -0.022***<br>(-4.835) |                       |                       |                    |
| <i>PSE</i>              |                       | -1.575***<br>(-2.710) | -2.515***<br>(-2.846) | -0.186<br>(-0.820) |
| Control                 | YES                   | YES                   | YES                   | YES                |
| Firm Fix                | YES                   | YES                   | YES                   | YES                |
| Year Fix                | YES                   | YES                   | YES                   | YES                |
| Observations            | 1,200                 | 1,200                 | 1,200                 | 1,200              |
| Adjusted R <sup>2</sup> | 0.566                 | 0.577                 | 0.332                 | 0.657              |

**Table 8. Subsample Analysis of the Impact of the Reporting Mandate on Investment**

This table reports the results from subsample analysis of the effect of the Corporate Governance Code (2010) on *R&D*, *INTANG*, and *CAPEX*. Panel A (Panel B) includes high (low) cash holding and low (high) leverage firms, which are likely to overinvest (underinvest). *POSTMAIN* is an interaction between an indicator for post-treatment period (*POST*) and an indicator of treatment group (*MAIN*). All regressions include the following control variables: *SIZE*, *LEV*, *CASH*, *LOSS*, *Q*, *AGE*, and *RAISE*. Z-statistics are provided in parentheses and based on robust standard error clustered at the firm level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively.

**Panel A. Effects of the Corporate Governance Code on Investment (Overinvestment sample)**

| Dependent Variable      | (1)<br><i>R&amp;D</i> | (2)<br><i>INTANG</i> | (3)<br><i>CAPEX</i> |
|-------------------------|-----------------------|----------------------|---------------------|
| <i>POSTMAIN</i>         | 0.003<br>(0.478)      | 0.005<br>(0.258)     | -0.006<br>(-0.955)  |
| Control                 | YES                   | YES                  | YES                 |
| Firm Fix                | YES                   | YES                  | YES                 |
| Year Fix                | YES                   | YES                  | YES                 |
| Observations            | 582                   | 582                  | 582                 |
| Adjusted R <sup>2</sup> | 0.782                 | 0.270                | 0.506               |

**Panel B. Effects of the Corporate Governance Code on Investment (Underinvestment sample)**

| Dependent Variable      | (1)<br><i>R&amp;D</i> | (2)<br><i>INTANG</i> | (3)<br><i>CAPEX</i> |
|-------------------------|-----------------------|----------------------|---------------------|
| <i>POSTMAIN</i>         | 0.077***<br>(3.980)   | 0.091***<br>(3.316)  | 0.010<br>(1.088)    |
| Control                 | YES                   | YES                  | YES                 |
| Firm Fix                | YES                   | YES                  | YES                 |
| Year Fix                | YES                   | YES                  | YES                 |
| Observations            | 618                   | 618                  | 618                 |
| Adjusted R <sup>2</sup> | 0.666                 | 0.453                | 0.622               |

**Table 9. Subsample analysis without FTSE350 firms**

This table shows the effects of the Corporate Governance Code (2010) on *R&D*, *INTANG*, and *CAPEX* without FTSE350 firms. *POSTMAIN* is an interaction between an indicator for post-treatment period (*POST*) and an indicator of treatment group (*MAIN*). All regressions include the following control variables: *SIZE*, *LEV*, *CASH*, *LOSS*, *Q*, *AGE*, and *RAISE*. Z-statistics are provided in parentheses and based on robust standard error clustered at the firm level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively.

| Dependent Variable      | (1)<br><i>R&amp;D</i> | (2)<br><i>INTANG</i> | (3)<br><i>CAPEX</i> |
|-------------------------|-----------------------|----------------------|---------------------|
| <i>POSTMAIN</i>         | 0.040***<br>(3.844)   | 0.067***<br>(3.133)  | 0.005<br>(0.700)    |
| Control                 | YES                   | YES                  | YES                 |
| Firm Fix                | YES                   | YES                  | YES                 |
| Year Fix                | YES                   | YES                  | YES                 |
| Observations            | 756                   | 756                  | 756                 |
| Adjusted R <sup>2</sup> | 0.624                 | 0.346                | 0.479               |

## Appendix A. Variable Definitions

| Variable  | Definition   |
|---|--|
| <b>Investment</b>   |  |
| <i>R&amp;D</i>  | Sum of R&D expenditure and change in net capitalized development costs, scaled by lagged total assets;   |
| <i>INTANG</i>   | Change in net intangible assets, scaled by lagged total assets. Intangible assets include patent and brand, license, computer software and other intangibles;  |
| <i>CAPEX</i>  | Capital expenditure, scaled by lagged total assets;  |
| <b>Enhanced Performance Reporting</b>                     |  |
| <i>MetricEPR</i>  | Measure of enhanced performance reporting calculated as the number of non-financial measures, financial ratio, investment, and granular financial measure, divided by the number of all performance measures. Appendix C provides the details;   |
| <i>TopicEPR</i>   | Measure of enhanced performance reporting calculated as the proportion of topics relevant to the process of value creation as opposed to the earnings result. Appendix D provides the word lists of topics;  |
| <b>Treatment variable</b>                                 |  |
| <i>POST</i>   | An indicator variable that equals one if the fiscal year-end is June 29 <sup>th</sup> 2011 or after;   |
| <i>MAIN</i>   | An indicator variable that equals one if the firm is in the Main Market on London Stock Exchange;  |
| <i>POSTMAIN</i>   | An interaction term between <i>POST</i> and <i>MAIN</i> ;  |
| <b>Additional Variables for External Channel Analysis</b> |  |
| <i>LTinvestor</i>   | Institutional ownership by quasi-indexer and dedicated investors. The classification of institutional investor is based on Bushee and Noe (2000). Four measures of portfolio turnover and four measures of ownership of institutional investors are reduced to two factors (factor analysis), and institution-years are split into one of three groups (transient investor, quasi-indexer, and dedicated investor) based on the two factors (three mean cluster analysis); |
| <b>Additional Variables for Internal Channel Analysis</b> |  |
| <i>Compen</i>   | Total compensation of CEO from BoardEx. In the case of co-CEO, the highest compensation is used;   |
| <i>TSR</i>  | One-year shareholder return assuming reinvestment of dividend with the window from the previous to current fiscal year end;  |
| <i>Earnings</i>   | Earnings before interest and taxes;  |
| <i>EPRdecile</i>  | A decile variable of <i>MetricEPR</i> ;  |
| <i>PSE</i>  | Pay sensitivity to earnings, calculated by $\beta_3 + \beta_4$ <i>EPRdecile</i> of regression result from column (3) in Table 6;   |
| <b>Control Variables</b>                                  |  |

|              |  |
|--------------|--|
| <i>SIZE</i>  | Natural logarithm of total assets;   |
| <i>Q</i>     | Tobin's Q as [market value of equity + total debt] / total assets;                   |
| <i>LEV</i>   | A ratio of total debt to total assets;   |
| <i>CASH</i>  | Cash and cash equivalents, scaled by total assets;                                   |
| <i>LOSS</i>  | An indicator of loss;  |
| <i>AGE</i>   | Firm's age, approximated by the number of years listed on London Stock Exchange; and |
| <i>RAISE</i> | An indicator of equity issue.  |

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## Appendix B. Major Amendments of the Corporate Governance Code

| The Combined Code on Corporate Governance 2008   | The U.K. Corporate Governance Code 2010   |
|--|---|
|  | New provision B.6.2   |
| -  | <b>Evaluation of the board of FTSE 350 companies should be externally facilitated at least every three years. A statement should be made available on whether an external facilitator has any other connection with the company.</b>  |
|  | Provision A.7.1 → Provision B.7.1   |
| All directors should be subject to election by shareholders at the first annual general meeting after their appointment, and to re-election thereafter at intervals of no more than three years. The names of directors submitted for election or re-election should be accompanied by sufficient biographical details and any other relevant information to enable shareholders to take an informed decision on their election. | <b>All directors of FTSE 350 companies should be subject to annual election by shareholders.</b> All other directors should be subject to election by shareholders at the first annual general meeting after their appointment, and to re-election thereafter at intervals of no more than three years. <b>Nonexecutive directors who have served longer than nine years should be subject to annual re-election.</b> The names of directors submitted for election or re-election should be accompanied by sufficient biographical details and any other relevant information to enable shareholders to take an informed decision on their election. |
|  | New Provision C.1.2   |
| -  | <b>The directors should include in the annual report an explanation of the basis on which the company generates or preserves value over the longer term (the business model) and the strategy for delivering the objectives of the company.</b>   |

## Appendix C. Example of Performance Measure Collection

### Annual report

|  |                            |                         |               |                      |
|--|----------------------------|-------------------------|---------------|----------------------|
| <b>Highlights</b>  |                            |                         |               |                      |
| <u>Revenue</u>   | <u>New product revenue</u> | <u>Operating profit</u> | <u>Stores</u> | <u>Selling space</u> |
| £3,802.8m  | £88.3m                     | £38.7m                  | 42            | 41,000 sqm           |
| ...  |                            |                         |               |                      |
| <b>Financial summary</b>   |                            |                         |               |                      |
| <ul style="list-style-type: none"> <li>• Group <u>revenue</u> of £3,802.8 million (2012: £3,896.7 million), down 2.5 per cent in constant currency and 1.1 per cent on a like-for-like basis.</li> <li>• <u>EBITDA</u> of £103.8 million (2012: £176.6 million) and <u>operating profit</u> of £38.7 million (2012: £89.8 million).</li> <li>• Adjusted Group <u>profit before tax</u> of £26.4 million (2012: £78.7 million).</li> <li>• Adjusted <u>earnings per share</u> of 2.5p (2012: 10.0p). Basic losses per share of 13.8p (2012: earnings per share of 3.4p).</li> </ul>   |                            |                         |               |                      |
| ...  |                            |                         |               |                      |
| <b>Chairman's letter to shareholders</b>   |                            |                         |               |                      |
| <p>We have made significant progress in our priorities, namely to restore shareholder value, renew the Board, review our markets and operations ... <u>Sales per client</u> was £47.5 (2012: £53.7) ... <u>Cash generated from operations</u> was an inflow of £20.0 million (2012: £83.8 million), largely reflecting the lower retail profit. Net <u>capital expenditure</u> was £53.5 million (2012: £99.1 million) ... We continue to plan prudently in what remain challenging market conditions. Nevertheless, we are confident that our new management team will deliver an improvement in earnings over the medium term.</p> |                            |                         |               |                      |
| ...  |                            |                         |               |                      |

### Metric classification

| Traditional Performance Reporting   | Enhanced Performance Reporting                                 |                         |
|---|--|-------------------------|
|   | Financial measure  |                         |
| Traditional financial measure   | Financial ratio / Investments / Granular financial measure     | Non-financial measure   |
| Revenue<br>Operating profit<br>EBITDA<br>Profit before tax<br>Earnings per share<br>Cash generated from operation | Sales per client<br>Capital expenditure<br>New product revenue | Stores<br>Selling space |

$$\text{Metric-based EPR} = \frac{5}{11}$$

**Appendix D. 20 Topics from LDA**

| EPR? | Broad category                | Topic                  | Word list   |
|------|-------------------------------|------------------------|---|
| 0    | Financial                     | Financial Statements   | cash net tax assets interest costs rate capital value debt income loss finance profit total credit balance charge liabilities due   |
|      |                               | Earnings Performance   | profit revenue increased growth sales net increase costs adjusted underlying cash margin total tax earnings revenues strong compared dividend items                                       |
|      |                               | Accounting             | accordance information accounting law responsible statement reasonable prepare position applicable auditors adopted preparing required state fair policies parent legislation concern     |
|      | Governance                    | Internal Control       | internal control board non-executive governance shareholders chairman committee remuneration meetings audit responsible system independent controls procedures auditors matters risk code |
|      |                               | Remuneration           | remuneration shares salary awards bonus options period award plan policy total non-executive scheme committee price value benefits granted subject vesting                                |
|      |                               | Directors              | chairman non-executive chief appointed joined finance experience officer member senior board held president managing previously prior companies worked positions independent              |
|      |                               | Committees             | chairman board governance non-executive meetings independent committee shareholders chief senior meeting committees appointment members evaluation code secretary process strategy role   |
|      |                               | Annual General Meeting | shares ordinary capital meeting general shareholders information issued held interests set details rights resolution dividend employees aware note auditors payment                       |
|      |                               | Audit                  | audit external internal committee auditors risk auditor services reviewed control effectiveness work reporting process non-audit controls reports independence risks considered           |
| 1    | Business Operation & Strategy | Progress               | strong progress period results growth future trading shareholders investment pleased increase increased position chairman strategy opportunities  |
|      |                               | Strategy               | growth strategy strategic markets global focus strong customers value people deliver opportunities customer businesses investment team support service delivering progress                |

|  |  |                                |  |
|--|--|--------------------------------|--|
|  |  | Risk                           | risk risks impact principal ensure future changes activities uncertainties economic potential customers ability products material results place cash subject currency            |
|  |  | Health, Safety and Environment | employees safety environmental health training local people emissions responsibility work environment waste energy community programme employee support social ensure staff      |
|  |  | Production                     | products sales product production customers manufacturing markets demand technology supply energy range global power equipment systems high industrial materials applications    |
|  |  | Contracts                      | services contract contracts service revenue sector project projects support construction clients work division provide major public engineering infrastructure fleet systems     |
|  |  | Marketing                      | sales stores retail brand store customers brands range product customer food total land distribution products value portfolio consumer sites growth                              |
|  |  | IT                             | services customers software products revenue technology online mobile data customer digital service revenues marketing product clients media solutions content network           |
|  |  | Pharmaceutical                 | products product sales clinical research patients pharmaceutical treatment technology healthcare drug medical phase regulatory disease study care manufacturing potential cancer |
|  |  | Mining                         | production gold mining exploration project mine ore coal copper projects resource drilling plant resources grade total area completed price iron                                 |
|  |  | Oil and Gas                    | oil gas production exploration drilling field wells reserves interest licence seismic area potential programme offshore boe resources drilled project block                      |

## Appendix E. Application of LDA

### E.1. Creating Corpus

For the textual analysis, I create a corpus by aggregating the annual reports of all firms listed on the London Stock Exchange in the sample period of 2008 to 2013 to use sufficient data for machine learning and avoid overfitting. The corpus includes 10,573 annual reports from 1,838 unique firms.

Unlike U.S. 10-Ks, U.K. annual reports do not have a standardized reporting template. However, they commonly comprise two broad components: a narrative component (front part of the document) and a statutory component (rear part of the document). The narrative component includes management commentary on periodic performance. Common sections of the narrative component are Chairman's statement, CEO review, Business review, Operating review, Financial review, and Corporate Social Responsibility. The statutory component includes financial statements, footnotes, and corporate governance and remuneration. To analyze management commentary on periodic performance and description of value creation, I extract the narrative part of annual reports using the method of El-Haj et al. (2019), which provides an automatic method to retrieve text from unstructured and glossy annual report.

### E.2. Preprocessing of the extracted text

The extracted text needs to be processed for textual analysis. First, I remove stop words such as function words and pronouns (and, as, it, be, have, do, that, etc) as they provide little information content. I adjust LM-stop word list (Loughran and McDonald 2011) not to delete some keywords related to business model or strategy: *need*, *new*, *novel*, *right*, and *value*. Next, I also exclude numbers, dates, special characters, company names, and personal names as they do not generate a meaningful topic. I also process hyphenated words. I identify all hyphenated words that appear at least once in my corpus (e.g., long-term, full-

time) and create a hyphenated word list. Then, I change non-hyphenated expressions to hyphenated ones (e.g., long term → long-term, full time → full-time). As too frequent and infrequent words are not useful for the identification of topics (Dyer et al. 2017), I delete the most frequent 30 words and the least frequent words that do not occur in at least 100 annual reports. Next, I create a dictionary of unique words and manually check them one by one using collocation analysis to remove invalid words such as encoding errors and typos from my corpus.

### E.3. Implementation of LDA

I use the Mallet software to implement collapsed Gibbs sampling for LDA training. The number of sampling iteration is 1,000, and the parameter alpha (document-topic distribution) and beta (topic-word distribution) are optimized every 10 iterations.

One important choice for LDA is the number of topics. Setting a too low number forces the model to combine distinct themes into one topic, leading to word lists that are semantically incoherent. On the other hand, setting a too high number may lead to too granular topics to interpret. Although prior research that applies LDA in accounting uses perplexity (Huan et al. 2018) to decide the number, the perplexity score approach often leads to less interpretable results (Chang et al. 2009). Instead of perplexity, I use two alternative methods to decide the number of topics. They are word intrusion task (Chang et al. 2009) and coherence score (Newman et al. 2010).

The word intrusion task examines if word lists generated by topic modeling agrees with human judgements. For each topic, I keep top five words and include an intruder word that is less likely to appear in the topic but likely to appear as top 10 words in any of the other topics. The following is an example question.

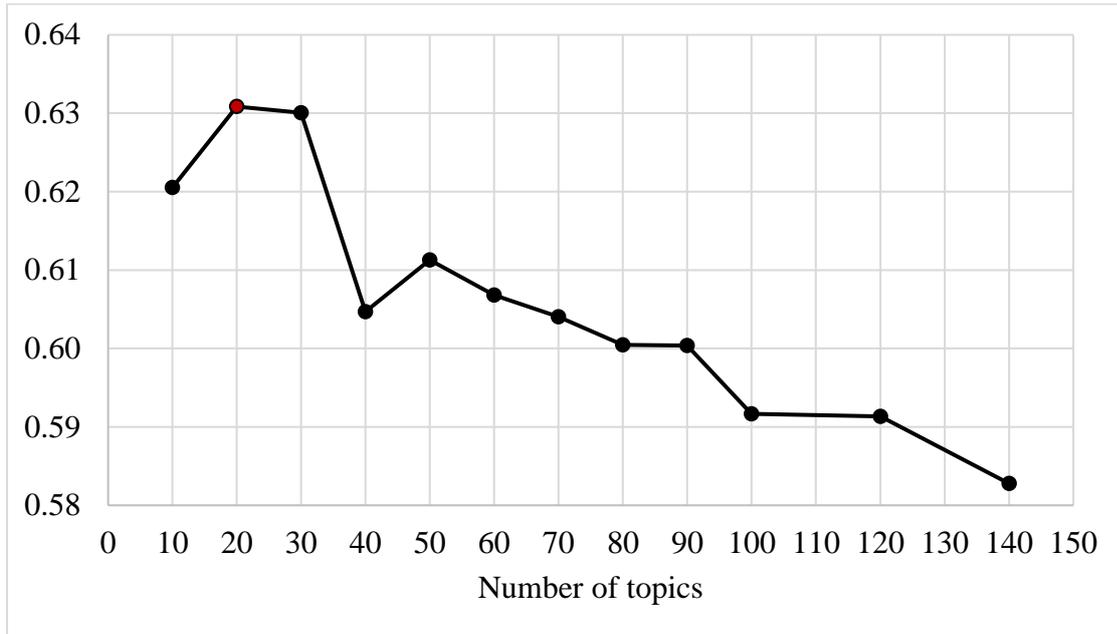
Choose the odd one out: (a) risk (b) rate (c) cash (d) brand (e) interest (f) credit

I ask three independent readers who have expertise in accounting and finance to perform the word intrusion tasks for models with 20, 30, 40, 50 and 60 topics.

| Model      |         | (1)        | (2)          | (3)          | (4)        | (5)        |
|------------|---------|------------|--------------|--------------|------------|------------|
| No. Topics |         | 20         | 30           | 40           | 50         | 60         |
| Accuracy:  | Coder 1 | 90%        | 83.3%        | 92.5%        | 88%        | 81.6%      |
|            | Coder 2 | 95%        | 86.6%        | 90%          | 94%        | 88.3%      |
|            | Coder 3 | 90%        | 86.6%        | 92.5%        | 86%        | 85%        |
|            | Average | <b>92%</b> | <b>85.5%</b> | <b>91.6%</b> | <b>89%</b> | <b>85%</b> |
| Rank:      | Coder 1 | 2          | 4            | 1            | 3          | 5          |
|            | Coder 2 | 1          | 5            | 3            | 2          | 4          |
|            | Coder 3 | 2          | 3            | 1            | 4          | 5          |
|            | Average | <b>1.6</b> | <b>4</b>     | <b>1.6</b>   | <b>3</b>   | <b>4.6</b> |

The above table shows the accuracy of their answers and ranking across five models. Model 20 and 40 are preferred in terms of average rank, and model 20 is marginally more preferred in terms of accuracy score.

I also test coherence score that evaluates the semantic relationship among topic words by testing the cooccurrence of word pairs in external corpora such as New York Times, Wikipedia, and Medline journals. I specifically use  $C_v$  metric, which has the strongest correlation with human ratings (Roder et al. 2015). The score range is zero to one, and higher score means higher quality.



As shown in the above figure, coherence score is maximized at 20 topics. Based on the results of coherence score test and word intrusion task, I choose 20 topics for the main analysis. For robustness check, I also use 40 and 60 topics to create alternative measures of *TopicEPR*. Untabulated results are robust to topic based EPR measures using 40 and 60 topics.

## Appendix F. DiD estimates ranking by topic

The following table shows the ranking of the treatment effects of the reporting mandate on individual topics. The estimates are the results of the regression:  $Topic_{it} = \beta_0 + \beta_1 POSTMAIN_{it} + \gamma'X_{it} + \alpha_i + \alpha_t + \varepsilon_{it}$ . *POSTMAIN* is an interaction between an indicator for post-treatment period (*POST*) and an indicator of treatment group (*MAIN*). All regressions include the following control variables: *SIZE*, *LEV*, *CASH*, *LOSS*, *Q*, *AGE*, and *RAISE*. Z-statistics are provided and calculated based on robust standard error clustered at the firm level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively.

| ranking | topic                          | $\beta_1$  | Z-value |
|---------|--------------------------------|------------|---------|
| 1       | Strategy                       | 0.0246***  | 3.754   |
| 2       | Health, Safety and Environment | 0.0145**   | 2.041   |
| 3       | Committees                     | 0.00248**  | 2.027   |
| 4       | Production                     | 0.0106*    | 1.81    |
| 5       | Marketing                      | 0.00823*   | 1.655   |
| 6       | Pharmaceutical                 | 0.00664    | 1.573   |
| 7       | Oil & Gas                      | 0.00408    | 1.057   |
| 8       | Audit                          | 0.000854   | 0.935   |
| 9       | Progress                       | 0.00740    | 0.753   |
| 10      | Internal control               | 0.00109    | 0.726   |
| 11      | Contracts                      | 0.00216    | 0.522   |
| 12      | Accounting                     | -0.0000638 | -0.117  |
| 13      | Mining                         | -0.00387   | -0.459  |
| 14      | Remuneration                   | -0.000530  | -0.493  |
| 15      | Earnings performance           | -0.00462   | -0.643  |
| 16      | IT                             | -0.00988   | -1.615  |
| 17      | Directors                      | -0.00343*  | -1.899  |
| 18      | Annual General Meeting         | -0.00637** | -2.559  |
| 19      | Risk                           | -0.0180*** | -3.314  |
| 20      | Financial Statements           | -0.0302*** | -3.535  |