An investigation into SEC efforts to reduce processing costs: Evidence from the hyperlink mandate

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Abstract

Over the past three decades, the SEC has required firms adopt various technologies to improve the "usability" of financial filings (e.g., EDGAR, XBRL). We examine the SEC's 2017 hyperlink mandate to evaluate the effectiveness of one such initiative in the context the Blankespoor et al. (2020) processing cost framework. While the SEC expects links to external exhibits to reduce acquisition costs, research in other fields indicates the links may simultaneously increase integration costs by increasing cognitive load. We find little evidence that the mandate affects the market response to 10-Ks, on average. However, post-mandate we observe muted market responses when investors are more constrained and stronger market responses when investors benefit most from acquiring additional information. Our evidence is consistent with integration costs offsetting acquisition benefits on average and each effect dominating in different circumstances. These findings have implications for regulators as they evaluate future technologies and suggest consideration of different processing cost effects may be warranted.

Keywords: Disclosure processing costs; hyperlinks; SEC regulation; acquisition costs; integration costs

JEL Classifications: G10; G14; M40; M41

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1. Introduction

Over the past three decades, the Securities and Exchange Commission (SEC) has consistently prioritized initiatives focused on reducing investor processing costs. Examples of these efforts include establishing the Electronic Data Gathering, Analysis, and Retrieval system (EDGAR), which improves the accessibility of SEC filings (SEC 1994); the *Plain English Handbook* that guides firms in improving the readability of financial disclosures (SEC 1998); and the XBRL mandates that require tagging financial information to enhance comparability (SEC 2009; SEC 2018). We build on prior research in this area by evaluating the effectiveness of one such regulation in the context of the Blankespoor et al. (2020) processing cost framework. Specifically, we provide insight into the implications of the SEC's 2017 hyperlink mandate for different types of processing costs, both on average and in different circumstances.

In 2017, the SEC began requiring firms provide hyperlinks to external documents referenced in exhibits to 10-Ks, 10-Qs, 8-Ks, and S-1s. This mandate offers a unique setting for demonstrating how the SEC's initiatives can differentially influence the various types of processing costs. Investors face processing costs in becoming aware of, acquiring, and integrating new information into their decisions (Blankespoor et al. 2020). The SEC states they expect the hyperlink mandate to reduce processing costs by helping users access referenced documents more efficiently (SEC 2017). This sentiment is supported by practitioners' comment letters, which are largely supportive of the rule.[1] If links decrease investors' acquisition costs, we should observe stronger market reactions to SEC filings after the mandate.

However, theories in other fields suggest this rule may also increase investors' integration

[1] The SEC's final rule states that hyperlinks "will help investors and other users to access a particular exhibit more efficiently" and notes the expectation that hyperlinks will be "beneficial in reducing search costs" (SEC 2017). We provide example comment letters in Appendix A.

costs. For example, computer science and psychology theories suggest including hyperlinks in SEC filings may increase integration costs by increasing the user's cognitive load (e.g., DeStefano and LeFevre 2007). When documents contain hyperlinks, users expend cognitive resources to quickly switch back and forth between documents and topics, reducing mental capacity available to form conclusions (e.g., Boechler 2001; Conklin 1987). Moreover, if acquisition benefits increase the number of documents accessed, studies in economics suggest the user's capacity to integrate information may be indirectly diminished due to information overload (e.g., Tversky and Kahneman 1974; Hirshleifer and Teoh 2003). To the extent findings from other fields generalize to our setting, increases in integration costs may offset acquisition benefits and diminish market responses to SEC filings after the mandate.

Regardless of whether acquisition benefits or integration costs dominate on average, disclosure theories predict each processing cost effect will prevail in different circumstances. First, because investors processing financial information solve the optimization problem of allocating scarce time and processing capacity across firm disclosures (e.g., Sims 2003; Hirshliefer et al. 2011; Blankespoor et al. 2020), we expect busier days and more complex filings to impose greater constraints on investors. While the effect of investor constraints on acquisition benefits is unclear, we predict constrained investors will face higher integration costs borne from a greater cognitive load from any external documents viewed.[2] Thus, we expect to observe muted market responses to SEC filings in the presence of investor constraints after the mandate.

Second, research indicates investors of firms with weak information environments benefit from acquiring additional information (e.g., Verrecchia 1982; Diamond and Verrecchia 1991; Frankel

[2] On one hand, acquisition benefits may be reduced as constrained investors have less capacity to acquire additional information relative to unconstrained investors. On the other hand, acquisition benefits may remain the same if costs to clicking on a link are sufficiently low such that constraints do not affect the propensity to click.

and Li 2004). Although the integration cost effect is ambiguous, we predict the mandate's acquisition benefits will be greater for investors of firms with weak information environments.[3] Thus, we expect to observe stronger market responses to these firms' filings in the post-period.

Finally, it is also possible links do not impact investors. Users may choose not to navigate away from the focal document, regardless of whether links are provided. Alternatively, users may ignore navigational features because they can efficiently access the underlying content without links. For these reasons, whether (and how) links affect investor processing costs and ultimately market responses is an open question.

We rely on 10-Ks to examine our research question, as they offer a strong setting for detecting any effects the link mandate may have on processing costs. 10-Ks are long and have grown longer over time (Dyer et al. 2017) and include substantial narrative disclosure, likely imposing integration costs on users (e.g., Arif et al. 2019). While new information in 10-Ks may be limited on average, research suggests the filings can complete the "mosaic" of information available to investors (SEC 2000) and contain value relevant information in certain circumstances.[4] Finally, 10-Ks generally include an extensive list of references to documents outside the filing, most often as part of the exhibit index in Item 15. Our sample includes Compustat firms with key variables and parseable 10-K text files on EDGAR from 2016 to 2019.

We begin by providing evidence that (1) firms incorporate links as required by the mandate and (2) users click on the links. First, we show a significant increase in the number of links post-mandate, with a median increase of 41 links per 10-K (untabulated). Second, we provide evidence

[3] On one hand, greater acquisition of information may lead to increased integration costs from information overload. On the other hand, one might expect lower integration costs for firms with weak information environments as there are fewer signals to combine and weigh in rendering investment decisions.

[4] See, for example, Li and Ramesh (2009) and You and Zhang (2009). Further, empirical evidence also suggests stale information can be relevant to the market (e.g., Tetlock 2011).

of a sharp increase in linked document views surrounding the 10-K filing: views of linked external documents almost double from two days before the 10-K is released to the day of release, consistent with users clicking on the links provided post-mandate.

We next examine our research question: how does the link mandate influence investor processing costs? We rely on three indirect market measures to proxy for investor processing costs: absolute cumulative abnormal returns, abnormal liquidity, and abnormal retail volume. While the returns and liquidity measures capture the overall market response to 10-Ks, retail volume is more likely to capture human trading activity. Our regressions include firm fixed effects, a control for the 10-K Item 15 length, and controls for firm, document, and information event characteristics.

We find little evidence that the mandate is associated with changes in market measures on average. However, there are several plausible reasons for the non-result. First, users may choose not to access the linked documents or may access the documents efficiently through alternative channels. Second, as we develop our findings from a human processing cost framework, it is possible the relevant trading activity may not be sufficient to detect the mandate's effects on processing costs. Finally, any acquisition benefits investors experience may be offset by an increase in integration costs.

Therefore, we next examine cross-sectional variation in 10-K market responses to provide further insights into the processing cost implications of the mandate. First, we observe weaker market responses to 10-Ks in the post-period when investors are constrained (i.e., on busier days and when filings are complex), consistent with the mandate increasing net processing costs in some circumstances. Second, we observe stronger market responses to 10-Ks in the post-period (using two of three measures) when firms have weaker information environments. This evidence suggests investors experience net acquisition benefits when acquiring additional information is most

helpful, consistent with the rule reducing net processing costs as anticipated by the SEC in other circumstances.[5]

The cross-sectional analyses provide important insights into the limited significance observed in the initial on-average tests. If we observe no relation between links and processing costs because investors ignore the 10-K's links or because our measures are unable to detect human processing cost effects, we would not expect to observe the predicted variation we document in our cross-sectional tests. In contrast, our evidence is consistent with offsetting processing cost effects underlying the insignificant results, and the mandate's effectiveness at improving usability varying with investor constraints and firms' information environments.

Finally, we perform several additional analyses to corroborate our findings. First, we show the results are robust to including calendar year fixed effects, which allows us to exploit the staggered adoption arising from variation in fiscal year ends. Second, we examine two additional market measures. Specifically, we observe slower (faster) price adjustments for firms filing on busy days (with weak information environments) in the post-period. We also expand the retail volume measure to include total volume and find consistent results using the broader measure. Third, we perform a falsification test using 10-Q filings, which were affected by the rule but include fewer links than 10-Ks include. External documents referenced in 10-Q exhibits are also less likely to be informative: the most common documents linked in 10-Qs are CEO and CFO certifications, as compared to material contracts in 10-Ks. We observe a significant coefficient in the predicted direction in only one of nine specifications in the 10-Q setting, which is inconsistent with contemporaneous events or macroeconomic trends underlying the variation we document in our main tests. Collectively, these additional analyses support our conclusion that the SEC's efforts to

[5] We observe that the proxies for complex documents and weak information environments have a Pearson correlation coefficient of -0.12 (untabulated), suggesting they capture different constructs.

reduce processing costs can have different processing cost effects in different circumstances.

This study has important implications for both regulators and academic research. First, our findings should inform the SEC, as they "continue to consider the expanded use of hyperlinks in Commission filings" and consider mandating other technologies (SEC 2017, page 17; SEC 2019; SEC 2020). Although we find little evidence of an overall reduction in net investor processing costs on average, our cross-sectional evidence suggests that links help investors in some circumstances (i.e., those following firms with weak information environments) but hinder investors in others (i.e., those facing high processing constraints). While our findings provide regulators with insights into the nuanced effects and potential unintended consequences of including links in financial filings, they also have implications for future "usability" initiatives. Specifically, as the SEC continues to prioritize improving usability, our evidence suggests careful consideration of various types of processing cost effects is warranted and that regulations enacted to reduce investor processing costs may not be optimal for all investors.

Second, we contribute to the disclosure processing literature, which often speaks in generalities and bundles processing costs together (Blankespoor et al. 2020). Blankespoor et al. (2020) calls for future research to consider the "differing or interactive effects across cost type," notes how new technologies are changing processing costs, and raises the importance of evaluating the effects of various technologies on different user groups. Our study examines processing costs in a setting that addresses each of these issues. We identify one technological feature that appears to differentially affect two types of processing costs. Moreover, our evidence that processing cost effects vary with firm and filing characteristics indicates that technologies can have different effects on different users.

2. Motivation and Predictions

2.1 Regulatory usability initiatives

In recent decades, regulators have focused on improving the "usability" of financial documents. For example, in 1998, the SEC published the *Plain English Handbook* (SEC 1998), which is an 83-page document dedicated to helping firms clearly write financial documents in language that can be easily understood by users. The SEC followed this handbook with an interpretation of the MD&A guidance, to assist companies "in preparing MD&A disclosure that is easier to follow and understand" (SEC 2003).

As firms transitioned to filing electronic documents, the SEC's focus shifted to usability in a more technical sense – e.g., improving users' ability to access and process information in electronic documents. For example, in 1994, the SEC mandated electronic submission of public filings using the Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system (SEC 1994). The SEC has continued to focus on standardizing machine-readable financial data for users, with the initial eXtensible Business Reporting Language ("XBRL") rule that was followed by the updated Inline eXtensible Business Reporting Language ("iXBRL") rule (SEC 2009; 2018). Along similar lines, the SEC's 2017 hyperlink mandate required firms to prepare SEC filings in HTML format and to provide links to external exhibits referenced in 10-Ks, 10-Qs, 8-Ks, and S-1s (SEC 2017).[6]

2.2 Cognitive load/mental processing literature

There is an extensive literature spanning the psychology and computer science fields that examines whether hyperlinks effectively improve information processing. This literature generally focuses on the concept of cognitive load (or mental processing) and defines three dimensions:

[6] We discuss this mandate further in section 3. Importantly, most firms were already using HTML in their filings at the time of the mandate, reducing concerns of confounding effects. Of the 8,414 filings between 10/1/2015 – 9/30/2016, only 65 (0.8%) were not already using HTML (SEC 2017).

mental load, mental effort, and performance (DeStefano and LeFevre 2007). The studies examining hyperlinks focus primarily on mental load and performance outcomes.

There are two paths through which hyperlinks can increase readers' mental load. First, hyperlinks can directly increase mental load by requiring the reader to make a decision (i.e., whether to click). Second, hyperlinks can indirectly increase the reader's mental load by moving the reader to a less related text, which can impair the user's ability to integrate information (DeStefano and LeFevre 2007). With respect to performance outcomes, research indicates that hyperlinks can impose greater demands on short-term memory, disorient the reader and interfere with existing knowledge (e.g., Foss 1989; Nielsen 1990; Charney 1994; Kim and Hirtle 1995; Miall and Dobson 2001). As noted in McDonald and Stevensen (1996), "the results of studies, with [a single exception], demonstrate that hypertext users are generally slower at answering questions and are less accurate" compared to those viewing the same materials in a linear paper or online document.

2.3 Hyperlinks and processing costs: Predictions

Blankespoor et al. (2020) describes three types of costs users can incur when processing financial documents – collectively referred to as "disclosure processing costs." These include the costs of becoming aware of the new disclosure or information (awareness), obtaining the information (acquisition), and processing and analyzing the information (integration). Regulators and practitioners expect links to improve the efficiency with which users can access financial documents (i.e., reduce acquisition costs, see section 2.1) while prior research suggests links could hinder readers' ability to process and comprehend information (i.e., increase integration costs, see section 2.2).[7]

[7] As defined in Blankespoor et al (2020), "awareness costs are the costs necessary to improve one's probably of knowing that a particular disclosure exists" (p. 5). Given the exhibits were required by the SEC before the link mandate, we do not expect the links

Prior studies assessing the effectiveness of the SEC's "usability" guidance have largely examined the net processing benefits of these initiatives. Examples of this research include studies examining EDGAR adoption (e.g., Qi et al. 2000; Asthana and Balsam 2001; Asthana et al. 2004; and Gao and Huang 2020) and the XBRL and iXBRL mandates (e.g., Blankespoor et al. 2014; Dong et al. 2016; Bhattacharya et al. 2018; and Luo et al. 2023). While these studies generally document that investors benefit from these initiatives, several evaluate whether the net benefits differ across investors. For example, studies document differential effects based on trade size (e.g., Asthana et al. 2004 and Blankespoor et al. 2014), institution size (e.g., Bhattacharya et al. 2018), and characteristics of the investment (e.g., Dong et al. 2016).

Rogers et al. (2017) provide another example of research examining processing effects across different investors. Specifically, this study examines the SEC's decision to provide filings via the Public Dissemination Service (PDS) feed alongside public posting on the EDGAR website. While the PDS feed was intended to improve awareness and acquisition costs, Rogers et al. (2017) shows the implementation of the PDS feed provided a timing (and trading) advantage to the PDS subscribers at the expense of other traders.

We diverge from these studies and examine a setting in which an SEC rule intended to improve usability potentially affects two types of processing costs in opposite directions, plausibly leading to unintended consequences for investors in some circumstances. Prior to the inclusion of links in SEC filings, readers trying to acquire external documents referenced in SEC filings had to manually search for and download the documents in the EDGAR repository or perform other

to materially alter awareness costs. However, if the change in exhibit formatting (e.g., linked text appearing blue and underlined in many browsers) enhances the likelihood that a user notices an exhibit, it is possible that the links could also reduce awareness costs. Given the small expected economic magnitude of this effect, we do not separately consider awareness costs.

manual searches to incorporate the exhibit's information into their investing decisions.[8] By embedding a link in the SEC filing, readers can instantly connect to the referenced document with a single click, thereby reducing the time and effort required to acquire the information.

In contrast, studies in psychology and computer science suggest including links can increase overall processing costs by increasing integration costs. For example, links may increase mental load imposed on readers by forcing them to make a choice (navigate away or not) and moving them to unrelated text, both of which have been shown to decrease comprehension and performance. Moreover, processing additional disclosures can result in information overload, and lead investors to overlook relevant information or sub-optimally apply short-cuts and heuristics (e.g., Hirshleifer and Teoh 2003; Tversky and Kahneman 1974), further increasing processing costs. For these reasons, an increase in the costs of integrating the information contained in the underlying documents may offset any acquisition benefits afforded by the links.[9]

If the reduction in acquisition costs exceeds any increase in integration costs, the link mandate should reduce net processing costs for investors. Alternatively, if the increase in integration costs dominates on average, links should increase net processing costs for investors. As we do not have an ex ante prediction for the relative acquisition and integration effects for the average firm, we state our hypothesis in null form:

H1: Links to external documents have no effect on net processing costs, on average.

We may not observe an association between investor processing costs and link use for two key

[8] We infer the linked information is expected to be relevant to users both because the SEC initially mandated firms reference the source documents as exhibits and then subsequently mandated the links. This sentiment is also supported by the comment letters the SEC received from practitioners regarding the mandate (see Appendix A).

[9] The expected increase in integration costs is a key difference between the link mandate and XBRL settings. Both mandates are expected to reduce acquisition costs (e.g., SEC 2017; Chen and Zhou 2019). However, while integration costs are expected to increase with the link mandate, any integration cost effects are likely to be in the opposite direction for XBRL, as the mandates standardized machine-readable information across firms reducing the cost of incorporating the information into decisions (e.g., Dong et al. 2016).

reasons. First, if an increase in integration costs offsets any decrease in acquisition costs, links may not change net processing costs for investors. Second, investors may have alternative ways to access linked disclosures and not rely on links. Ultimately, whether we will observe a response to external links is an open question.

Regardless of whether we observe an on-average effect, disclosure theories predict links will have different processing cost effects in certain circumstances. The first condition we examine is based on processing constraint theories (Sims 2003; Hirshleifer et al. 2011) and the notion that processing disclosures is an "optimization problem in which investors allocate scarce processing resources across multiple disclosures" (Blankespoor et al. 2020).

We do not have a clear prediction for whether the acquisition benefits of links differ for constrained investors. On one hand, constrained investors may be less aware of and less likely to acquire external disclosures, such that any benefits from expediting the acquisition process are reduced. On the other hand, because little time and effort is required to actually click on a link, it is possible that constraints will not alter the acquisition benefits.

Nonetheless, we do have a directional prediction for constrained investors' integration costs. For any linked documents viewed, costs arising from a greater cognitive load or information overload should be magnified for more constrained (versus less constrained) investors, as they have less processing capacity ex ante. Given the ambiguous acquisition benefit effect, we expect the integration costs to dominate and constrained investors to experience greater processing costs than unconstrained investors in the presence of links.

H2: Investor processing constraints increase the net processing costs associated with links to external documents.

The second condition we examine is based on theory and empirical research that shows investors are more likely to acquire additional information for firms with weaker information

environments as there is a greater opportunity to earn abnormal returns (e.g., Verrecchia 1982; Diamond and Verrecchia 1991; Luo et al. 2023). Specifically, we expect investors in firms with weaker information environments to be more likely to seek linked information and any acquisition benefits to be magnified for these investors.

There is no clear ex ante prediction for the effect of the additional links on integration costs for investors in firms with weak information environments. On one hand, greater information acquisition may lead to increased integration costs from information overload. On the other hand, investors in weak information environment firms may experience lower integration costs as there are fewer signals to combine in rendering investment decisions. Given the ambiguous integration cost effect, we expect the acquisition benefits to dominate and investors of firms with weak information environments to experience net processing benefits in the presence of links.

H3: Weaker information environments decrease the net processing costs associated with links to external documents.

3. Setting and Measurement

3.1 Setting and sample selection

3.1.1 SEC link mandate

In 2017, the SEC issued a rule requiring firms to prepare SEC filings in HTML format and to provide links to external documents referenced in exhibits to 10-Ks, 10-Qs, 8-Ks, and S-1s (SEC 2017).[10] Links are required for exhibits filed under Item 601 that reference documents outside the focal filing. The mandate requires firms to provide links to external documents listed in any exhibit

[10] The HTML requirement was included to facilitate the use of links. However, the SEC notes that more than 99% of firms were using HTML in their filings at the time of the mandate (SEC 2017).

index for filings issued on or after September 1, 2017.[11,12] The link mandate provides a unique setting for gaining insight into how the SEC's initiatives can influence different types of processing costs. While the SEC stated their motivation for the mandate was to "facilitate easier access" to source documents, theories in other fields suggest this rule may increase investor processing costs (see section 2).

3.1.2 10-K Setting

While the mandate applies to any public filing with an exhibit index (including 10-Ks, 10-Qs, 8-Ks and S-1s), we argue the 10-K is the strongest setting for testing our research question for several reasons. First, the 10-K is an important and comprehensive mandatory financial filing. Thus, better understanding whether and how users rely on the 10-K is inherently important. Further, the 10-K is long and getting longer (e.g., Dyer et al. 2017) and contains substantial narrative text, raising concerns about the cost of processing 10-K disclosures. In addition, the average 10-K references a non-trivial number of external documents, increasing our ability to detect any processing cost effects that might exist.[13]

There are also costs to relying on the 10-K setting. For example, prior research indicates that the information extracted from 10-Ks is generally limited, either because the information is stale by the time it is released or because the excessive length of the document results in information overload for readers (Arif et al. 2019; Lev 2018; Li and Ramesh 2009). There is also cross-sectional variation in the information firms provide concurrently with the 10-K. For example, firms

[11] Firms can only provide hyperlinks to documents contained in the EDGAR database. EDGAR will not accept a filing if it has hyperlinks to non-EDGAR sources (e.g., a firm's website link, see SEC 2017, p.17) due to concerns about inactive links.

[12] Although SEC filings often include both "internal links" (i.e., links to other locations within the same filing) and external links (links to documents outside the filing), the mandate only applies to external links. As such, internal links are outside the scope of our study.

[13] We plot the average number of external links by year in Figure 1 Panel A. Consistent with our expectations (and a meaningful treatment effect in 10-K filings), we observe that links are near zero in the pre-period, and increase substantially in the post-period. We discuss this evidence further in section 3.2.

increasingly release earnings and host conference calls in conjunction with issuing the 10-K (see Arif et al. 2019).[14]

While the 10-K may contain limited "news," research suggests the filings are value relevant and associated with market responses in certain circumstances (Li and Ramesh 2009; You and Zhang 2009). Further, even disclosures that are not new or material on their own can still help a reader complete the "mosaic" of information and put other information in context (SEC 2000). Relatedly, empirical evidence also suggests stale information can be relevant to the market (e.g., Tetlock 2011), suggesting that the 10-K is plausibly useful to investors even if much of the information contained within has been previously released.

Moreover, the information that became more accessible post-mandate is different from the information that became more accessible with previous "usability" regulations (e.g., EDGAR or XBRL).[15] Information linked in the exhibits generally covers a different context or topic than the focal document and often relates to prior events rather than current financial performance. In addition, the links generally reference documents already in the public domain when the 10-K is filed. Finally, the external exhibits are generally presented in Item 15: "Exhibits, Financial Statement Schedules" which can be found at the end of the 10-K filing. We provide examples of Item 15 before and after the mandate in Appendix B.

We infer the SEC believes the linked information is relevant to users, because the SEC mandates firms reference the documents in the 10-K and, more recently, link the references to the

[14] We do not find any evidence that our results are concentrated in either the firm-years in which the earnings release is bundled with the 10-K or the firm-years in which it is not (untabulated), suggesting the variation in earnings release timing is unlikely underlying our main inferences.

[15] The most closely related setting is XBRL. As our post-period ends with calendar year 2019 and iXBRL adoption began for fiscal years ending on or after June 15, 2019, there is limited overlap in our study. Moreover, a key difference is that the links ask more of the reader than iXBRL tags. While tags allow a reader to quickly access information directly related to the underlined data, links require the reader to decide whether to click on the link and switch to a different document and context. Because the information provided in linked documents is less directly related to firms' current financial disclosures, it may exacerbate cognitive and information overload.

source documents. A review of comment letters submitted in response to the proposed rule suggests that various stakeholders also view the information in the exhibits to be important. We provide excerpts from these comment letters in Appendix A.

3.1.3 Sample selection

We begin with the universe of firms with Compustat data in the two calendar years before and after the SEC's link mandate (N=46,846, see Table 1 Panel A). This approach minimizes confounding events (including overlap with the iXBRL mandate) while still ensuring we have sufficient power to detect any processing cost effects present in our data. We exclude firm-years with missing or negative assets or sales and require CRSP data for calculating our market measures (N=23,964). After requiring a parseable 10-K for each firm-year and sufficient data to calculate key control variables, we have a final sample of 13,073 firm-years.

3.2 Measurement: Links

3.2.1 Content of linked documents

We provide descriptive evidence of the linked documents' contents in Table 2. The 10-Ks include a mean of 67 total links, of which 12% are linked to contemporaneously released documents listed on the landing page.[16] 22% of linked documents were released in the ninety days preceding the 10-K (including landing page exhibits), 34% were initially issued within the prior year, and 73% were issued within the last five years. Moreover, 22% of linked documents are categorized as a material contract by the SEC.[17] Firms also link to a wide variety of SEC filings,

[16] All linked exhibits in Item 15 are either in the EDGAR database from prior public filings or are new and attached to the current 10-K as exhibits. The new exhibits attached to the current filing can be accessed on the "landing page" of the current 10-K as additional "Document Format Files" (as described in Reg S-K, rule 601). We note that the landing page itself has not changed from the pre- to the post-period. The only change between the pre and post periods with respect to the exhibits (both those already in the EDGAR database and those that are newly posted on the landing page) is the requirement to link the exhibit references in the filings to the underlying source documents.

[17] We identify material contracts using exhibit numbers from the landing page (EX 10) and item numbers from linked 8-Ks (Item 1.01).

with 32% of the links connecting to previously issued 8-Ks (or related attachment), while 16%, 14% and 8% linked to prior 10-Qs, 10-Ks, and S-1s, respectively.

We supplement the descriptive evidence in Table 2 with a manual content evaluation of 25 randomly sampled post-period 10-Ks (untabulated). In our hand collected sample, we observe an average (median) of 49 (38) external links with an upper bound of 192. With respect to content, the largest link categories are material documents and contracts covering compensation and employment (28% of links, found in 21/25 10-Ks), debt (22% of links, found in 19/25 10-Ks), and other industry and firm specific agreements such as business combinations, purchases, intercompany activities, R&D agreements, etc. (29% of links, found in 23/25 10-Ks). In smaller quantities are links to documents such as CEO and CFO certifications (9% of links), articles of incorporation (4% of links), and by-laws and other firm regulations (3% of links).

Finally, as evident in Table 2, the linked documents range from newly issued (i.e., their first public appearance is on the landing page for the current 10-K) to those that were first publicly available over five years prior to the 10-K filing. We plot the average number of clicks on a given exhibit in the 21 days around the 10-K by the length of time the linked document has been in the public domain in Figure 2, providing evidence that document views do not vary systematically with the length of time the linked document has been available. This evidence is consistent with both the SEC's conjecture that the information linked in the exhibits is likely to be important to users (regardless of document age) and that even disclosures that are not new can still help a reader complete the "mosaic" of information and put other information in context.

3.2.2 Link measure

Our measure of link use is *Adopt_Links,* which is equal to one for 10-Ks filed after the link

mandate went into effect and zero otherwise (all variables are defined in Appendix C).[18] Table 1 Panel B suggests we have a balanced sample, with 6,772 (or 51.8%) of our firm-years occurring in the post-period. We also tabulate our control variables pre- and post-mandate. Although some firm characteristics exhibit significant differences (e.g., firms are slightly larger and 10-Ks are more readable in the post-period) these differences are not economically large. Nonetheless, we control for these characteristics throughout the analyses.[19]

We next validate that *Adopt_Links* captures a significant increase in external links in 10-Ks and that the linked source documents are viewed by readers. First, Figure 1 Panel A and Table 3 Panel A show visually and statistically that firms generally complied with the mandate and included substantially more links in the post-period. Specifically, Table 3 Panel A column 4 indicates that there was an increase of approximately 45 links for the average firm, after including fixed effects and controlling for Item 15 length. Importantly, this increase does not appear to result from an increase in the number of exhibits in the post-period, as the difference in the average length of the exhibit index in the year before the mandate is not statistically different from the average length of the index in the year after the mandate (untabulated).

Second, Figure 3 and Table 3 Panel B provide evidence from EDGAR log files that users click on the exhibit links to view the linked documents. In Figure 3, we present the average number of clicks on links to filings in the EDGAR database (i.e., non-landing page filings) surrounding the

[18] We expect the effects of hyperlinks will be most evident when examining the extensive margin (i.e., "turning links on") as opposed to the intensive margin (i.e., adding one additional link). Moreover, this variable is more likely to capture exogenous variation in link use than a continuous measure will capture. For example, firm characteristics such as firm size, complexity and information environment are likely correlated with both the number of links in a 10-K as well as market outcomes, leading to correlated omitted variable concerns. For these reasons, we rely on an indictor variable to capture our treatment effect throughout our tests.

[19] Importantly, we fully interact our model (including the control variables) with the *Adopt_Links* indicator throughout our cross-sectional analyses to mitigate concerns that our results manifest from changes in firm characteristics from the pre- to the post-period.

10-K filing date [-10, +10].[20] Consistent with our expectations, Figure 3 shows that previously filed documents linked in a 10-K receive a substantial increase in views, almost doubling from 2 days before the 10-K is released (181 average clicks) to the day of release (319 clicks). In Table 3 Panel B, we tabulate the average clicks across three windows: the pre-10-K window ([-10,-2]), the 10-K window ([-1,1]) and the post 10-K window ([+2, +10]). We document that average clicks per day in the 10-K window are significantly higher than both the preceding and subsequent windows ($p<0.01$), suggesting that the exhibit documents are accessed more frequently when the 10-K is released, consistent with users clicking on the links mandated in the post period.

3.3 Measurement: Processing costs

As noted in Blankespoor et al. (2020), "processing costs […] affect the market's informational efficiency and hence its ability to effectively allocate capital" (p. 8). The study also discusses analytical and empirical motivations for processing costs affecting various market outcomes. To the extent processing costs affect investor perceptions of information asymmetry, this could influence investors' willingness to trade and ultimately, observed market responses to firms' disclosures. We draw inspiration from the discussion in Blankespoor et al. (2020) to construct our market-based proxies for investor processing costs.

3.3.1 Absolute returns

Our first processing cost proxy is the absolute value of abnormal returns around the 10-K filing date, consistent with recent studies examining the processing costs around 10-Ks and 10-Qs (e.g., Yen and Wang, 2015; Arif et al. 2019; Glaze et al. 2023). This measure captures the information

[20] We rely on the 2020-2023 log files to perform these tests. The 2020-2023 log files (available from 5/19/2020 – 6/30/2023) do not contain an IP address or other unique identifier, so we are unable to categorize the data into human versus machine clicks. Moreover, the 2020-2023 log files do not overlap with our sample period. However, they do record clicks after the SEC's 2017 ruling which we view to be sufficient for this validation test. Any clicks on landing page exhibits are combined with clicks on the 10-K itself such that we cannot separately identify them (e.g., Ryans, 2017) and we focus on non-landing page links for the purposes of these analyses accordingly.

processed by investors immediately around the 10-K filing date and facilitates an interpretation of market response independent of the direction of any "news." If increased processing costs reduce investor willingness to trade, we expect a weaker price response to the 10-K (and vice versa).

Our measure of the absolute value of cumulative abnormal returns (*AbsCAR*) is the absolute value of the difference between the firm's three-day cumulative stock return around the 10-K filing date [-1,+1] less the CRSP value-weighted cumulative market return over the same period. For any 10-K filed after 4PM EST, we adjust day zero to be the next trading day. On average, we observe a 4.5 percent *AbsCAR* in our sample window (Table 2 Panel A).

3.3.2 Abnormal liquidity

When processing costs increase, the perceived increase in information asymmetry and corresponding decrease in willingness to trade (i.e., lower volume) suggests that firms' stocks will be less liquid (e.g., Kyle 1989; Fishman and Hagerty 1989).[21] Therefore, our second measure of processing costs is abnormal liquidity. We follow prior research and measure liquidity as negative one times Amihud's abnormal illiquidity measure (Amihud 2002), which is measured as:

$$Abn\_Liq = -1 * \left[\sum_{0}^{1} \frac{|R_t|}{DVol_t/1{,}000{,}000} - \sum_{-50}^{-5} \frac{|R_t|}{DVol_t/1{,}000{,}000}\right] \quad (1)$$

This measure first calculates daily illiquidity as the absolute return divided by the dollar volume in millions, consistent with the notion that when stocks are illiquid, individual trades have a greater impact on price. Using the daily measures, we then calculate the average daily illiquidity on [0, +1] surrounding the 10-K filing date and then subtract the average daily illiquidity from days [-50, -5] to arrive at an "abnormal" measure. We then transform the measure to represent

[21] As discussed in Blankespoor et al. (2020), the predicted negative association between processing costs and liquidity is likely to occur in "mid-range" levels of liquidity. In the extremes (both high and low), the opposite is expected. On average, empirical results cited (using a variety of measures) generally support the negative association.

abnormal *liquidity* by multiplying by negative one and decile ranking the measure, consistent with Guay et al. 2016. Similar to the previously discussed market measures, we adjust day 0 to be the next trading day for any 10-K filed after 4PM EST.

3.3.3 Abnormal retail volume

We develop our predictions from the Blankespoor et al. (2020) processing cost framework, which characterizes the costs faced by human investors actively processing firm disclosures. Importantly, our prior measures capture an on average market response to firms' 10-K filings, which incorporates all activity, including algorithmic trading. Therefore, we supplement the prior measures with a proxy for abnormal retail volume, as we conjecture that retail trade measures are more likely to capture processing cost effects. In addition, analytical research suggests that abnormal volume can capture processing costs, showing that when investors are uncertain about how to respond to firm news, they are hesitant to trade (Holthausen and Verrecchia 1990; Kim and Verrecchia 1991). Consistent with this argument, we expect increases in processing costs to be associated with decreased retail trading volume (and vice versa).[22]

We measure abnormal retail volume (*AbnRetailVol*) as the average daily retail volume over days [0,+1] less the average daily retail volume over days [-50, -5], and then scaled by the standard deviation of retail volume during the control period [-50, -5] (Arif et al. 2019; Bamber et al. 2011). We identify the trades that are more likely to be retail driven following Boehmer et al. (2021). We argue this measure is more likely to capture active human trading than overall market volume, and acknowledge that it is likely a lower bound on actual retail trading activity (Barardehi et al. 2023).

[22] Abnormal volume measures increased trading activity. Some studies suggest this activity is indicative of more informative disclosure leading to more trading, while other studies suggest abnormal volume is indicative of increased disagreement (suggestive of less informative disclosure). In our setting, irrespective of whether the additional clicks result in a convergence or divergence of beliefs, we expect any reduction in processing costs to be associated with more trading, which is the mechanism underlying both arguments. See Bamber et al. (2011) for further discussion.

We use event and benchmark windows consistent with our liquidity proxy. As with the previous market measures, for any 10-K filed after 4PM EST, we adjust day 0 to be the next trading day.

4. Research Design and Results

4.1 Tests of H1: Links and processing costs

We rely on the following model to estimate the on-average relation between links and processing costs:

$$Investor\ Response = \alpha + \beta_1 Adopt\_Links + \sum \delta\ Controls + \gamma_{Firm\ FE} + \varepsilon \qquad (2)$$

We cluster standard errors at the firm-level. *Investor Response* takes the values of *AbsCAR*, *AbnLiq*, or *AbnRetailVol* as defined in section 3.3 and *Adopt_Links* as discussed in section 3.2. If acquisition benefits outweigh increased integration costs, we expect a significantly positive coefficient on *Adopt_Links* (β_1). If the reverse is true, we expect a significantly negative β_1. Finally, we interpret an insignificant β_1 as consistent with links either having offsetting processing cost effects or no effect on market outcomes. One benefit of the mandate is that it introduces plausibly exogenous variation in link use. However, to further mitigate the concern that our results manifest from underlying time-invariant firm or document characteristics correlated with links, we include firm fixed effects throughout our analyses. Finally, we include several variables to control for potential within-firm variation in firm or document characteristics that may be associated with both link use and market responses to 10-Ks.

We include three vectors of controls at the document, firm, and event level, respectively. First, we control for variation in the complexity of the 10-K documents. Specifically, we control for document length (*Ln(Word_Count)*), readability using the Gunning-Fog index (*FOG*), and the proportions of negative and litigious words using Loughran and McDonald (2011) dictionaries (%*Negative_Words* and %*Litigious_Words*, respectively). Second, we control for firm

characteristics including firm size (*MVE*), book-to-market (*BTM*), *Leverage* and *PP&E*, and firm performance with *ROA*, a *Loss* indicator, and earnings surprise (*SUE*).

Finally, we control for various information events that may occur in our treatment period and be associated with market responses to 10-Ks. We include an indicator equal to one if a firm's 10-K is released on the day of or day following the earnings release (Arif et al. 2019; *Bundled*). We also include an indicator if the firm engaged in M&A activity during the year (*M&A*), and if special items are greater than 1% of firm assets (*Large_Sp_Items*). Finally, because the links are often related to debt or compensation contracts, we control for the change in leverage (*Change_Leverage*) and the change in stock-based compensation (*Change_StockComp*).

We construct one final control variable to account for variation in exhibit information across firms and filings that may not be captured by our other controls. Table 1 Panel B indicates 10-Ks have 418 (197) rows of text in the average (median) Item 15 section in our sample (*Item15_Length*), indicating the distribution of this variable is highly skewed, and that there is likely non-trivial noise in the measure.[23] To the extent this is a firm-specific, time-invariant feature, including firm fixed effects should alleviate measurement concerns. Nonetheless, we include this variable to at least partially control for potential changes in Item 15 length over time.

We present the results from estimating equation (2) in Table 4, with *AbsCAR, AbnLiq,* and *AbnRetailVol* results presented in columns 1-2, 3-4 and 5-6 respectively. We first show the results without control variables (columns 1, 3 and 5) and layer on controls (columns 2, 4 and 6). We find no relation between external links and *AbsCAR* and *AbnLiq*. While we observe a significant on-average increase in *AbnRetailVol* in the post-period (column 5), the coefficient is no longer statistically significant when we add controls (column 6).

[23] For example, because Item 15 is generally at the very end of the 10-K, there may be additional (superfluous) rows included in the calculation of *Item15_Length* for some firms.

Overall, Table 4 provides little evidence that linking 10-K exhibits to source documents results in abnormal market responses to the filings, on average. These results are consistent with links either having limited or offsetting effects on investor processing costs. To provide further insight into the implications of links for investors, we next test theoretically motivated cross-sectional predictions around the implications of links for different types of processing costs.

4.2 Tests of H2: Investor processing constraints

4.2.1 Measurement

We predict that investors facing high processing constraints will have increased net processing costs (or reduced net benefits, relative to unconstrained investors) after the link mandate. We proxy for increased investor processing constraints in two ways. First, as investors have fewer resources available to process a given 10-K on busy days (e.g., Hirshleifer et al. 2009; deHaan et al. 2015; Blankespoor et al. 2020), our first investor constraint proxy is the log of additional 10-Ks filed on the same day as the focal firm's 10-K (*Busy_Day*).

We also proxy for investor processing constraints using the complexity of the 10-K filing, as greater document complexity is associated with reduced trading and less consensus, consistent with complex documents taxing investor resources (Miller 2010). We measure document complexity using the first principal component of our four document complexity variables (*Ln(Word_Count), FOG, %Negative_Words* and *%Litigious_Words*). All four variables load positively on the first factor (eigenvalue = 1.82). Our variable of interest is an indicator for if the 10-K is in the top quintile of document complexity (*Complex_Doc*).[24]

[24] Given that *Complex_Doc* is calculated using principal component analysis, its mean is zero by definition, rendering the continuous variable challenging to interpret in a regression. Therefore, we create an indicator variable representing "high complexity" to facilitate interpretation of this measure in these analyses.

4.2.2 Results

To examine whether the relation between links and market outcomes varies with ex ante processing constraints, we estimate the following OLS regression:

$$Investor\ Response = \alpha + \beta_1 Adopt\_Links + \beta_2 Constraint + \beta_3 Adopt\_Links * Constraint + \sum \delta\ Controls + \gamma_{Firm\ FE} + \varepsilon \quad (3)$$

Investor Response and *Adopt_Links* variables are as defined in sections 3.2 and 3.3. *Constraint* is either *Busy_Day* or *Complex_Doc*, as defined in section 4.2.1. The model includes the same control and fixed effects structures and standard error clustering as equation (2). H2 predicts a negative coefficient on the interaction of *Adopt_Links* and *Constraint* (β_3).

We present the results from estimating equation (3) in Table 5. Panel A (B) contains the results using *Busy_Day* (*Complex_Doc*) to proxy for processing constraints. In each Panel, columns 1, 4, and 7 exclude controls; 2, 5 and 8 layer on controls; and 3, 6, and 9 further layer on the interactions of controls with *Adopt_Links*. Consistent with our predictions, firms whose investors face high processing constraints experience a muted market response after the mandate in 17 out of 18 specifications. Interestingly, we also observe a significantly positive link main effect in 11 of 18 specifications (with the remaining seven positive but not significant at conventional levels), providing some evidence that less constrained investors appear to benefit from the link mandate. Collectively, our findings support H2 and are consistent with investor processing constraints altering how links affect processing costs.

4.3 Tests of H3: Firm information environment

4.3.1 Measurement

H3 predicts investors enjoy greater acquisition benefits from the link mandate when the firm's information environment is weaker. We develop our weak information environment proxy using

the first principal component of firm size (*Ln(MVE)*), institutional ownership (the percent of shares outstanding held by institutions), and analyst following (the natural logarithm of one plus the number of unique analysts following the firm). All three variables load positively on the first factor (eigenvalue = 2.19). *Weak_Info* equals one if the firm-year is in the bottom quintile of the continuous information environment measure.

4.3.2 Results

To examine whether the relation between links and market outcomes varies with firm information environments, we estimate the following OLS regression:

$$Investor\ Response = \alpha + \beta_1 Adopt\_Links + \beta_2 Weak\_Info + \beta_3 Adopt\_Links * Weak\_Info + \sum \delta\ Controls + \gamma_{Firm\ FE} + \varepsilon \quad (4)$$

Investor Response, *Adopt_Links*, and *Weak_Info* variables are calculated as defined in sections 3.2, 3.3, and 4.3.1. The regressions include the same controls, fixed effects structures, and standard error clustering as equation (3). H3 predicts β_3 will be positive. We present the results from estimating equation (4) in Table 6. Consistent with our predictions, firms with weak information environments experience stronger post-mandate market responses in 6 out of 9 specifications (*AbsCAR* and *AbnRetailVol*). While we also observe a positive β_3 in the *AbnLiq* tests, the coefficients are not significant at conventional levels. Collectively, we interpret the evidence in Table 6 as consistent with the firm's information environment having implications for the relation between links and processing costs, and suggesting the links are more helpful to investors when there are greater benefits from additional information acquisition.[25]

[25] We acknowledge that our *Weak_Info* variable captures firm characteristics and that firm fixed effects may account for much of the variation in the measure. Therefore, in untabulated analyses, we exclude firm fixed effects or replace firm fixed effects with industry (2-digit SIC) fixed effects and find consistent results.

4.4 Additional analyses

4.4.1 Calendar year fixed effects

While all firms are required to link exhibits in SEC filings after September 1, 2017, there is variation in firm fiscal year ends and, thus, in whether 10-Ks filed in calendar year 2017 occur before or after the mandate. In our next tests, we include calendar-year fixed effects to exploit this variation. By focusing on the variation between 10-Ks filed before and after the mandate within calendar 2017, we are able mitigate concerns that our results arise from macroeconomic events or other regulations such as ASC 606 (which affected public firm revenue recognition for reporting periods after December 15, 2017) or the Tax Cuts and Jobs Act (which made substantial changes to the US tax code effective January 1, 2018).

We present the results from estimating equations (3) and (4) with calendar-year fixed effects in Table 7. We observe the expected coefficients on the interaction terms in seven of nine specifications. Specifically, we observe a significantly negative β_3 in all *Busy_Day* specifications and two of three *Complex_Doc* specifications, and a significantly positive β_3 in two of three *Weak_Info* specifications. This evidence provides further support for H2 and H3 and helps mitigate concerns that macroeconomic trends underly our main results.

4.4.2 Additional dependent variables

We also examine two additional market variables to provide further insight into our primary results. First, while our primary market measures capture an immediate market response, they do not provide evidence as to whether there are differences in later price movement. To provide these insights, our first alternative dependent variable is the fraction of the [0,+63] day post-10-K raw returns realized in the [0,+4] day period after the 10-K, following Lee and Zhu (2022) (*RetFrac*).[26]

[26] Because this measure is inherently noisy (e.g., it is susceptible to issues related to both large and small denominator issues), we decile rank *RetFrac*.

This measure is agnostic to the direction of the news and incorporates the relative magnitude of the immediate return to a longer window return, capturing price responsiveness.

Second, while our measure of volume captures retail trading activity, it is possible that retail and sophisticated investors are differentially affected by the links, and we may not observe an on average volume effect. As such, our second alternative dependent variable is *AbnVol*, measured similarly to *AbnRetailVol*, but using all trades in place of assumed retail trades exclusively.

We re-estimate equations (3) and (4) with the alternative dependent variables and present the results in Table 8. We provide some evidence consistent with H2: β_3 is negative and significant in two of four specifications. However, we provide more consistent evidence in support of H3: β_3 is positive and significant using both dependent variables. Overall, these analyses provide additional insights into our earlier results, providing some evidence that processing cost effects have price implications beyond the immediate market response, and that trade volume (beyond retail) is also associated with link use.

4.4.3 Falsification exercise

We further corroborate our main results by performing a falsification test examining links in 10-Qs. As described in section 3.1.1, the link mandate applies to any firm filing that references external documents as exhibits, including 10-Ks, 10-Qs, S-1s and 8-Ks.

To gain more descriptive insights into the content underlying the 10-Q links relative to that underlying the 10-K links, we randomly select 25 10-Qs from our post-mandate sample and perform an evaluation similar to the exercise performed for 10-Ks described in section 3.2.1. Specifically, the 10-Qs have a mean (median) of 6 (5) links compared to 49 (38) for 10-Ks. Further, 10-Qs have a maximum of 14 links, compared to 192 for 10-Ks. The majority of 10-Q links are CEO and CFO certifications required under Sarbanes-Oxley (59% vs. 9% for 10-Ks). The next

most frequent category of links are the articles of incorporation (11% vs. 4% for 10-Ks). 10-Qs also have many fewer material documents and contracts. For example, 5%, 4%, and 7% of the 10-Q links cover compensation and employment, debt, or other industry and firm specific agreements (relative to 28%, 22%, and 29% found in 10-Ks), respectively. Overall, the subsample analysis shows that, in addition to having fewer links, 10-Qs link to documents that are plausibly less likely to contain information useful to investors.

Given 10-Qs have fewer links (see Figure 1 Panel B) to documents containing plausibly useful information, we expect to find weaker results when we re-estimate equations (3) and (4) using the 10-Q sample. This test also further helps to mitigate concerns that our results manifest from contemporaneous macroeconomic or regulatory events. If the variation we document in our investor constraint and information environment analyses results from the link mandate, we would not expect to observe the same variation in the 10-Q setting. However, if our results arise from one of these other factors, we should observe 10-Q results similar to those in the 10-K setting: muted (stronger) market responses to post-period filings given investor constraints (weak information environments).

We re-estimate equations (3) and (4) using our 10-Q sample, replacing the 10-K-oriented variables with analogous variables calculated using 10-Q filings. We present the results in Table 9. Consistent with our expectations, we find limited evidence that market responses are muted for firms with constrained investors or stronger for firms with weak information environments after the increase in 10-Q links (i.e., only one of nine coefficients of interest loads as expected). Overall, this analysis provides additional support that our results are not an artifact of changes in macroeconomic circumstances or other contemporaneous regulatory efforts.

Taken together, the findings from our additional analyses suggest that any alternative

explanation for changes in market response to 10-Ks after the mandate would have to vary predictably with disclosure theories, affect 10-Ks filed in 2017 after September 1, but not before, hold for our five complementary processing cost proxies, and affect 10-Ks but not 10-Qs. Overall, this additional evidence supports our primary conclusion that linking external documents in 10-Ks has implications for investor processing costs, and that different types of processing costs dominate in different circumstances.

5. Conclusion

In conjunction with various "usability" initiatives, the SEC issued a mandate in 2017 requiring firms to provide links to external documents referenced in their financial filings. We examine how this mandate is associated with investor processing of SEC filings in the context of the Blankespoor et al. 2020 processing costs framework. On one hand, links can benefit investors by reducing the costs to acquire information (e.g., Boechler 2001). On the other hand, cognitive load theories from the computer science and psychology fields and information overload theories from economics suggest links may increase integration costs (DeStefano and LeFevre 2007; Tversky and Kahneman 1974).

We examine our predictions using 10-K filings around the 2017 mandate and find little evidence that links are associated with our market measures, on average. We then test theoretically motivated predictions around when links are more likely to increase processing costs (i.e., when investors are more constrained) or decrease processing costs (i.e., in weak information environments). We find investor processing constraints reduce the market response to 10-Ks in the post-mandate period, consistent with more constrained investors experiencing fewer acquisition benefits and exacerbated integration costs. We also find evidence consistent with the link mandate conferring net processing benefits to investors of firms with weaker information environments,

consistent with the links helping most when investors are most likely to benefit from acquiring the additional information.

This study offers two key contributions. First, our study has implications for regulators. We find little evidence that links reduce acquisition costs, on average, as the SEC anticipated. However, the relation between links and processing costs varies with investor constraints and the firm's broader information environment. Second, by examining different processing costs with potentially offsetting effects, we contribute to the disclosure processing literature, which has limited work on "differing or interactive effects across cost type" to date (Blankespoor et al. 2020).

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Appendix A: Excerpts from comments to SEC in support of the 2017 hyperlink mandate

Panel A: Davis Polk and Wardwell, LLP

"The Commission aptly describes the process of locating and accessing an exhibit to SEC filings as time consuming and cumbersome. The exhibit index can be lengthy and unwieldy. The numbering convention for exhibits that are in the same item number category is not consistent across issuers, which adds to the difficulty of finding a document in the exhibit index. For exhibits that are incorporated by reference, a user often needs to consult a numbered footnote or a symbol for the listed exhibit to find the prior filing or submission where the sought-after exhibit is located. Then the user must locate the prior filing of the registrant to access the exhibit. Sometimes, the exhibit that is incorporated by reference is located in a filing or submission of different registrant, such as a subsidiary or other affiliate. The time savings afforded by hyper-linking exhibits, in particular, those incorporated by reference, will benefit all users of EDGAR, including retail investors and institutional investors. We note that EDGAR has long had the ability to support hyperlinks to exhibits in the exhibit index and the proposed amendments will leverage this feature. We concur with the Commission that the compliance cost of adopting the rule is minimal compared to the benefits to investors."

Panel B: Kenneth Bertsch Executive - Director Council of Institutional Investors

"Ease of access to the exhibits provided in the exhibit table is important to investors. CII commends the SEC for advancing reforms to ensure that market participants are equipped to quickly and inexpensively retrieve the information they seek."

Panel C: Cynthia M. Fornelli - Executive Director Center for Audit Quality

"We applaud the Commission's efforts to enhance the functionality of the EDGAR filing system by requiring registrants to provide a hyperlink for each exhibit listed in a filing's exhibit index. We agree that requiring registrants to provide hyperlinks to the actual filed documents would facilitate easier access to these exhibits. By eliminating the cumbersome need to search through the registrant's EDGAR file to locate the actual exhibit, this requirement will provide investors and users with a more efficient and effective means of locating documents attached to company filings. We believe this requirement would further the objectives of the Commission's Disclosure Effectiveness Initiative by improving the navigability of disclosures provided by registrants, thereby enhancing the ability of investors to access and use important information."

Appendix B: Item 15 pre and post mandate

Panel A: Pre-mandate Item 15

Exhibit Number	Document Description	Incorporated by Reference		
		Form	Exhibit	Filing Date
2.1	Agreement, dated as of April 3, 2012, by and among Molson Coors Brewing Company, Molson Coors Holdco - 2 Inc. and Starbev L.P.	8-K	2.1	April 3, 2012
2.2	Amendment and Novation Agreement, dated as of June 14, 2012, by and among Molson Coors Holdco 2 LLC, Molson Coors Netherlands B.V., Molson Coors Brewing Company, Starbev L.P. and the other individuals thereto.	8-K	10.4	June 18, 2012
2.3	Management Warranty Deed, dated as of April 3, 2012, by and among the management warrantors named therein, Starbev L.P. and Molson Coors Holdco - 2 Inc.	8-K	2.2	April 3, 2012
2.4.1	Purchase Agreement, dated as of November 11, 2015, by and between Anheuser-Busch InBev SA/NV and Molson Coors Brewing Company.	8-K	2.1	November 12, 2015
2.4.2	Amendment No. 1 to Purchase Agreement, dated as of March 25, 2016, by and between Anheuser-Busch InBev SA/NV and Molson Coors Brewing Company.	10-Q	2.1	May 3, 2016
2.4.3	Amendment No. 2 to Purchase Agreement, dated as of October 3, 2016, by and between Anheuser-Busch InBev SA/NV and Molson Coors Brewing Company.	8-K	2.1	October 4, 2016
3.1.1	Restated Certificate of Incorporation of Molson Coors Brewing Company.	Schedule 14A	Annex G	December 10, 2004
3.1.2	Amendment No.1 to Restated Certificate of Incorporation of Molson Coors Brewing Company.	10-Q	3.1	August 6, 2013
3.2	Third Amended and Restated Bylaws of Molson Coors Brewing Company.	10-Q	3.1	August 4, 2009

Panel B: Post-mandate Item 15

Exhibit Number	Document Description	Incorporated by Reference		
		Form	Exhibit	Filing Date
2.1.1	Purchase Agreement, dated as of November 11, 2015, by and between Anheuser-Busch InBev SA/NV and Molson Coors Brewing Company.	8-K	2.1	November 12, 2015
2.1.2	Amendment No. 1 to Purchase Agreement, dated as of March 25, 2016, by and between Anheuser-Busch InBev SA/NV and Molson Coors Brewing Company.	10-Q	2.1	May 3, 2016
2.1.3	Amendment No. 2 to Purchase Agreement, dated as of October 3, 2016, by and between Anheuser-Busch InBev SA/NV and Molson Coors Brewing Company.	8-K	2.1	October 4, 2016
3.1.1	Restated Certificate of Incorporation of Molson Coors Brewing Company.	Schedule 14A	Annex G	December 10, 2004
3.1.2	Amendment to Restated Certificate of Incorporation of Molson Coors Brewing Company.	10-Q	3.1	August 6, 2013
3.2	Third Amended and Restated Bylaws of Molson Coors Brewing Company.	10-Q	3.1	August 4, 2009
4.1.1	Indenture, dated as of May 3, 2012, by and among Molson Coors Brewing Company, the guarantors named therein and Deutsche Bank Trust Company Americas, as trustee.	8-K	4.1	May 3, 2012
4.1.2	First Supplemental Indenture, dated as of May 3, 2012, to the Indenture dated May 3, 2012, by and among Molson Coors Brewing Company, the guarantors named therein and Deutsche Bank Trust Company Americas, as trustee.	8-K	4.2	May 3, 2012

Appendix C: Variable definitions

Link variables:

LandingPage	The number of links that are on the landing page of a company's 10-K (i.e., exhibits filed along with the 10-K)
NonLandingPage	The number of links that are not on the landing page (i.e., previously filed documents)
Links	The number of hyperlinks that link to a different document. These include (1) *LandingPage* plus (2) *NonLandingPage*.
Pct<90 Days	The percentage of links that are to documents filed within 90 days prior to the 10-K filing date
Pct<1 Year	The percentage of links that are to documents filed within one year prior to the 10-K filing date
Pct<5 Year	The percentage of links that are to documents filed within five years prior to the 10-K filing date
Pct>5 Year	The percentage of links that are to documents filed more than 5 years prior to the 10-K filing date
Pct Mtl Contracts	The percentage of links that are to material contracts (i.e., EX 10 landing page exhibits or Item 1.01 8-Ks).
PctLandingPage	The percentage of links that are links on the 10-K's landing page
Pct 8K	The percentage of links that are to 8-K documents
Pct 10Q	The percentage of links that are to 10-Q documents
Pct 10K	The percentage of links that are to 10-K documents
Pct S4	The percentage of links that are to S-4 documents
Pct S1	The percentage of links that are to S-1 documents
Pct Other	The percentage of links that are to other documents (i.e., not 8-K, 10-Q, 10-K, S-4, or S-1)

Independent variables:

Adopt_ Links	An indicator variable that equals one for 10-Ks (10-Qs) filed between 9/1/2017-12/31/2019, and equals zero for 10-Ks (10-Qs) filed between 1/1/2016-8/30/2017.
Item15_Length	The number of rows in listed in Item 15 (Exhibits and Financial Statements Schedules) of the 10-K (10-Q).
Busy_Day	The natural logarithm of one plus the number of additional 10-Ks (10-Qs) filed on the same day as the firm-year observation's 10-K (10-Q).
Complex_Doc	An indicator variable that equals one if an observation falls in the highest quintile of the first principal component of: Ln(*Word_Count), FOG, %Negative_Words,* and *%Litigious_Words*, and equals zero otherwise.
Weak_Info	An indicator variable that equals one if an observation falls in the lowest quintile of the first principal component of: the percentage of shares owned by institutional investors, the natural logarithm of one plus the number of unique analysts following the firm, and Ln*(MVE)*, and equals zero otherwise.

Dependent variables:

AbsCAR	The absolute value of the difference between the firm's cumulative stock return over the period [-1,+1] relative to the 10-K (10-Q) filing date less the CRSP value-weighted cumulative market return over the same period. For any 10-K (10-Q) filed after 4PM EST, we adjust day 0 to be the next trading day.
AbnLiq	Negative one times abnormal illiquidity which is calculated as follows: for every day, we calculate the absolute return divided by the dollar volume in millions. We calculate the average daily illiquidity on [0, +1] surrounding the 10-K filing date. For any 10-K filed after 4PM EST, we adjust day 0 to be the next trading day. We then subtract the average daily illiquidity from days [-50, -5]. $Abn\_Illiquidity = \sum_{0}^{1} \frac{\lvert R_t \rvert}{DVol_t/1{,}000{,}000} - \sum_{-50}^{-5} \frac{\lvert R_t \rvert}{DVol_t/1{,}000{,}000}$ We then decile rank this measure across all observations in our sample.
AbnRetailVol	The average daily retail volume over days [0, +1] less the average daily retail volume over days [-50, -5], and scaled by the standard deviation of retail volume during the control period [-50, -5]. We obtain the daily retail volume from the TAQM_Common file on WRDS (total_vol_retail). For any 10-K (10-Q) filed after 4PM EST, we adjust day 0 to be the next trading day.
RetFrac	The fraction of the [0,+63] post-10-K raw returns realized in the [0,+4] period following the 10-K, following Lee and Zhu (2022). We then decile rank this measure across all observations in our sample.
AbnVol	The average daily volume over days [0,+1] less the average daily volume over days [-50, -5], and then scaled by the standard deviation of volume during the control period [-50, -5]. For any 10-K (10-Q) filed after 4PM EST, we adjust day 0 to be the next trading day.

Document characteristics:

Word_Count	The number of words in the 10-K filing.
FOG	The Gunning Fog Index for the 10-K filing.
%Negative_Words	The percentage of negative words in the 10-K filing using the Loughran-McDonald dictionary.
%Litigious_Words	The percentage of litigious words in the 10-K filing using the Loughran-McDonald dictionary.

Firm characteristics:

ROA	Income before extraordinary items divided by total assets.
Loss	An indicator variable that equals one if a firm's income before extraordinary items is negative, and equals zero otherwise.
SUE	Standardized unexpected earnings for this fiscal year defined using a seasonal random walk model. This is calculated using as basic EPS (excluding extraordinary items) for this fiscal year less the same amount for the prior fiscal year, scaled by price (adjusted for stock splits).
MVE	A firm's market value of equity.
BTM	The ratio of book value of equity to market value of equity, where market value of equity is calculated as price times common shares outstanding.
Leverage	Debt divided by total assets.
PP&E	Property, plant, and equipment scaled by total assets.

Information events:

Bundled	An indicator variable that equals one if a firm's 10-K (10-Q) filing date is the same day or one day after the earnings announcement date, and equals zero otherwise.
M&A	An indicator variable that equals one if a firm had any cash outflow of funds used for and/or the costs relating to the acquisition of a company (i.e., AQC in Compustat>0), and equals zero otherwise.
Large_Sp_Item	An indicator variable that equals one if a firm's special items is larger than 1% in magnitude of a firms assets, and equals zero otherwise. Note, for the 10-Q sample, this variable equals one if a firm's special items is larger than 0.25% in magnitude of a firms assets, and equals zero otherwise.
Change_Leverage	Leverage (debt divided by total assets) this year less the same amount from the prior fiscal year.
Change_StockComp	Stock-based compensation (scaled by assets) this year less the same amount from the prior fiscal year.

Appendix D: Measuring links

1. We first use SEC Analytics Suite on WRDS to compile a comprehensive list of URLs to 10-K text files on EDGAR from 1996-2023. We require that the firm-year observations are also in Compustat. This leads to 144,825 10-K text files. We ignore amended 10-Ks.

2. We then write a python script that visits and downloads each of the 144,825 text files. While it is common in the accounting literature to clean text files on EDGAR of HTML (typically with the BeautifulSoup library on python), we retain HTML elements for the purposes of our study to identify external links (which is the HTML attribute "href").

3. We then use another python script to count the total number of links in each 10-K. Specifically, we count the number of occurrences of "href" tags using the *a_tag.get* package in pyhton. "Href" denotes a hyperlink. We use case-insensitive matching.

4. We then classify appearances of *href=* into one of the following two categories (mutually exclusive):

(1) **Landing page links**, which are links for exhibits that are filed as part of the 10-K package. We calculate this as the number of times *href="*ex/d**"* or *href="*exhibit/d**"* appears in the 10-K. The "*" allows for wild cards. The "/*d*" denotes that a digit is required after "*ex*" or "*exhibit*". Below is an example where the boxed items represent landing page links for Chipotle's 2022 10-K filing.[27]

Seq	Description	Document	Type	Size
1	10-K	cmg-20221231x10k.htm iXBRL	10-K	4387354
2	EX-10.33	cmg-20221231xex10_33.htm	EX-10.33	649508
3	EX-21.1	cmg-20221231xex21_1.htm	EX-21.1	16317
4	EX-23.1	cmg-20221231xex23_1.htm	EX-23.1	10907
5	EX-31.1	cmg-20221231xex31_1.htm	EX-31.1	17684
6	EX-31.2	cmg-20221231xex31_2.htm	EX-31.2	17719
7	EX-32.1	cmg-20221231xex32_1.htm	EX-32.1	9879
8	GRAPHIC	cmg-20221231x10kg001.jpg	GRAPHIC	40659
9	GRAPHIC	cmg-20221231x10kg002.jpg	GRAPHIC	189912
10	GRAPHIC	cmg-20221231xex10_33g001.jpg	GRAPHIC	1223
	Complete submission text file	0001058090-23-000010.txt		17093967

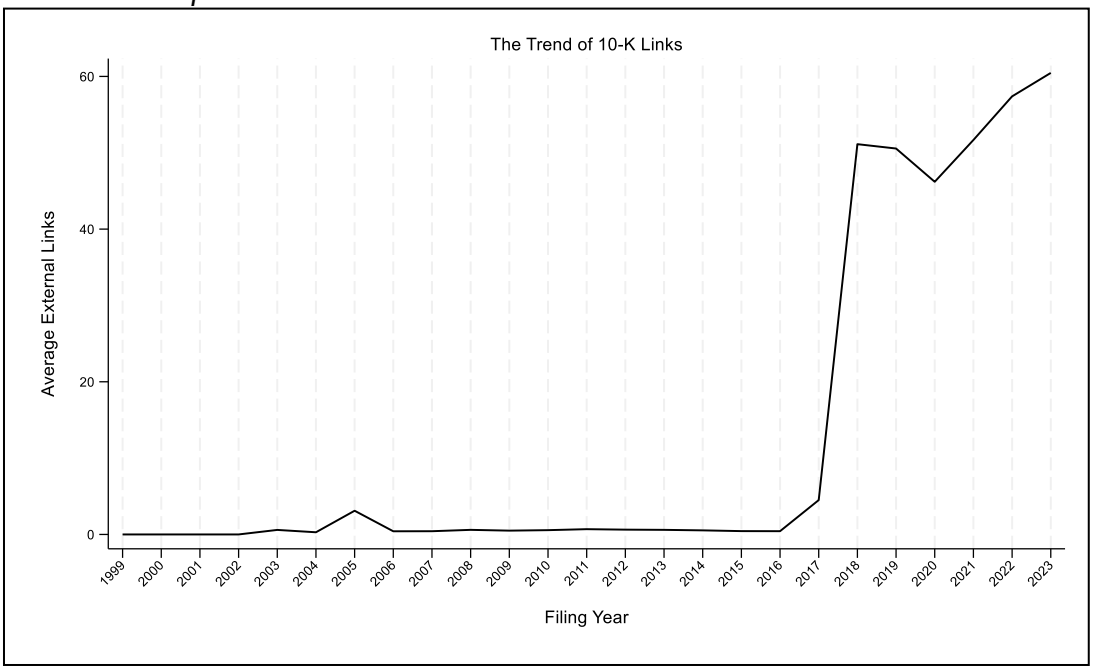
(2) **Non-landing page links**, which are for documents that were previously filed on EDGAR. We calculate this as the number of times *href="http(s)://(www.)sev.gov*"* appears, where items in parentheses are optional and "*" allows for wildcards.

5. We take the sum of the links in category 1 (landing page links) and category 2 (non-landing page links) to arrive out our main variable of interest: *Links*. We present the distribution of *LandingPage* and *NonLandingPage* links in Table 2. Note, the landing page itself has not changed from the pre- to the post-period. However, similar to the non-landing page documents, the landing page filings are now linked in the exhibit index in the post period.

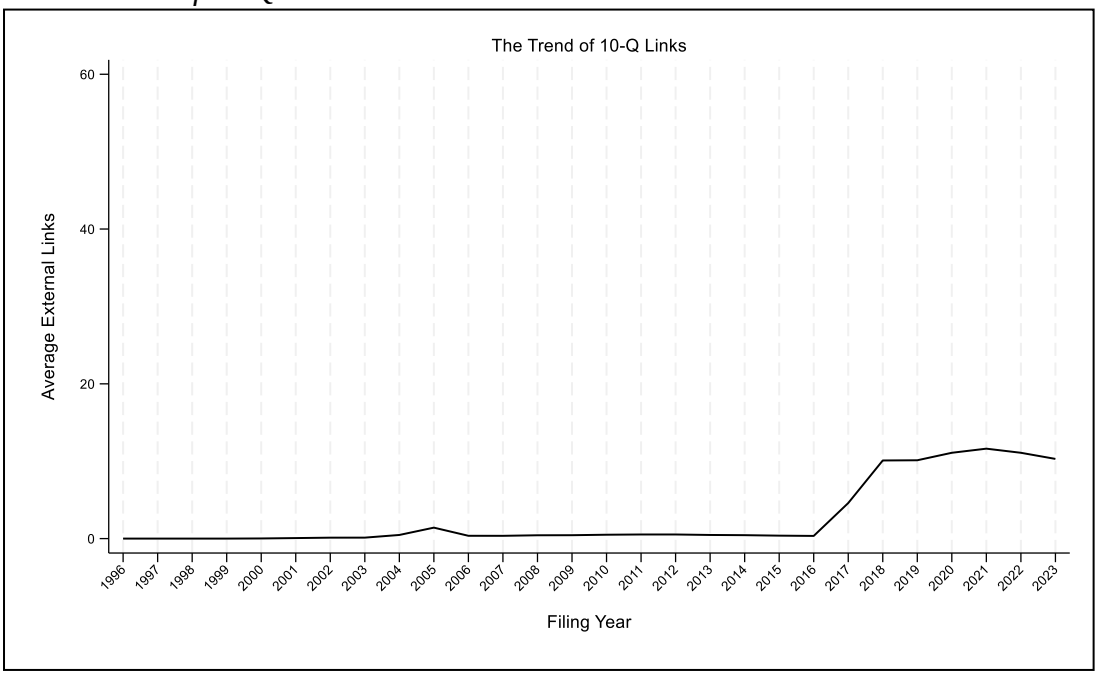
[27] The landing page exhibits do not have a URL in the "href" tag, as the exhibits that are filed concurrently with the 10-K do not yet have a URL associated with it at the time the 10-K is filed.

Figure 1: Time trends in links to external exhibits

Panel A: The trend of 10-K links over time

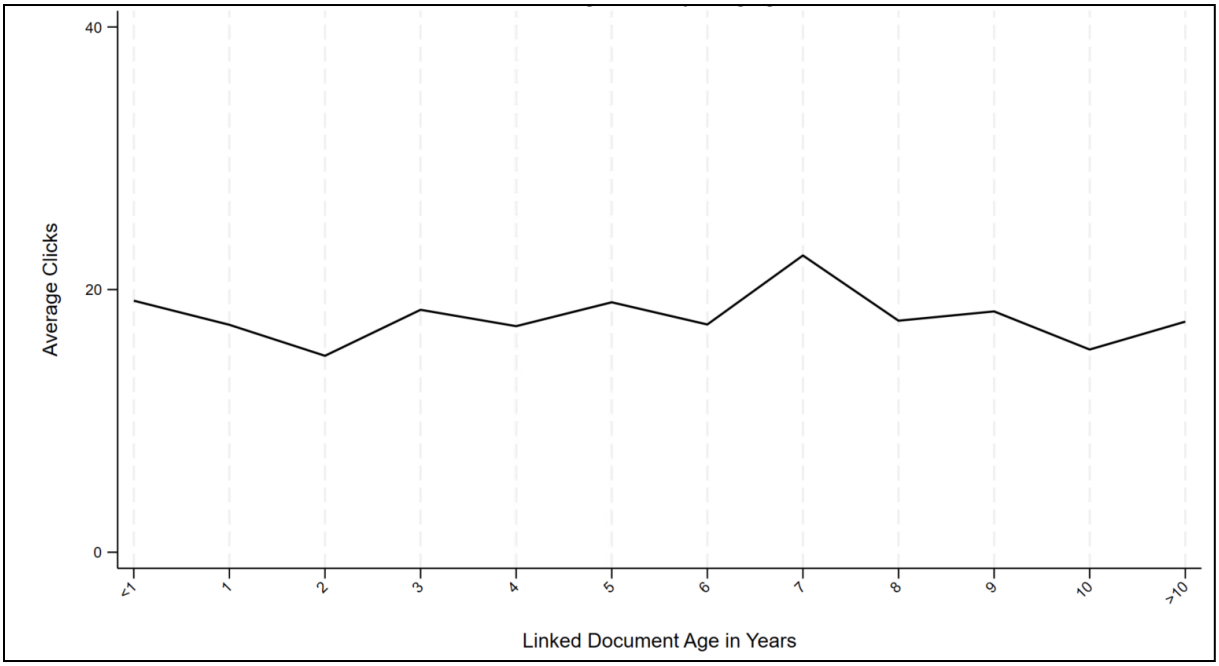


Panel B: The trend of 10-Q links over time



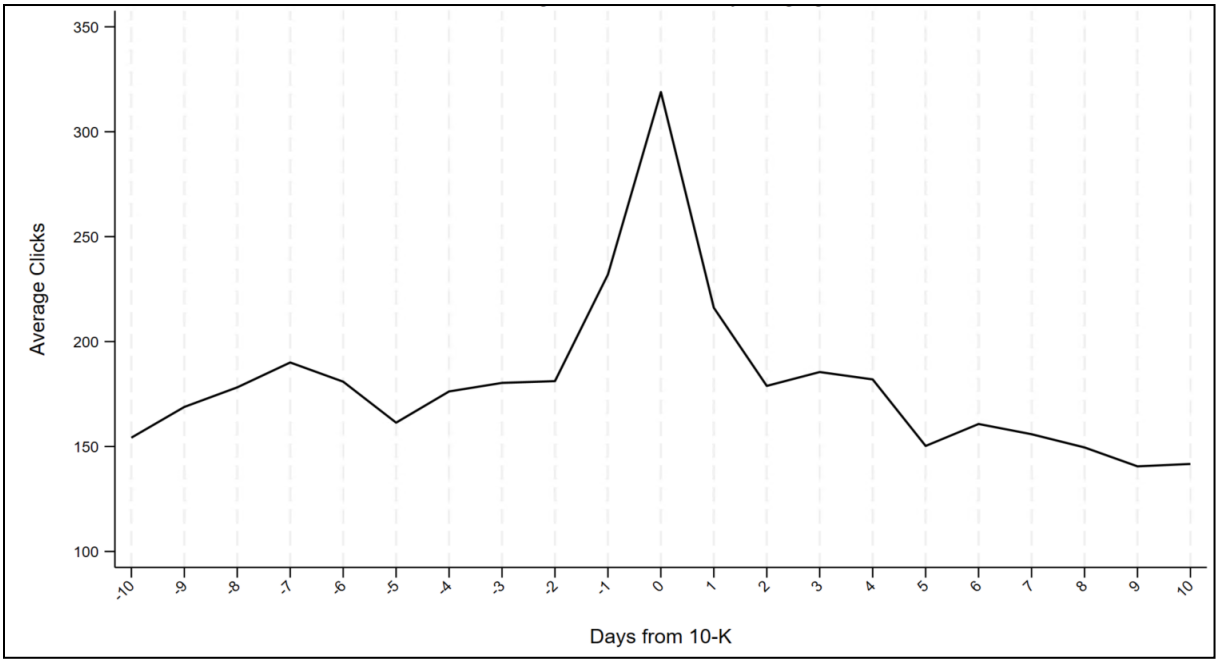
These figures present the trend in the average number of links by filing year (unwinsorized). Panel A presents the links in 10-Ks and Panel B presents the links in 10-Qs. The figures include all external links (i.e., links to documents already in the EDGAR database and links to newly filed documents that are attached to the current filing and appear on the filing's landing page).

Figure 2: Clicks on linked exhibits by source document age



This figure presents the average number of clicks on a given non-landing page 10-K exhibit by source document age. The number of clicks are accumulated over the [-10, +10] day window. We use the EDGAR log files to calculate the daily clicks, which are available from 5/19/2020 – 6/30/2023.

Figure 3: Clicks on linked exhibits around the 10-K filing date



This figure presents the average number of clicks on all linked non-landing page documents in a 10-K. We present the average clicks for the 21 days surrounding the 10-K filing date. We use the EDGAR log files to calculate the daily clicks, which are available from 5/19/2020 – 6/30/2023.

Table 1: Sample selection and summary statistics

Panel A: Sample selection

		Remaining N
Compustat firm-year universe 2015-2019		46,846
Drop if missing or negative assets	(12,814)	34,032
Drop if missing or negative sales	(230)	33,802
Drop if missing permno	(9,838)	23,964
Drop if missing accession	(5,930)	18,034
Drop if missing necessary variables	(652)	17,382
Drop if filing year <2016 or >2019	(3,538)	13,844
Drop if singleton	(803)	13,073
Final Sample		**13,073**

Table 1 (continued)

Panel B: Summary statistics

				Adopt_ Links = 0			Adopt_ Links = 1			Diff	
	N	**Mean**	**P50**	N	Mean	P50	N	Mean	P50		
Independent Vars:											
Item15_Length	13,073	418	197	6,301	430	210	6,772	408	188	-22	***
Busy_Day	13,073	134	103	6,301	147	117	6,772	123	95	-24	***
Complex_Doc	13,073	0.000	-0.043	6,301	0.021	-0.021	6,772	-0.020	-0.068	-0.041	*
Weak_Info	13,073	0.000	-0.179	6,301	-0.023	-0.201	6,772	0.021	-0.168	0.045	*
Dependent Vars:											
AbsCAR	13,073	0.045	0.024	6,301	0.045	0.024	6,772	0.045	0.024	0.001	
AbnLiq	12,695	0.706	0.000	6,111	0.868	0.000	6,584	0.555	0.000	-0.313	***
AbnRetailVol	10,655	0.959	0.064	5,409	0.889	0.065	5,246	1.032	0.063	0.142	***
Document Characteristics:											
Word_Count	13,073	249,844	234,109	6,301	249,024	232,879	6,772	250,606	235,468	1583	
FOG	13,073	25.000	24.952	6,301	25.042	24.989	6,772	24.962	24.921	-0.079	***
%Negative_Words	13,073	0.015	0.015	6,301	0.015	0.015	6,772	0.015	0.015	0.000	*
%Litigious_Words	13,073	0.015	0.015	6,301	0.015	0.015	6,772	0.015	0.015	0.000	
Firm Characteristics:											
ROA	13,073	-0.096	0.011	6,301	-0.097	0.010	6,772	-0.095	0.012	0.001	
Loss	13,073	0.360	0.000	6,301	0.368	0.000	6,772	0.353	0.000	-0.014	*
SUE	13,073	0.075	0.004	6,301	0.042	0.003	6,772	0.106	0.006	0.064	***
MVE	13,073	4728	790	6,301	4484	732	6,772	4955	832	472	**
BTM	13,073	0.548	0.468	6,301	0.555	0.466	6,772	0.543	0.471	-0.012	
Leverage	13,073	0.266	0.208	6,301	0.267	0.208	6,772	0.266	0.208	-0.001	
PP&E	13,073	0.186	0.067	6,301	0.189	0.067	6,772	0.184	0.067	-0.006	
Information Events:											
Bundled	13,073	0.442	0.000	6,301	0.421	0.000	6,772	0.462	0.000	0.041	***
M&A	13,073	0.336	0.000	6,301	0.337	0.000	6,772	0.335	0.000	-0.002	
Large_Sp_Item	13,073	0.297	0.000	6,301	0.290	0.000	6,772	0.304	0.000	0.014	*
Change_Leverage	13,073	0.009	0.000	6,301	0.014	0.000	6,772	0.003	0.000	-0.011	***
Change_StockComp	13,073	0.000	0.000	6,301	0.001	0.000	6,772	0.000	0.000	-0.001	*

Panel A presents the sample selection procedures. Panel B presents the summary statistics of independent, dependent, and controls variables for the full sample, pre-period (i.e., *Adopt_Links* = 0), and post-period (i.e., *Adopt_Links* = 1). We present a t-test difference in means between the pre- and post- periods. All continuous variables in Panel B are winsorized at the 1st/99th percentiles. Variable definitions are in Appendix C.

Table 2: Descriptive statistics on links in the 10-K (post-period)

Variable	N	Mean	P25	P50	P75
LandingPage	6,772	7.983	6	7	9
NonLandingPage	6,772	59.188	25	39	62
Links	6,772	67.171	32	47	71
Pct < 90 Days	6,772	0.219	0.119	0.175	0.250
Pct < 1 Year	6,772	0.335	0.209	0.289	0.396
Pct < 5 Year	6,772	0.729	0.583	0.723	0.930
Pct > 5 Year	6,772	0.271	0.070	0.277	0.417
Pct Mtl Contracts	6,772	0.222	0.095	0.196	0.327
Pct 8K	6,772	0.322	0.171	0.316	0.462
Pct 10Q	6,772	0.156	0.053	0.133	0.234
Pct 10K	6,772	0.141	0.048	0.118	0.209
Pct S4	6,772	0.017	0	0	0
Pct S1	6,772	0.084	0	0	0.079
Pct Other	6,772	0.078	0.000	0.045	0.103

This table presents descriptive statistics related to the links in the 10-K in the post-period (i.e., *Adopt_Links* = 1). We calculate these variables using a link-level dataset in the post-period. After analyzing the data at the link-level, we collapse the variables to the 10-K level. These variables are not winsorized.

Table 3: Validation of the link measure

Panel A: Adoption and the number of links

	(1)	(2)	(3)	(4)
Dep. Vars.	*Ln(Links)*		*Links*	
Adopt_Links	1.620***	1.623***	45.713***	45.859***
	(48.14)	(48.42)	(33.66)	(33.86)
Ln(Item15_Length)		0.107***		5.254***
		(4.88)		(4.32)
Observations	13,073	13,073	13,073	13,073
R-squared	0.874	0.874	0.735	0.736
Document Controls	No	Yes	No	Yes
Firm Controls	No	Yes	No	Yes
Info Event Controls	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes
Calendar-Year FE	Yes	Yes	Yes	Yes
Cluster Firm	Yes	Yes	Yes	Yes

Panel B: EDGAR Clicks

Average Daily Clicks:	N	Mean	P25	P50	P75
Pre Window [-10,-2]	94,614	174.692	18	49	126
10-K Window [-1,1]	26,804	253.792	22	65	175
Post Window[2,10]	67,969	160.521	16	45	116

Differences Across Windows	Mean		P50	
10-K Window - Pre Window	79.100	***	16	***
10-K Window - Post Window	93.270	***	20	***

This table presents validation analyses. Panel A shows that the mandatory adoption of links led to a significant increase in the number of links in the 10-K. Control variables are not presented for brevity but include the following: *Ln(Word_Count), FOG, Ln(Negative_Words), Ln(Litigious_Words), ROA, Loss, SUE, Ln(MVE), BTM, Leverage, PP&E, Bundled, M&A, Large_Sp_Item, Change_Leverage,* and *Change_SBC.* Panel B presents descriptives statistics on the number of clicks on linked documents both before the 10-K filing date (pre window), in the three days surrounding the 10-K filing date (10-K window), and after the 10-K filing date (post window). Panel B also presents t-tests for the difference in means and Wilcoxon rank-sum test for differences in medians between the 10-K window and the pre- and post-windows. Standard errors are clustered by firm and t-statistics are in paratheses. ***, **, * denotes statistical significance at the 1%, 5%, and 10% levels, respectively. Variable definitions are in Appendix C.

Table 4: Link adoption and investor response

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Vars.	*AbsCAR*		*AbnLiq*		*AbnRetailVol*	
Adopt_Links	0.001	0.001	-0.041	0.045	0.093**	0.020
	(0.91)	(1.22)	(-0.85)	(0.89)	(2.00)	(0.41)
Item15_Length	0.002	0.002	0.079	0.101	0.065	0.096
	(0.90)	(0.89)	(0.74)	(0.95)	(0.49)	(0.72)
Observations	13,073	13,073	12,650	12,650	10,555	10,555
R-squared	0.479	0.498	0.431	0.442	0.463	0.483
Document Controls	No	Yes	No	Yes	No	Yes
Firm Controls	No	Yes	No	Yes	No	Yes
Info Event Controls	No	Yes	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster Firm	Yes	Yes	Yes	Yes	Yes	Yes

This table presents the impact of external link adoption on investor response. The sample period is filing years 2016-2019. All columns include firm fixed effects. Odd (even) columns exclude (include) control variables. Control variables are not presented for brevity but include the following: *Ln(Word_Count), FOG, %Negative_Words, %Litigious_Words, ROA, Loss, SUE, Ln(MVE), BTM, Leverage, PP&E, Bundled, M&A, Large_Sp_Item, Change_Leverage*, and *Change_StockComp*. Standard errors are clustered by firm and t-statistics are in parentheses. ***, **, * denotes statistical significance at the 1%, 5%, and 10% levels, respectively. All continuous variables are winsorized at the 1st and 99th percentiles. Variable definitions are in Appendix C.

Table 5: Cross-sectional analyses related to investor processing constraints

Panel A: Busy filing days

Dep. Vars.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		AbsCAR			*AbnLiq*			*AbnRetailVol*	
Adopt_Links	0.009***	0.010***	0.047	0.243	0.374**	3.594**	0.525***	0.443**	0.855
	(2.63)	(2.93)	(1.60)	(1.34)	(2.10)	(2.05)	(2.80)	(2.38)	(0.62)
Busy_Day	0.000	0.000	0.000	0.057	0.079	0.085	-0.015	-0.003	-0.008
	(0.13)	(0.36)	(0.07)	(1.07)	(1.49)	(1.60)	(-0.29)	(-0.07)	(-0.16)
*Adopt_Links * Busy_Day*	-0.002***	-0.002***	-0.001**	-0.065*	-0.074**	-0.072*	-0.100**	-0.097**	-0.084**
	(-2.58)	(-2.81)	(-2.03)	(-1.69)	(-1.97)	(-1.87)	(-2.51)	(-2.50)	(-2.15)
Item15_Length	0.002	0.002	0.002	0.082	0.105	0.086	0.069	0.100	0.143
	(0.94)	(0.94)	(0.88)	(0.76)	(0.98)	(0.79)	(0.52)	(0.74)	(1.05)
*Adopt_Links * Item15_Length*			-0.000			0.029			-0.084*
			(-0.46)			(0.54)			(-1.74)
Observations	13,073	13,073	13,073	12,650	12,650	12,650	10,555	10,555	10,555
R-squared	0.479	0.498	0.501	0.432	0.443	0.446	0.464	0.483	0.486
Document Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Firm Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Info Event Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Interacted Controls	No	No	Yes	No	No	Yes	No	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 5 (continued)

Panel B: Complex filings

Dep. Vars.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		AbsCAR			*AbnLiq*			*AbnRetailVol*	
Adopt_Links	0.003***	0.003***	0.017***	0.011	0.099	0.404	0.164***	0.085	0.822**
	(2.58)	(2.87)	(2.67)	(0.18)	(1.58)	(1.11)	(3.01)	(1.56)	(2.55)
Complex_Doc	0.006***	0.005**	0.005**	0.058	0.035	0.035	0.207*	0.193*	0.135
	(2.77)	(2.50)	(2.33)	(0.59)	(0.36)	(0.35)	(1.89)	(1.82)	(1.25)
*Adopt_Links * Complex_Doc*	-0.008***	-0.008***	-0.007***	-0.199*	-0.235**	-0.234**	-0.259**	-0.239**	-0.139
	(-3.80)	(-3.99)	(-3.38)	(-1.95)	(-2.31)	(-2.21)	(-2.40)	(-2.24)	(-1.23)
Item15_Length	0.002	0.002	0.002	0.080	0.073	0.070	0.060	0.086	0.124
	(0.84)	(0.87)	(0.81)	(0.74)	(0.69)	(0.64)	(0.45)	(0.65)	(0.91)
*Adopt_Links * Item15_Length*			-0.000			0.006			-0.085*
			(-0.48)			(0.11)			(-1.77)
Observations	13,073	13,073	13,073	12,650	12,650	12,650	10,555	10,555	10,555
R-squared	0.480	0.498	0.501	0.432	0.442	0.445	0.463	0.483	0.485
Document Controls	No	No	No	No	No	No	No	No	No
Firm Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Info Event Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Interacted Controls	No	No	Yes	No	No	Yes	No	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table presents cross-sectional analyses related to net disclosure processing costs. We use two proxies for ex ante investor constraints: busy days (Panel A) and 10-K complexity (Panel B). The sample period is filing years 2016-2019. All columns include firm fixed effects. For each dependent variable, we first present no controls, controls, then fully-interacted controls. Standard errors are clustered by firm and t-statistics are in parentheses. ***, **, * denotes statistical significance at the 1%, 5%, and 10% levels, respectively. All continuous variables are winsorized at the 1st and 99th percentiles. Variable definitions are in Appendix C.

Table 6: Cross-sectional analyses related to information environment

Dep. Vars.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		AbsCAR			*AbnLiq*			*AbnRetailVol*	
Adopt_Links	-0.000	-0.001	0.028	-0.073	-0.060	3.213*	0.068	0.015	0.734
	(-0.23)	(-1.02)	(1.01)	(-1.51)	(-1.21)	(1.86)	(1.44)	(0.31)	(0.52)
Weak_Info	-0.005	-0.005	-0.006	0.390	0.327	0.438	-0.165	-0.127	-0.079
	(-0.76)	(-0.86)	(-0.96)	(1.11)	(0.92)	(1.21)	(-0.72)	(-0.53)	(-0.33)
*Adopt_Links * Weak_Info*	0.017***	0.018***	0.018***	0.507	0.512	0.343	0.544**	0.533**	0.454*
	(3.15)	(3.39)	(3.08)	(1.60)	(1.63)	(1.02)	(2.48)	(2.36)	(1.82)
Item15_Length	0.002	0.002	0.002	0.083	0.111	0.093	0.069	0.099	0.145
	(0.91)	(0.92)	(0.88)	(0.77)	(1.03)	(0.84)	(0.52)	(0.74)	(1.06)
*Adopt_Links * Item15_Length*			-0.000			0.037			-0.091*
			(-0.31)			(0.70)			(-1.88)
Observations	13,073	13,073	13,073	12,650	12,650	12,650	10,555	10,555	10,555
R-squared	0.480	0.495	0.498	0.432	0.435	0.438	0.463	0.483	0.485
Document Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Firm Controls (without *Ln_MVE*)	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Info Event Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Interacted Controls	No	No	Yes	No	No	Yes	No	No	Yes
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table presents cross-sectional analyses related to net disclosure processing benefits. We use a proxy for firms with a weaker information environment: *Weak_Info*. The sample period is filing years 2016-2019. All columns include firm fixed effects. For each dependent variable, we first present no controls, controls, then fully-interacted controls. Standard errors are clustered by firm and t-statistics are in parentheses. ***, **, * denotes statistical significance at the 1%, 5%, and 10% levels, respectively. All continuous variables are winsorized at the 1st and 99th percentiles. Variable definitions are in Appendix C.

Table 7: Calendar year fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Busy Days			**Complex Document**			**Weak Info Environment**	
Dep. Vars.	*AbsCAR*	*AbnLiq*	*AbnRetailVol*	*AbsCAR*	*AbnLiq*	*AbnRetailVol*	*AbsCAR*	*AbnLiq*	*AbnRetailVol*
Adopt_Links	0.051*	3.289*	0.973	0.018***	0.566	0.738*	0.039	3.261*	0.763
	(1.74)	(1.87)	(0.70)	(2.59)	(1.38)	(1.93)	(1.40)	(1.88)	(0.54)
Busy_Day	-0.000	0.086	-0.004						
	(-0.10)	(1.62)	(-0.08)						
*Adopt_Links * Busy_Day*	-0.002**	-0.065*	-0.087**						
	(-2.51)	(-1.69)	(-2.17)						
Complex_Doc				0.005***	0.043	0.124			
				(2.61)	(0.44)	(1.15)			
*Adopt_Links * Complex_Doc*				-0.008***	-0.215**	-0.145			
				(-3.53)	(-2.03)	(-1.29)			
Weak_Info							-0.006	0.457	-0.098
							(-1.07)	(1.26)	(-0.40)
*Adopt_Links * Weak_Info*							0.018***	0.344	0.449*
							(3.13)	(1.02)	(1.80)
Item15_Length	0.002	0.089	0.143	0.002	0.072	0.124	0.002	0.094	0.144
	(0.91)	(0.81)	(1.05)	(0.85)	(0.66)	(0.92)	(0.90)	(0.84)	(1.06)
*Adopt_Links * Item15_Length*	-0.000	0.027	-0.082*	-0.000	0.006	-0.085*	-0.000	0.037	-0.090*
	(-0.44)	(0.51)	(-1.70)	(-0.49)	(0.12)	(-1.76)	(-0.30)	(0.69)	(-1.85)
Observations	13,073	12,650	10,555	13,073	12,650	10,555	13,073	12,650	10,555
R-squared	0.503	0.447	0.486	0.503	0.446	0.486	0.500	0.438	0.485
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interacted Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Calendar-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table presents our cross-sectional analyses but includes calendar year fixed effects. The sample period is filing years 2016-2019. All columns include firm fixed effects and fully-interacted controls. For columns 1-3, 4-6, and 7-9, we use the same controls outlined in Table 5A, 5B, and 6 respectively. Standard errors are clustered by firm and t-statistics are in parentheses. ***, **, * denotes statistical significance at the 1%, 5%, and 10% levels, respectively. All continuous variables are winsorized at the 1st and 99th percentiles. Variable definitions are in Appendix C.

Table 8: Additional dependent variables

	(1)	(2)	(3)	(4)	(5)	(6)
	Busy Days		**Complex Document**		**Weak Info Environment**	
Dep. Vars.	*RetFrac*	*AbnVol*	*RetFrac*	*AbnVol*	*RetFrac*	*AbnVol*
Adopt_Links	-0.179	1.528**	0.303	0.473***	-0.037	1.695***
	(-0.10)	(2.39)	(0.82)	(3.63)	(-0.02)	(2.73)
Busy_Day	0.199***	-0.021				
	(3.91)	(-1.16)				
*Adopt_Links * Busy_Day*	-0.107***	-0.010				
	(-2.65)	(-0.72)				
Complex_Doc			-0.041	0.103**		
			(-0.33)	(2.41)		
*Adopt_Links * Complex_Doc*			0.054	-0.141***		
			(0.42)	(-3.13)		
Weak_Info					0.049	-0.167*
					(0.18)	(-1.71)
*Adopt_Links * Weak_Info*					0.480*	0.166*
					(1.85)	(1.77)
Item15_Length	0.036	0.054	0.063	0.048	0.046	0.054
	(0.27)	(1.10)	(0.49)	(0.99)	(0.35)	(1.11)
*Adopt_Links * Item15_Length*	0.062	-0.036*	0.056	-0.036*	0.053	-0.039**
	(1.10)	(-1.83)	(1.02)	(-1.84)	(0.95)	(-1.96)
Observations	13,073	13,073	13,073	13,073	13,073	13,073
R-squared	0.294	0.542	0.292	0.542	0.293	0.541
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Interacted Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster Firm	Yes	Yes	Yes	Yes	Yes	Yes

This table presents our cross-sectional analyses using two alternative dependent variables: *RetFrac* and *AbnVol*. The sample period is filing years 2016-2019. Columns 1-2 (3-4) [5-6] relate to busy days (complex documents) [weak information environments]. All columns include firm fixed effects and fully-interacted controls. For columns 1-2, 3-4, and 5-6, we use the same controls outlined in Table 5A, 5B, and 6 respectively. Standard errors are clustered by firm and t-statistics are in parentheses. ***, **, * denotes statistical significance at the 1%, 5%, and 10% levels, respectively. All continuous variables are winsorized at the 1st and 99th percentiles. Variable definitions are in Appendix C.

Table 9: Falsification analysis – 10-Q Sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Busy Days			**Complex Document**			**Weak Info Environment**	
Dep. Vars.	*AbsCAR*	*AbnLiq*	*AbnRetailVol*	*AbsCAR*	*AbnLiq*	*AbnRetailVol*	*AbsCAR*	*AbnLiq*	*AbnRetailVol*
Adopt_Links	-0.040**	0.436	-0.108	-0.000	-0.321	-0.039*	-0.036**	0.223	-0.135
	(-2.55)	(0.49)	(-1.43)	(-0.06)	(-1.46)	(-1.91)	(-2.26)	(0.25)	(-1.55)
Busy_Day	-0.001*	-0.106***	-0.002						
	(-1.93)	(-3.30)	(-0.65)						
*Adopt_Links * Busy_Day*	0.000	-0.007	0.000						
	(0.19)	(-0.24)	(0.06)						
Complex_Doc				0.003**	-0.135**	-0.001			
				(2.39)	(-2.13)	(-0.09)			
*Adopt_Links * Complex_Doc*				0.002	0.022	0.011			
				(1.41)	(0.33)	(1.53)			
Weak_Info							-0.001	-0.450***	0.019
							(-0.59)	(-5.21)	(1.38)
*Adopt_Links * Weak_Info*							-0.000	0.283***	-0.001
							(-0.04)	(3.79)	(-0.09)
Item15_Length	0.000	0.047	-0.009**	0.000	0.052	-0.009**	0.000	0.028	-0.009**
	(0.50)	(0.95)	(-2.06)	(0.33)	(1.05)	(-2.05)	(0.38)	(0.57)	(-2.12)
*Adopt_Links * Item15_Length*	0.000	-0.012	0.005	0.000	-0.019	0.005	0.000	0.006	0.005
	(0.28)	(-0.26)	(1.03)	(0.39)	(-0.42)	(1.04)	(0.30)	(0.13)	(1.17)
Observations	35,346	34,346	28,021	35,346	34,346	28,021	35,346	34,346	28,021
R-squared	0.362	0.228	0.335	0.362	0.227	0.335	0.361	0.224	0.335
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interacted Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table presents a falsification analysis. Specifically, we use an alternative sample of 10-Q filings (i.e., quarters 1, 2, and 3 of the fiscal years). The sample period is filing years 2016-2019. All columns include firm fixed effects and fully-interacted controls. For columns 1-3 (4-6) [7-9], we use the same controls outlined in Table 5A (5B) [6]. Standard errors are clustered by firm and t-statistics are in parentheses. ***, **, * denotes statistical significance at the 1%, 5%, and 10% levels, respectively. All continuous variables are winsorized at the 1st and 99th percentiles. Variable definitions are in Appendix C