Operating Leases and the Market's Assessment of Equity Risk: Evidence from the Adoption of ASC 842

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September 2022

Preliminary Draft (please do not circulate or cite)

Acknowledgment: We thank Qiang Wu, Cheng Zeng, and workshop participants at the Hong Kong Polytechnic University for their valuable comments.

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ABSTRACT

ASC 842, the new lease standard in the U.S., tightened lease reporting requirements and significantly increased the balance sheet's total leverage. In this study, we focus on the balance sheet effect of ASC 842 and examine whether the increased disclosures and the formal recognition of operating lease assets and liabilities on the balance sheet–as required by the new standard–improve the informativeness of lease accounting. Specifically, we investigate if the new standard benefits investors in assessing equity risk based on leverage, especially the operating lease leverage. We manually collect the weighted-average discount rate, the cumulative-effect adjustment to the beginning balance of operating lease assets and liabilities following ASC 842, and distinct lease-related monetary XBRL tags from 10-K filings. We calculate the estimated operating lease leverage based on footnote disclosures and the reported operating lease leverage based on the balance sheet recognitions. We find that the estimated operating lease leverage explains more of the firms' equity risk after the adoption of ASC 842. We also find that the reported operating lease leverage on the balance sheet provides additional explanatory power to equity risk beyond the estimated operating lease leverage. The results show that the difference between the reported and estimated operating lease leverage is more informative when the estimates are less likely to be reliable, for example, when lease accounting reporting complexity is high. These findings suggest that ASC 842 has improved the lease reporting for the market to better assess equity risk.

I. INTRODUCTION

We investigate if the new lease standard (ASC 842) improves the informativeness of reported leverage for the market to assess a firm's risk. ASC 842 recognizes operating lease liabilities formally on the balance sheet. If the market was not aware of such off-balance sheet liabilities, then the new rule shall increase the market's assessment of risk. However, the market could have estimated the off-balance sheet operating lease liabilities based on previous reporting rule (ASC 840); hence, it is an empirical question to evaluate if ASC 842 improves the informativeness of reported leverage for the market to assess firm risk.

Since the major accounting scandals of the early 2000s, investors, auditors, analysts, and regulators have demanded more information about registrants' off-balance-sheet activities because companies hide a large sum of debt off the balance sheet (e.g., Chang 2002). Lease accounting has long received criticism for its failure to faithfully represent leasing transactions because it did not require lessees to recognize operating lease assets and liabilities on the balance sheet, even though the operating lease arrangement also increases the right of the use of assets and committed liabilities. In 2006, the FASB and the IASB initiated a joint project on lease accounting.[1] Since its inception, a vast controversy about the impacts of recognizing the assets and liabilities arising from operating leases was echoed in the comment letters to the Boards. As a result, issuing lease accounting standards has been dragged out for a long time.

It is not until 2016, that the FASB issued ASC 842 and the IASB issued IFRS 16. These standards become effective for public business entities for the fiscal years that began after December 15, 2018 and January 1, 2019, respectively.[2] Under the core principle of the new standards, a lessee is required to recognize right-of-use ("ROU") assets and related lease liabilities, for lease terms that are longer than 12 months, on the balance sheet.[3] ASC 842 allows leases to be categorized as either finance or operating leases, while IFRS 16 categorizes all leases as one type (i.e., finance lease). Under ASC 842, the accounting

[1] SEC (2005) estimated that public companies in the U.S. might have approximately $1.25 trillion in non-cancelable future cash obligations committed under operating leases. IFRS (2006) suggested almost $3 trillion of off-balance-sheet lease commitments.

[2] In the U.S., the effective date for most other entities (e.g., private companies and some NFP entities) was deferred for three years (i.e., December 15, 2021). Early adoption is permitted for all entities.

[3] The median weighted-average remaining operating lease term of our sample firms is 6.6 years.

treatments of finance and operating leases on the balance sheet are similar (i.e., all leases longer than 12 months need to be capitalized). The main difference between these two types is the recognition of expenses on the income statement. For finance leases, depreciation expenses and interest expenses will be recognized; for operating leases, no recognition of depreciation and interest expenses, and the lease payments will continue to be recognized as lease expenses. As the objective of the new standard is to improve the information usefulness of lease accounting, we examine whether the increased disclosures and the formal recognition of operating lease assets and liabilities under the new standard improve the informativeness of lease accounting for investor's risk assessment.[4]

Previous studies have documented that estimated operating lease obligations explain equity risk (e.g., Bratten et al. 2013); we follow previous methodology and investigate the effect of ASC 842 on the informativeness of estimated or reported operating lease obligations. Prior to ASC 842, firms had to formally recognize long-term leases categorized as capital leases (now referred to as finance leases) but not operating leases. The old standard (i.e., ASC 840) has several problems. First, it treats operating lease and capital lease commitments differently although operating leases involve commitments and right-of-use assets that are very similar to capital leases. Second, as managers prefer to report lower leverage on the balance sheet, they often construct their firms' lease contracts, so the leases do not have to be categorized as capital leases. This behavior leads to many should-have-been-reported as capital leases being classified as operating leases.[5] Third, although firms were required to provide disclosures about their future lease payments for both capital and operating leases under the old standard, information for investors to be able to accurately estimate the operating lease obligations was limited. For example, the old standard mainly

[4] Please refer to Appendix A Background for a more detailed discussion of the development of lease accounting standards.

[5] Treating capital and operating leases similarly shall prevent such behavior. In an untabulated analysis, we find that ASC 842 does not change the total leverage (when estimated operating lease assets and liabilities are included in the pre-ASC 842 total leverage) but the ratio of finance lease (operating lease) relative to total leases increases (decreases) after the adoption. This simple statistic is consistent with the stringent categorization rule for a lease being able to be categorized as an operating lease. This is consistent with the findings of some concurrent studies.

required disclosures of future minimum payments but not discounting rates. Hence, the estimation of lease liabilities may overly rely on subjective judgments and oversimplified models.[6]

The adoption of ASC 842 is likely to be useful. First, ASC 842 aims to enhance the disclosure requirements, which can reveal unknown risk factors so that investors can benefit from more detailed disclosures and asses risk.[7] Second, to improve comparability for lease accounting treatment, ASC 842 aligns the lease reporting between the capital and operating leases by requiring the formal recognition of operating lease assets and liabilities on the balance sheet. This formal recognition shall raise investors' awareness of the underlying operating leases, thereby reducing investors' information processing costs (especially for unsophisticated investors) and facilitating their risk assessments. It is important to provide empirical evidence to show whether and how the ASC 842 improves the usefulness of lease accounting, especially because that previous research has also shown that the market pays attention to footnote disclosures of leases.

We focus on examining how the operating lease leverage affects the market assessment of firms' equity risk after the adoption of ASC 842, using both the level and change specifications of two main equity risk measures: the post-filing equity beta and stock return volatility measured over a 52-week period beginning the first week after the firm's 10-K filing date. Our final sample consists of 22,201 firm-year observations between fiscal years 2011 and 2020 for 3,028 U.S. companies that have adopted ASC 842.[8] We collect reported operating lease assets and liabilities from S&P Capital IQ database and extract the operating lease weighted-average discount rate, the cumulative-effect adjustments to the beginning balance of operating lease assets and liabilities, and all distinct lease-related monetary XBRL tags from 10-K filings.

We use a pre-post analysis to examine if ASC 842 adoption affects the informativeness of *estimated* operating lease leverage because the self-estimated lease leverage is important for investors' decision-

[6] For example, users may just multiply the lessee's annual lease expense by a factor: a factor from six to eight to approximate the fair value of the operating lease obligations (FASB 2016b).
[7] For example, under the new standard, a lessee shall disclose the weighted-average remaining lease term, the weighted-average discount rate, the cash flows arising from lease transactions, and separate maturity analyses of its finance lease liabilities and operating lease liabilities, etc.
[8] The adoption year in our sample ranges between 2016 and 2020.

making and the market can estimate the lease leverage before ASC 842 adoption. We predict that informative *estimated* operating lease leverage will improve investors' risk assessment. Our pre-post analysis is based on the final sample of 22,201 firm-year observations from 2011 to 2020. As ASC 842 was issued in 2016, we include five years before and five years after (including 2016) the release of ASC 842 for our full-sample analyses.[9] We first examine if the ASC 842 improves the informativeness of estimated operating lease liability. Having the pre- and post-adoption estimations of operating lease liabilities comparable, we use the disclosed minimum future lease payments and the estimated discount rate for the full-sample analyses (such information is available for both pre- and post-adoption periods). After controlling for firms' pre-filing risk, other firm characteristics, other information in the 10-K filings, and market-level economic factors, we find that the estimated operating lease leverage has a stronger effect on the level of post-filing equity risk in the post-ASC 842 adoption period than in the pre-adoption period. This evidence suggests that investors revise their assessment of the level of firms' fundamental risk after firms adopting ASC 842.

We then examine the usefulness of reported operating lease leverage beyond estimated operating lease leverage. As reported operating lease leverage is only available after the adoption of ASC 842, we focus on the post-ASC 842 adoption period and examine whether the differences between the reported and the estimated operating lease leverage are informative in explaining the market assessment of firms' equity risk. If the market can adequately estimate the operating lease leverage based on lease disclosures, the reported operating lease leverage would have no additional explanatory power. We hypothesize that the adoption ASC 842 provided reported operating lease leverage that is informative beyond the market's estimate. Using a post-ASC 842 adoption sample of 5,163 firm-year observations, we find that the post-filing equity risk measures increase with the reported operating lease leverage. Specifically, we find that the level of post-filing equity risk is positively associated the difference between the reported and estimated magnitudes of operating lease leverage after controlling for the estimated operating lease leverage.

[9] Most companies adopt the standard after its effective date (in 2019); hence, we only have 5,163 observations for the post-adoption period. We also use a balanced design (two years before and two years after the adoption year) for the robustness check.

Contrary to critics' assertion that the implementation of ASC 842 provides limited incremental information, our findings support the hypothesis that the reported operating lease leverage reveals additional information beyond the estimated magnitude, thereby improving investors' risk assessment.

We perform a few additional analyses to substantiate our findings. First, we investigate the information channel through which the reported operating lease leverage is useful to investors. We find that the incremental effect of the reported operating lease leverage on market's assessment of firm risk after ASC 842 adoption is stronger for companies with greater lease accounting reporting complexity. These results suggest that the reported operating lease leverage plays an information role, especially when it is difficult to estimate using footnote disclosures.

Second, in our analyses of the estimated operating lease leverage, we use a simple estimate based on the estimated effective interest rate and adjusted total assets, assuming the right-of-use assets equal to the operating lease liabilities. To reduce potential estimation errors, we refine the estimated operating lease leverage measure for the post-adoption period by using the weighted-average discount rate disclosed in 10-K filings and using the reported right-of-use operating lease assets to calculate total assets. As expected, the refined estimate improves estimation and is closer to the reported value than the simple estimate. We find that our main results are robust when we use the refined estimate of operating leases.

Third, to address concerns related to correlated omitted variables and reverse causality, we employ the annual and short-window changes analyses. We find that the annual changes in the estimated operating lease leverage do not have a significant incremental effect on the annual changes in the post-filing equity risk after the adoption of ASC 842. However, when we refine our analysis (applicable only to return volatility) by focusing on the short-window effect (the stock return volatility between the 60 trading-day period before and the 60 trading-day period after the firm's 10-K filing date), our result using the change model is significant. For the post-adoption analyses, we find that both the annual and short-window changes in post-filing risk significantly increase with changes in the reported operating lease leverage and changes in the difference between the reported and estimated magnitudes. Taken together, we observe stronger effects of changes in the reported operating lease leverage on changes in investors' risk assessment than

effects of changes in the estimated values, suggesting that the estimated operating lease leverage is less informative than the reported operating lease leverage following the adoption of ASC 842.

Fourth, we conduct a difference-in-differences analysis for a balanced sample of firms with non-missing data in two years before and two years after the first year of adoption. We use propensity score matching to identify a control sample of firms with low operating leases and a similar probability of being high operating lease firms. We find that the treatment sample of firms with high operating leases experiences higher post-filing equity risk than firms with low operating leases only in the period after the adoption of ASC 842, but not before, supporting our attribution of increase in investors' risk assessment to ASC 842 adoption.

Fifth, although we control for market-level economic factors in all analyses above, to further alleviate the concern that the increase in investors' risk assessment may be driven by the shock of the Covid-19 crash, we investigate the effect of operating lease leverage on post-filing equity risk potentially affected and unaffected by the Covid-19 crash. We use both the estimated operating lease leverage and the difference between the reported and estimated amount as the leverage components. We find that although the magnitude of the effect of operating lease leverage on the post-filing equity risk in the post-adoption period is higher when the risk measurement window overlaps with the Covid-19 crash than when there is no overlap, the difference between the magnitudes of the effect in these two subsamples (potentially affected and unaffected by the Covid-19 crash) is largely insignificant. This finding suggests that the incremental effect of the estimated and the additionally reported operating lease leverage on investors' risk assessment after the adoption of ASC 842 is not driven by the shock of the Covid-19 crash.

Our study makes important contributions to the academic literature and accounting practices. First, lease accounting's reporting cost and potential negative economic consequences have long been debated. It is important to document whether the new lease standard improves the informativeness of lease accounting. Second, we further prior studies that consider financial statement recognition versus disclosures by extending the research to operating lease liability, confirming the importance of the recognition over disclosures. Third, the existing literature on the impact of ASC 842 focuses on estimated operating lease

liability using footnote disclosures. We confirm that estimated operating lease leverage continues to be an important determinant of investors' risk assessment, which supports the decision-usefulness of estimated lease liability information. Fourth, we contrast the reported and estimated operating lease leverage measures and document that the reported operating lease leverage reveals additional information beyond the estimated magnitude, especially when lease accounting reporting complexity is high. In sum, we conclude that both the increased disclosure requirements and the formal recognition of operating lease liabilities on the balance sheet, as required by ASC 842, are impotent enhancements for the usefulness of lease accounting in assessing firms' equity risk. This study should be of interest to academics, regulators, managers, auditors, and members of the general public who deal with lease accounting-related issues.

The remainder of this paper is organized as follows. In section II, we discuss prior literature and develop our hypotheses. We describe our sample selection, research methodology, and measures in section III, and present our empirical tests in section IV. In section V, we discuss robustness tests and offer additional analysis. Section VI concludes.

II. RELATED LITERATURE AND HYPOTHESIS DEVELOPMENT

Related Literature

Prior literature presents alternative hypotheses on the usefulness of disclosed versus recognized financial information. Schipper (2007) has discussed two hypotheses. The Efficient Market Hypothesis (Fama 1970) predicts that the location and presentation format does not matter. If all financial report users are rational, knowledgeable, and unconstrained by cognitive limitations, once an item has been included in a financial report, then the item's location and the presentation should be irrelevant to how the information impacts the market. The Incomplete Revelation Hypothesis (Grossman and Stiglitz 1980, Bloomfield 2002) predicts that the disclosed information may be undervalued because users lack the ability, knowledge, or willingness to process the information thoroughly. We consider both hypotheses. Following the Efficient Market Hypothesis, we evaluate the informativeness of estimated operating lease liabilities (based on footnote disclosures) as the market will pay attention to the disclosures. Following the Incomplete

Revelation Hypothesis, we evaluate the informativeness of the reported operating lease liabilities since the location matter and the reported numbers will reduce the information cost.

Numerous studies consider whether the market pays attention to off-balance-sheet financing disclosures and whether these disclosures are reflected in various market measures. While some findings are more consistent with the Incomplete Revelation Hypothesis (e.g., Ge 2006, Gallery and Imhoff 1998), many others are consistent with the Efficient Market Hypothesis. As such disclosures are often material and noticeable, research generally finds that off-balance-sheet financing disclosures, such as operating leases (e.g., Lasman and Weil 1978, Imhoff et al. 1991, Imhoff et al. 1993, Ely 1995, Beattie et al. 2000, Cheng and Hsieh, 2000, Lim et al. 2003, Dhaliwal et al. 2011, Bratten et al. 2013, Cook et al. 2021), pension plans (e.g., Dhaliwal 1986, Choi et al. 1997, Jin et al. 2006), asset securitizations (e.g., Niu and Richardson 2006, Landsman et al. 2008, Dechow and Shakespeare 2009), derivatives (e.g., Breuer 2000, Choudhary 2011), and off-balance-sheet R&D limited partnerships or variable interest entities (e.g., Shevlin 1991, Zhang 2008), all have effects on the firm's market valuation or its risk-related measures.

Concurrent studies on ASC 842 find some mixed evidence. One line of research finds that operating leases' disclosure location (e.g., whether in a footnote or on the balance sheet) impacts stock returns and cost of debt. Milian and Lee (2021) find that firms with significant operating leases earn negative returns around the initial recognition of operating leases, suggesting that the market does not fully consider operating lease liability prior to ASC 842 adoption. Hill et al. (2022) find that the effects of expected and unexpected operating lease leverage on abnormal stock returns are both insignificant, suggesting that the increased visibility of operating lease liabilities is not economically meaningful. However, they find that unexpected operating lease leverage has a significantly positive effect on stock returns if operating lease assets and liabilities are disclosed as separate items on the balance sheet. They conclude that the economic significance of ASC 842 is small for most companies but substantial for companies with large unexpected operating lease liabilities (i.e., at the 90th percentile and above). Qiu and Ronen (2019) find that after the issuance of the exposure draft on August 17, 2010 (anticipating ASC 842) and before the formal implementation of ASC 842, loan spread and credit default swap premia significantly increase for firms

with high operating leases. They also find that the effect is more pronounced in firms with lower disclosure reliability and longer lease maturity.

Regarding how operating leases arise, Caskey and Ozel (2019) find that operating leases relate primarily to non-reporting incentives. They find that operating leases relate positively to the probability of bankruptcy and volatility of operations, and negatively relate to marginal tax rates and profit margin. They also find evidence that firms increase their operating leases in advance of issuing equity. They conclude that lease reporting incentives do not drive leasing decisions. In examining the effect of ASC 842, concurrent studies find mixed evidence on the effect on managerial decisions. Yoon (2020) finds that adopting the new standard leads to a decrease in operating leases and provides evidence that operating leases being recognized on balance sheets have a significant impact on managerial leasing decisions. Ma and Thomas (2021) find that operating leases decrease after ASC 842 adoption due to reporting incentives. They find no evidence that these firms suffer a decrease in performance nor that their shareholders, debtholders, and employees are adversely affected. Al-Matouq (2022) find that EBITDA-focused firms are likely to shift between the finance leases and operating leases when making fixed asset investment decisions. Christensen et al. (2022) find that under the old standard, firms whose financing costs are highly sensitive to book leverage have greater balance sheet incentives to finance with operating leases but these incentives reduce under the new standard, consistent with ASC 842's objective to limit opportunistic structuring of lease contracts. In contrast, Ferreira et al. (2022) find that firms affect by the new standard reduce existing debt, while contracting costs play a significant role in the relative decrease in existing debt following the adoption of ASC 842.

Hypotheses Development

Under the previous GAAP guidance (ASC 840), companies follow described rules to categorize leases into capital or operating leases. There is a fine line for leases to be defined as capital or operating leases. Only capital leases will be formally recognized on the balance sheet, increasing leverage. As managers prefer to report lower leverage, firms often write lease contracts to categorize the leases as operating leases rather than capital leases. To protect investors, if operating lease liabilities are not

recognized on the balance sheet, they are required to be disclosed in the notes accompanying financial statements (SFAS 13/ASC 840) and in the Management's Discussion and Analysis (MD&A) section of the registrant's annual reports (SEC Rule FR-67). The purpose of these disclosures is for investors to assess the potential risks arising from operating lease obligations. However, the estimation can be unreliable. As a result, ASC 842 tightened the requirement for leases that have to be categorized as capital leases to not be categorized as operating leases, and it also increased the requirements of disclosures. The most drastic move is that even if operating lease liabilities can be estimated, they have to be formally recognized on the balance sheet. This change drastically increases firms' reported leverages. Literature has long suggested and shown that leverage affects a firm's market risk. Even not formally recognized on the balance sheet, off-balance-sheet financing (e.g., operating leases) should increase the leverage, hence, the market risk. For example, Bratten et al. (2013) find that estimated operating lease liabilities reliably affect a firm's costs of debt and equity; however, investors place less weight on less-reliable estimation of lease values. Therefore, whether ASC 842 improves the reliability of the estimation based on more detailed disclosures is an empirical question.

The estimation involves discounting footnote disclosures of the minimum future lease payments at the effective interest rate. Prior to ASC 842, investors can estimate the present value based on the disclosures of minimum future lease payments and self-estimated effective interest rates. There are two methods suggested in the literature: the constructive capitalization model and the factor model (Imhoff et al. 1991). They differ in the assumption of discounting factor. The constructive capitalization model estimates the present value of future operating lease payments (e.g., Imhoff et al. 1991; S&P 2008, 2019). The factor model multiplies the rent expense by an ad hoc factor (e.g., Imhoff et al. 1993, Jonas 2005). Studies suggested that the traditional footnote disclosure may not be adequate for most market users due to its lack of reliability (e.g., Harper et al. 1987, Aboody 1996, Amir and Ziv 1997, Davis-Friday et al. 2004, and Barth et al. 2003). As ASC 842 requires firms to disclose the discounting rate and mandates many lease-related disclosures, it is likely that the reliability of estimation has increased. In addition to improving the reliability of estimation, the new standard, through requiring formal recognition, should have raised

awareness of the operating lease liability for all investors, especially non-sophisticated users. This awareness will lead to more attention being paid to the operating lease liabilities.

As self-estimation is important since it can be used as a benchmark to evaluate the recognized operating lease liabilities, we first examine whether ASC 842 has improved the informativeness of estimated operating lease leverage.

HYPOTHESIS 1: The estimated operating lease leverage has a stronger effect on investors' assessment of equity risk after the adoption of ASC 842 than before the adoption.

We next examine if the reported operating lease liabilities on the balance sheet, as required by ASC 842, improve the risk assessment of lease leverage. Studies have shown that the location of accounting information matters with respect to its influence on market measures, including valuation and risk. The market, as a whole, pays more attention to the recognition than to the disclosure of accounting information due to reliability differences between recognized and disclosed values. Investors are more likely to process recognized and disclosed information differently when financial reporting requires judgement and estimation (e.g., Choi et al. 1997, Davis-Friday et al. 2004, Choudhary 2011, Bratten et al. 2013). Market participants can either fixate on what is formally recognized on the balance sheet or rely more on their own estimations using the parsimonious models.

In this paper, we do not intend to distinguish the quality of the reported versus estimated information because it is also likely that our estimates may not represent the market's average estimation. Rather, we focus on the relative information role of the reported versus estimated operating lease leverage. If investors can adequately estimate the operating lease leverage, the reported operating lease leverage would provide no additional information to their risk assessment. However, there are at least three reasons leading to the difference between reported and estimated operating lease leverage. First, firms may intend to under-report the operating lease liabilities to avoid high leverage. Second, firms may over-report operating lease liabilities as ASC 842 requires firms to recognize all long-term operating leases into operating lease liabilities. Some operating leases, such as those containing service contracts, can be overstated and not fully reflected in the disclosed information. Third, the estimates may either be higher or

lower than the reported operating lease leverage as the disclosures that are used for estimation may not fully reflect the managerial information set. For example, without additional disclosure, a synthetic lease cannot be differentiated from an operating lease, resulting in external users' misclassification of operating leases (e.g., Zechman 2010). When the reported operating lease leverage deviates from the estimated magnitude, the reported operating lease leverage can reveal additional information beyond the estimated magnitude, thereby affecting investors' risk assessment. Therefore, we present the second hypothesis:

HYPOTHESIS 2: Investors' assessment of equity risk increases with the difference between reported and estimated values of operating lease leverage.

III. SAMPLE, RESEARCH METHODOLOGY, AND MEASURES

Sample Selection

We collect sample observations starting 5 years before the issuance of ASC 842 (in 2016). The initial sample includes 129,970 firm-year observations between fiscal years 2011 and 2020 from the S&P Capital IQ database, which includes firms that are both listed and geographically located in the United States. We remove 71,101 firm-year observations with missing Capital IQ Excel Company ID and Compustat Gvkey link, 26,315 observations for which the ASC 842 adoption year is missing, and 10,353 observations with missing financial and industry information. The final sample consists of 22,201 firm-year observations from 3,028 U.S. companies. Panel A in Table 1 presents the sample selection procedure. Even though companies can elect early adoptions, the majority of the firms adopt the ASC 842 after it becomes effective.[10]

The reported operating lease liabilities, ROU operating lease assets, and the cost of borrowing are collected from Capital IQ. Other financial and accounting data are collected from COMPUSTAT and CRSP. Because early adoption is permitted, we identify the ASC 842-adoption year for each firm and employ firm-specific pre- and post-adoption periods.[11] We extract the operating lease weighted-average discount rate,

[10] 87.1% of our sample firms adopted the new standard in fiscal year 2019, 0.23% adopted early (ranges between 2016 and 2018), and 12.67% adopted in fiscal year 2020.

[11] We identify the year of ASC 842 adoption for each firm by using the COMPUSTAT variable *acctchg* (equal to "ASU16-02" in the annual data). We also use a Python code to extract the first adoption date from 10-K filings and

the cumulative-effect adjustments to the beginning balance of operating lease liabilities and assets in the period of adoption, and distinct lease-related monetary XBRL tags from 10-K filings.[12]

Research Methodology

To test the effects of ASC 842 and consider how the lease leverage affects equity risk, we use a pre-post analysis method focusing on the full sample from 2011 to 2020, with each firm having an adoption year. We estimate the operating lease leverage for the pre- and post-ASC 842 adoption periods. For the pre-adoption period, we adjust the reported leverage to estimated leverage by adding the estimated operating lease liabilities (assets) to the reported liabilities (assets). For the post-adoption period, we adjust the actual leverage by substituting the reported with the estimated operating lease assets and liabilities. The purpose of these adjustments is to assure that we are comparing similar constructs: using the same estimation method and assumptions for the pre- and post-adoption periods. We discuss our research model and measures as equations 1 and 2.

Similar to prior literature (e.g., Ely 1995, Kimmel and Warfield 1995, Niu and Richardson 2006, Kravet and Muslu 2013, and Campbell et al. 2014), the dependent variable, *Equity Risk*, is defined as either the equity beta (systematic risk) or the stock-return volatility (total risk). The equity beta ($Beta_{t+1}$) is estimated from the market model regression of weekly stock returns on the weekly value-weighted market returns over a 52-week period beginning the first week after the firm's 10-K filing date for fiscal year *t*. *Stock-return Volatility*$_{t+1}$ is the standard deviation of weekly stock returns, measured over a 52-week period beginning the first week after the firm's 10-K filing date for fiscal year *t*.[13]

The main independent variable operating lease leverage (*OL_Leverage*) is defined as either the reported (actual) operating lease leverage ($OL\_Leverage^{Actual}$) or the estimated operating lease leverage

manually check the firms' 10-Ks and confirm their adoption dates if there is a difference between the adoption dates collected from COMPUSTAT and 10-Ks, which account for less than 1% of our sample firms.

[12] Appendix C presents the details of the data collection procedure.

[13] Stock return volatility includes the systematic and unsystematic (idiosyncratic) risk components. Studies have used idiosyncratic risk to measure firm-specific information after control for typical risk measures. As we use the raw measures without control for risk, we believe that it is likely that "risk" is the major explanations for the total return volatility.

(*OL_Leverage*^{Estimated}), which are components of *Total Leverage*^{Actual} or *Total Leverage*^{Estimated}, respectively.

Their definitions are presented below.

$$Total\ Leverage^{Actual} = \frac{LT}{AT}$$

$$= Actual\ D^{Exclude\ OL} leverage\ + Actual\ OL\ leverage$$

$$= \frac{D^{Exclude\ OL}}{AT} + \frac{D^{OL}}{AT} \quad (1)$$

$$Total\ Leverage^{Estimated} = \begin{cases} \frac{D^{Exclude\ OL} + \widehat{D^{OL}}}{AT + \widehat{D^{OL}}}, & pre\text{-}ASC\ 842\ adoption\ period \\ \frac{D^{Exclude\ OL} + \widehat{D^{OL}}}{AT - A^{ROU\ OL} + \widehat{D^{OL}}}, & post\text{-}ASC\ 842\ adoption\ period, \end{cases}$$

$$= Estimated\ D^{Exclude\ OL} leverage\ + Estimated\ OL\ leverage$$

$$= \begin{cases} \frac{D^{Exclude\ OL}}{AT + \widehat{D^{OL}}} + \frac{\widehat{D^{OL}}}{AT + \widehat{D^{OL}}}, & pre\text{-}ASC\ 842\ adoption\ period \\ \frac{D^{Exclude\ OL}}{AT - A^{ROU\ OL} + \widehat{D^{OL}}} + \frac{\widehat{D^{OL}}}{AT - A^{ROU\ OL} + \widehat{D^{OL}}}, & post\text{-}ASC\ 842\ adoption\ period. \end{cases} \quad (2)$$

where

LT = the fiscal-year-end total on-balance-sheet liabilities.

AT = the fiscal-year-end total on-balance-sheet assets.

$D^{Exclude\ OL}$ = total on-balance-sheet liabilities excluding reported operating lease liabilities (=LT) in the pre-adoption period and =($LT - D^{OL}$) in the post-adoption period.

D^{OL} = the reported operating lease liabilities recognized on the balance sheet in the post-adoption period.

$A^{ROU\ OL}$ = the net right-of-use (ROU) operating lease asset recognized on the balance sheet following the new lease accounting standard.

$\widehat{D^{OL}}$ = the estimated operating lease liability based on disclosed future minimum lease payments and either the estimated effective interest rate or the disclosed discount rate.[14]

[14] In additional analyses, we refine the post-adoption formula in equation 2 and calculate an alternative measure of the estimated operating lease leverage: use total assets as the denominator while replace $\widehat{D^{OL}}$ with $\widehat{D^{OL(R)}}$ in the numerator, where $\widehat{D^{OL(R)}}$ is the estimated operating lease liability based on disclosed future minimum lease payments and the disclosed discount rate. In untabulated analyses, we two additional alternative measures of the estimated operating lease leverage: use total assets as the denominator, or replace $\widehat{D^{OL}}$ in both the numerator and denominator with $\widehat{D^{OL(R)}}$ for the post-adoption period. Overall, we find that our main results remain robust (to be discussed in the empirical results section).

For $Total\ Leverage^{\ Estimated}$, to be consistent between the pre- and post-adoption periods, we adjust *AT* by substituting the ROU ($A^{ROU\ OL}$) with the estimated operating lease liability.[15]

As ASC 842 mainly affects the accounting treatment of operating leases, we evaluate which component, operating lease or its counterpart (i.e., debt excluding operating leases) in the total leverage drives equity risk. We provide a description of the measures as equations 1 and 2.

We calculate the estimated operating lease leverage ($\widehat{D^{OL}}$) using the constructive capitalization method (Imhoff et al. 1991).[16] Specifically, we follow the S&P's (2008, 2019) methodology and prior literature (e.g., Bratten et al. 2013, Caskey and Ozel 2019) for capitalizing operating leases.[17] The capitalization method estimates the present value of future lease payments by discounting minimum future lease payments at the effective interest rate and assumes the operating lease assets equal to the operating lease liabilities. For the lease payments beyond the fifth year, which are disclosed in an aggregate value as "thereafter," we assume the payments are distributed equally at the fifth year's level (or the amount in the nearest year with available data) until the total amount is paid. We calculate the effective interest rate as the interest expense divided by the average total debt. Similar to prior literature (e.g., Caskey and Ozel 2019), if the effective interest rate is missing or non-positive, it is replaced with the average of the one-year-lagged and one-year-ahead cost of borrowing. If the average cost of borrowing or total debt is missing, the effective interest rate is replaced with the mean borrowing rate in the same two-digit SIC code industry year. We first use the estimated effective interest rate to keep the estimation method similar for the pre- and post-adoption periods. This analysis focuses mainly on whether the adoption raises investor awareness as the estimation quality is similar. According to Bratten et al. (2013), estimated lease liabilities are of high quality except when the estimation is likely to be unreliable. For additional analyses, we also use the

[15] Similar to Bratten et al. (2013), we assume the estimated lease asset is the same as the estimated lease liability.

[16] Further, Imhoff et al. (1993) evaluate two alternative methods for capitalizing operating lease obligations: the constructive capitalization method (Imhoff et al. 1991) and the factor method. The former applies effective interest rate to discount future lease payments and the latter simply multiplies the future lease payment by a factor. They find that the factor method leads to over-estimation.

[17] As a robustness check, we use the factor method (e.g., Jonas 2005) to calculate an alternative measure for estimating the operating lease liabilities by multiplying the rent expense by a factor of 8 (8 × Rent Expense). Overall, we find that our main results remain robust.

reported discount rate by the managers in estimating the leverage to examine if this disclosure improves the informativeness of estimated leverage.

We include seventeen firm- and market-level control variables that impact risk according to prior research. In particular, we control for the pre-filing equity risk (e.g., Campbell et al. 2014), size, the dividend payout ratio (e.g., Beaver et al. 1970, Bowman 1979), the market-to-book ratio (Jin et al. 2006), the profit margin, asset turnover (e.g., Logue and Merville 1972), free cash flow (e.g., Guay 1999), the net working capital, capital expenditure, acquisition activity (e.g., Bates et al. 2009), research and development, advertising (e.g., Chan et al. 2001), earnings volatility (e.g., Healy and Palepu 1990), and foreign pre-tax income (e.g., Thomas 1999). Similar to Kravet and Muslu (2013), we also control for market-level economic factors (e.g., market return volatility and market returns) and the overall information in the 10-K filings using the signed and absolute value of the firm's three-day filing returns (i.e., *Filing Return* and *Absolute Filing Return*). Industry fixed effects are defined based on the SIC 2-digit industry classifications. Appendix B presents the variable definitions.

Leverage Component Model: evaluating the components of total leverage:

$$\begin{aligned} Equity\ Risk_{i,t+1} = {} & \propto_0 + \propto_1 Leverage_{i,t}^{Exclude\ OL} + \propto_2 OL\_Leverage_{i,t}^{Estimated} \\ & + \propto_3 Leverage_{i,t}^{Exclude\ OL} \times POST_{i,t} + \propto_4 OL\_Leverage_{i,t}^{Estimated} \times POST_{i,t} \\ & + \propto_5 POST_{i,t} + \propto_6 Equity\ Risk_{i,t} + \propto_7 Equity\ Risk_{i,t} \times POST_{i,t} \\ & + \sum \propto_k Other\ Controls_{i,t} + \sum \propto_k Other\ Controls_{i,t} \times POST_{i,t} \\ & + Industry\ and\ Year\ FE + \epsilon_{it.} \end{aligned} \quad (3)$$

POST is an indicator variable equal to one for fiscal years after the firm first adopts ASC 842, and zero otherwise. If the impact of leverage on investors' assessment of equity risk, on average, increases after the adoption of ASC 842, We expect the coefficients on the interaction terms of the leverage measures with *POST* to be positive, reflecting the informational impact of the new lease standard.

Our second hypothesis evaluates the relative informativeness of the reported operating liabilities over the estimated operating lease liabilities. As firms only report operating lease assets and liabilities for the post-adoption period, we focus our analysis on the post-adoption sample. To examine whether the magnitude of reported over the estimated operation lease leverage has risk implications, we modify equation

(3) by adding a difference-related variable $OL\_Leverage_{i,t}^{Actual-Estimated}$ and develop equation (4) as the following:

$$Equity\ Risk_{i,t+1} = \propto_0 + \propto_1 Leverage_{i,t}^{Exclude\ OL} + \propto_2 OL\_Leverage_{i,t}^{Estimated} + \propto_3 OL\_Leverage_{i,t}^{Actual-Estimated} + \propto_4 Equity\ Risk_{i,t} + \sum \propto_k Other\ Controls_{i,t} + Industry\ and\ Year\ FE + \epsilon_{it.} \quad (4)$$

where $OL\_Leverage_{i,t}^{Actual-Estimated}$ is the difference between the actually reported and estimated values of operating lease leverage. We discuss these regression models in more details in the empirical section.

IV. EMPIRICAL RESULTS

Summary Statistics

Panel B of Table 1 presents the summary statistics for the market-based risk measures, the leverage measures, firm characteristics, and market-level economic factors. Specifically, the mean (median) *OL_Leverage*^{Estimated} is 0.0475 (0.0211) for the full sample period. For the post-adoption period, the mean (median) *OL_Leverage*^{Actual} is 0.0456 (0.0202), while the mean (median) *OL_Leverage*$^{Actual–Estimated}$ is 0.0015 (0.0015). An untabulated test also shows that the mean difference between the reported and estimated operating lease leverage (i.e., *OL_Leverage*$^{Actual–Estimated}$) is significantly positive at the 1 percent level, suggesting that, on average, firms recognized more operating leverage than the estimated magnitude.[18]

Panel C in Table 1 presents the univariate tests on the market-based risk measures, the leverage measures, and the control variables for both the pre- and post-adoption periods. The future and contemporaneous equity beta and stock return volatility are all significantly higher in the post-adoption period than those before the adoption. *Leverage*$^{Exclude\ OL}$ is not significantly different between the pre- and post-adoption periods, suggesting that the new standard has no significant effect on companies' lease decisions. However, it is apparent that the standard affects the composition of finance (capital) lease leverages and operating lease leverages. The mean (median) of the estimated operating lease leverage (*OL_Leverage*^{Estimated}) is 0.0484 (0.0210) in the pre-adoption period and 0.0445 (0.0214) in the post-

[18] It is puzzling why managers would recognize operating leases more than the estimated operating leases as managers prefer to report lower leverage. As discussed later, it is likely that this is due to estimation errors.

adoption period. The difference is significant. In an untabulated analysis, we compare the estimated operating lease leverage with the finance lease leverage (*FL_Leverage*) for the pre- and post-adoption periods. The mean of finance lease leverage is significantly higher after adoption (mean=0.0038) than before it (mean=0.0027) (p-value<0.0001). The ratio of operating lease leverage relative to the sum of operating lease and finance leverages has significantly decreased (from 0.9370 to 0.8842, t-test's p-value<0.0001), but the relative ratio of finance lease leverage significantly increases (from 0.0620 to 0.1149, t-test's p-value<0.0001).[19] This evidence suggests that since ASC 842 tightened the categorization of leases as operating leases, more operating leases are categorized as finance leases. In addition, the lease accounting reporting complexity (*Lease ARC*) and the operating lease accounting reporting complexity (*Operating Lease ARC*) significantly increase from the pre- to post-adoption period. All other control variables, except *Earnings Volatility*, are significantly different between the two periods, suggesting that these variables may drive the differences in equity risk between the two periods. We now turn to multivariate analysis.

Effect of ASC 842 Adoption on the Risk Implications of Estimated Operating Lease Leverage (Pre-Post Analysis)

To confirm how the new standard affects the risk implications of estimated operating lease leverage, we first use a pre-post model to examine if the adoption of ASC 842 affects the impact of operating lease leverage on investors' risk assessment. Table 2 details the results. Columns 1 and 2 are for equity beta, and columns 3 and 4 are for stock-return volatility. Columns 1 and 3 (columns 2 and 4) analyze the full-sample analyses without (with) interaction terms with *POST*, focusing on the effect of the estimated operating leverage on the one-year-ahead beta and stock-return volatility, respectively.

We decompose *Total Leverage*^{Estimated} into *Leverage*$^{Exclude\ OL}$ and *OL_Leverage*^{Estimated} as defined in equation 2. Table 2 presents the results of estimating equation 3. We first analyze the post-filing risk

[19] *FL_Leverage* is measured as $\frac{D^{FL}}{AT+\widehat{D^{OL}}}$ for the pre-adoption period and $\frac{D^{FL}}{AT-A^{ROU\ OL}+\widehat{D^{OL}}}$ for the post-adoption period. The ratio of operating lease leverage relative to the sum of operating lease and finance leverages is measured as $\frac{OL\_Leverage^{Estimated}}{OL\_Leverage^{Estimated}+FL\_Leverage}$. Similarly, the relative ratio of finance leases is measured as the ratio of operating lease leverage relative to the sum of operating lease and finance leverages is measured as $\frac{FL\_Leverage}{OL\_Leverage^{Estimated}+FL\_Leverage}$.

measured as equity beta. In column 1 (for equity beta), the coefficient on $Leverage^{Exclude\ OL}$ is significant and positive with the coefficient = 0.0476 and *t*-stat. =1.76 but the coefficient on $OL\_Leverage^{Estimated}$ is insignificant with the coefficient = 0.1735 and *t*-stat. =1.29. The χ^2-test shows that the magnitudes of the coefficients on $Leverage^{Exclude\ OL}$ and $OL\_Leverage^{Estimated}$ are not statistically different (*p*-value = 0.3403).[20] We add *POST* and the interaction terms with *POST* variables in column 2, which shows that the coefficient on $OL\_Leverage^{Estimated} \times POST$ (coefficient = 0.8853; *t*-stat. =4.77) is significant and positive. However, the coefficient on $Leverage^{Exclude\ OL} \times POST$ is insignificant. This result suggests that the operating lease leverage, but not its counterparts, has significant incremental effect on the one-year-ahead equity beta in the post-adoption period. We repeat the above analyses in columns 3 and 4 using the post-filing *Stock-return Volatility* as the dependent variable and find similar results, except that the coefficient on $OL\_Leverage^{Estimated}$ in columns 3 and 4 are also significant and positive (coefficient = 0.0203 and 0.0106 with *t*-stat. =2.66 and 2.42, respectively). For the *POST* effect, column 4 shows that the coefficient on $OL\_Leverage^{Estimated} \times POST$ is positive and significant (coefficient = 0.0509; *t*-stat. =3.67), while the coefficient on $Leverage^{Exclude\ OL} \times POST$ is insignificant.

These results are consistent with *Hypothesis 1* that the estimated operating lease leverage has a stronger effect on investors' risk assessment after the adoption of ASC 842 than before the adoption.

Risk Implications of Reported versus Estimated Operating Lease Leverage (Post-Adoption Analysis)

The previous section reports that the adoption of ASC 842 has improved the risk implication of the operating lease leverage. To examine the incremental effect of reported versus estimated operating lease liabilities on investors' assessment of equity risk, we analyze the post-adoption sample. For each of the 5,163 post-adoption observations, we derive a new variable defined as the difference between $OL\_Leverage^{Actual}$ and $OL\_Leverage^{Estimated}$, i.e., $OL\_Leverage^{Actual–Estimated,}$ and add it to the component model of $Total\ Leverage^{Estimated}$ in equation 2.

[20] In untabulated tests, we exclude the pre-filing risk control variables ($Beta_t$ and $Stock\text{-}return\ Volatility_t$) in the regression analyses. Results are consistent with those in Table 2.

We report regression results of equation 4 in Table 3. Refer to columns 1 through 3 for the post-filing equity beta; the coefficients on the operating lease leverage variables are all significantly positive. The coefficients on $Leverage^{Exclude\ OL}$ in columns 1 and 2 are insignificant but the coefficients on $OL\_Leverage^{Actual}$ (coefficient = 0.7078; *t*-stat. =11.77 in column 1) and $OL\_Leverage^{Estimated}$ (coefficient = 0.9254; *t*-stat. =5.45 in column 2) are both significant and positive. In addition, the coefficients on $OL\_Leverage^{Actual}$ and $OL\_Leverage^{Estimated}$ are significantly greater than the coefficient on $Leverage^{Exclude\ OL}$ (χ^2-test's *p*-value = 0.000). We find similar results when use the post-filing stock-return volatility as the dependent variable in columns 4 and 5. These results suggest that, for the post-adoption period, both the estimated and reported operating lease leverage contribute more than their counterparts to the variations in post-filing equity risk.

Columns 3 and 6 add $OL\_Leverage^{Actual–Estimated}$ to the component model of total estimated leverage. We still find significant and positive coefficients on $OL\_Leverage^{Estimated}$ (coefficient = 0.9012, *t*-stat. =7.85 in column 3; coefficient = 0.0594, *t*-stat. =3.21 in column 6). Moreover, the coefficient on $OL\_Leverage^{Actual–Estimated}$ is significantly positive in column 3 (coefficient = 0.4171; *t*-stat. =2.85) and marginally significant at the 10 percent level (based on a one-tailed test) in column 4. This result suggests that the reported operating lease leverage provides additional implications to investors' risk assessment beyond the estimated operating lease leverage.

In sum, the evidence supports *Hypothesis 2* that investors' assessment of equity risk increases with the difference between reported and estimated values of operating lease leverage. However, the comparison between the reported and estimated operating lease leverage values may be subject to potential estimation errors. We further discuss this in Section V, where we adjust the estimation assumptions based on the managers' disclosed discounting rate and the reported right-of-use operating lease assets.

V. ROBUSTNESS AND ADDITIONAL ANALYSES

Reported Operating Lease Leverage on Equity Risk–Effect of Estimation Error Likelihood

Prior literature suggests that the estimated operating lease leverage based on disclosures may not explain risk well when the estimations are unreliable (e.g., Bratten et al. 2013, Qiu and Ronen 2019).

Similarly, we expect that the reported operating lease leverage is more useful to investors if estimating the operating lease leverage is more difficult. Specifically, we identify cross-sectional variation in the difficulty in estimating operating lease leverage by using lease accounting reporting complexity to surrogate the difficulty in estimation. Prior literature finds that the textual complexity of 10-K filings is positively associated with equity capital cost (Rjiba et al. 2021), and is more likely to lead to stock price underreaction (You and Zhang 2009). Enache et al. (2022) find that as firms' lease transition disclosures become less readable and more dissimilar as they get closer to the adoption of ASC 842. We predict that estimation errors of operating lease leverage are likely to be high when lease accounting reporting complexity is high. This will make the reported operating lease leverage more useful to financial statement users for companies with greater lease accounting reporting complexity. As a result, we shall observe that the reported operating lease leverage is more informative for firms with higher lease accounting reporting complexity than firms with lower lease accounting complexity.

Hoitash and Hoitash (2018) create an accounting reporting complexity measure as the natural log of the total number of distinct monetary XBRL tags in 10-K filings and find that this measure broadly captures accounting reporting complexity and is associated with a greater likelihood of misstatements and material weakness disclosures, longer audit delays, and higher audit fees. We modify the Hoitash and Hoitash (2018) measure by focusing on lease accounting reporting complexity. Our first measure is the lease accounting reporting complexity (*Lease ARC*) calculated as the natural log of one plus the total number of distinct monetary XBRL tags containing the keyword "*Lease*" in a 10-K filing. Our second measure is the operating lease reporting complexity (*Operating Lease ARC*) calculated similar to *Lease ARC* but restrict XBRL tags to those containing the keyword "*OperatingLease*". We expect the difficulty in estimating operating lease liabilities increases with these two measures.

Panel A of Table 4 presents the results of the effect of lease accounting reporting complexity (*Lease ARC*) on the relation between leverage components and the post-filing equity risk for the post-adoption sample. The coefficients on our main variable of interest, $OL\_Leverage^{Actual–Estimated} \times Lease\ ARC$ are positive and significant in columns 3 (coefficient = 1.5480, *t*-stat.=3.60) and 6 (coefficient = 0.0604, *t*-

stat.=8.55). This result suggests that the effect of the reported versus estimated operating lease leverage on investors' assessment of equity risk is stronger for firms with higher lease accounting reporting complexity. The χ^2-tests (based on one-tailed tests) show that the economic significance of the incremental effect of the difference between reported and estimated values on investors' risk assessment is substantial for companies with high lease accounting reporting complexity (i.e., at the median or above). Panel B of Table 4 presents the results using operating lease reporting complexity (*Operating Lease ARC*). Similar to results in Panel A, the coefficients on $OL\_Leverage^{Actual-Estimated}$ × *Operating Lease ARC* are positive and significant in columns 3 (coefficient = 1.4020, *t*-stat.=4.50) and 6 (coefficient = 0.0991, *t*-stat.=2.90). The χ^2-tests (based on one-tailed tests) show that the economic significance of the incremental effect of the difference between the reported and estimated operating lease leverage is substantial for companies with high operating lease reporting complexity (i.e., at the 75th percentile or above).

Overall, these results suggest that the incremental effect of the difference between the reported and estimated operating lease leverage on the market's assessment of firm risk after ASC 842 adoption is stronger when operating lease leverage is more difficult to estimate using parsimonious models.

Refined Estimation Based on Operating Lease Weighted-average Discount Rate

Previous analyses estimate the present value of future lease payments by discounting minimum future lease payments at the estimated effective interest rate for both pre- and post-adoption periods. Since the weighted-average discount rate for operating leases is required to be disclosed under the new standard, it is likely that investors will use the disclosed discount rate. To reduce potential estimation errors, we refine the estimate of operating lease leverage using the disclosed discount rate for the post-adoption period. Therefore, equation 2 is modified as the following:

$$Total\ Leverage^{Estimated(R)} = Estimated\ D^{Exclude\ OL} leverage + Estimated\ OL\ leverage$$

$$= \begin{cases} \dfrac{D^{Exclude\ OL}}{AT + \widehat{D^{OL}}} + \dfrac{\widehat{D^{OL}}}{AT + \widehat{D^{OL}}}, for\ the\ pre\text{-}ASC\ 842\ adoption\ period \\ \dfrac{D^{Exclude\ OL}}{AT} + \dfrac{\widehat{D^{OL(R)}}}{AT}, \quad for\ the\ post\text{-}ASC\ 842\ adoption\ period. \end{cases} \quad (5)$$

The operating lease weighted-average discount rates are collected from XBRL tags in 10-K filings. Specifically, for the post-adoption period, the estimated operating lease liability measure $\widehat{D^{OL(R)}}$ is calculated as the present value of future lease payments by discounting minimum future lease payments at the weighted-average discount rate. For the pre-adoption period, $\widehat{D^{OL(R)}}$ is estimated by using the estimated effective interest rate, as defined in equation 2. For the post-adoption period, the denominator is total assets (*AT*). If the newly disclosed discount rate is informative, we expect the estimated operating lease leverage to be more accurate and closer to the reported magnitude than the unrefined measure. Table 5 shows that the mean (median) of the absolute value of $OL\_Leverage^{Actual-Estimated(R)}$ is 0.0075 (0.0010) for the post-adoption sample. This amount is smaller than the mean (median) of the absolute value of $OL\_Leverage^{Actual-Estimated}$ based on the unrefined estimate, consistent with our expectation that using the newly disclosed discount rate brings the estimation closer to the reported value.

To test Hypotheses 1 and 2, we repeat our previous analyses in Tables 2 and 3, using the refined operating lease leverage measures. Similar to our previous results in Table 2, Panel A of Table 5 shows that the coefficients on $OL\_Leverage^{Estimated(R)} \times POST$ are positive and significant (coefficient = 0.5692, *t*-stat. =3.69 in column 2; coefficient = 0.0290, *t*-stat. =1.83 in column 4). Similar to results in Table 3, Panel B of Table 5 shows that the coefficients on $OL\_Leverage^{Actual-Estimated(R)}$ are also positive and significant (coefficient = 0.8744, *t*-stat. =8.02 in column 3; coefficient = 0.0398, *t*-stat. =2.12 in column 6). These results are consistent with the suggestion that the newly disclosed information is useful for market participants in estimating the operating lease leverage. We conclude that the effect of the refined estimate of operating lease leverage on investors' risk assessment is stronger in the post-adoption period than before the ASC 842 adoption. While both the refined estimate and the reported operating lease leverage are informative in assessing equity risk after the adoption, the difference between the reported and refined estimate of operating lease leverage has incremental effect on investors' risk assessment, suggesting the importance of formal recognition.

Changes Analyses

To address concerns related to correlated omitted variables and reverse causality, we employ changes analyses for the pre-post and post-adoption analyses, respectively. To calculate $\Delta OL\_Leverage^{Actual}$ and $\Delta OL\_Leverage^{Actual-Estimated}$, for the post-adoption period, the reported operating lease leverage $OL\_Leverage^{Actual}$ is defined the same as in equation 1, which is the ending balance of the reported operating lease liability recognized on the firm's balance sheet in the period of adoption, deflated by total assets ($\frac{D^{OL}}{AT}$). For the year prior to the first year of adoption (year –1), we refine reported operating lease leverage $OL\_Leverage^{Actual}$ as below:

$$OL\_Leverage^{Actual} = \frac{D^{OL(B)}}{AT + A^{ROU\ OL(B)}}, \quad (6)$$

where $D^{OL(B)}$ and $A^{ROU\ OL(B)}$ are the disclosed cumulative-effect adjustments to the beginning balance of operating lease liabilities and assets in the adoption period, respectively.

Table 6 presents results of estimating the effect of changes in leverage components on annual changes in equity risk, where the dependent variables are the change in equity beta ($\Delta Beta_{t+1}$) and the change in stock-return volatility ($\Delta Stock\text{-}return\ Volatility_{t+1}$) measured between the 52-week period before and the 52-week period after the firm's 10-K filing date for fiscal year *t*. Table 7 presents results of estimating the effect of changes in leverage components on the short-window changes in equity risk after controlling for the quarterly changes in seasonally adjusted sales growth and income. The short-window change in the post-filing risk is measured as the difference in stock return volatility between the 60 trading-day period before and the 60 trading-day period after the firm's 10-K filing date, multiplied by 100.

We find mixed results for the change in the estimated operating lease leverage in the pre-post analyses. Tables 6 shows that the coefficients on $\Delta OL\_Leverage^{Estimated} \times POST$ are statistically insignificant, suggesting that the annual changes in the estimated operating lease leverage do not have a significant incremental effect on the annual changes in the post-filing equity risk after the adoption of ASC 842. However, Table 7 shows that the effect of the annual changes in the estimated operating lease leverage on short-window changes in the post-filing risk is significantly stronger in the post-adoption period than in the pre-adoption period (coefficient on $\Delta OL\_Leverage^{Estimated} \times POST$ = 3.1310; t-stat. =4.01).

Tables 6 and 7 show that, for the post-adoption analyses, both the annual and short-window changes in post-filing risk measures are all significantly and positively associated with annual changes in the reported operating lease leverage ($\Delta OL\_Leverage^{Actual}$) as well as the difference between the reported and estimated magnitudes of operating lease leverage ($\Delta OL\_Leverage^{Actual–Estimated}$). However, the coefficients on $\Delta OL\_Leverage^{Estimated}$ in the post-adoption analyses in Tables 6 and 7 are largely insignificant or lower than those on $\Delta OL\_Leverage^{Actual}$ or $\Delta OL\_Leverage^{Actual–Estimated}$. Taken together, our results may suggest that the increase in investors' risk assessment is more likely to be driven by the increase in reported operating lease leverage than by the increase in estimated operating lease leverage.

Difference-in-Differences Analysis: High versus Low Operating Lease Leverage

We conduct a difference-in-differences analysis for a sample of firms with non-missing data in two years before and two years after the first year of adoption. The treatment sample includes firms in the highest quintile of estimated operating lease each year (High-OL firms). We use propensity score matching to identify a control sample of firms in the lowest operating lease quintile (Low-OL firms) and a similar probability of being High-OL firms.[21] Each High-OL firm is matched with one Low-OL firm that has the nearest propensity score in the same Fama and French (1997) 12-industry classification and year. The propensity scores are estimated using the logistic regression:

$$\Pr(Treat) = \alpha + \gamma Match\ Variables + \varepsilon. \quad (7)$$

where *Treat* is an indicator variable that equals one if the firm is a High-OL firm and zero if the firm is a Low-OL firm. The match variables include $Leverage^{Exclude\ OL}$, *Size*, *MB*, *Profit Margin*, *Free Cash Flow*, *Net Working Capital*, *Capital Expenditure*, *R&D*, *Advertising*, *Dividend Payout*, *Asset Turnover*, *Earnings Volatility*, *Acquisition activity*, and *Foreign pretax income.*

Table 8 shows that the coefficient on *Treat* × *POST* is significant and positive (coefficient = 0.4632, *t*-stat. =3.17 in column 1; coefficient = 0.0243, *t*-stat. =2.97 in column 2). In contrast, the coefficients on the standalone variables *Treat* and *POST* are both insignificant. This evidence suggests that the treatment

[21] To construct the control sample, we start with the initial sample of 129,970 firm-year observations which may contain non-ASC-842 adopters and firm-year observations with zero operating leases.

sample of High-OL firms experiences higher post-filing equity risk than Low-OL firms only in the post-adoption period, but not before, supporting our attribution of the increase in investors' risk assessment to the adoption of ASC 842.

The Effect of the Shock of Covid-19 Crash

Covid-19 broke out around the world at the end of 2019 and triggered huge market uncertainty. For example, Rizwan et al. (2020) find a significant increase in systemic risk in the banking sectors. In particular, prior literature (e.g., Huang et al. 2021, Glossner et al. 2021) define the period from February 24, 2020 to March 23, 2020 as the U.S. stock-market crash period in response to the Covid-19 outbreak. Although we control for market-level economic factors in all analyses, to further alleviate the concern that the increase in investors' risk assessment may be driven by the shock of the Covid-19 crash but not the adoption of ASC 842, we split our sample into two cohorts that are potentially affected and unaffected by the Covid-19 crash. To exclude the overlap between the one-year-ahead risk measurement window and the Covid-19 crash period, if a firm's 10-K filing date is before February 24, 2019 or after March 23, 2020, it is classified into the Non-Covid-19 period. If a firm's 10-K filing date is between February 24, 2019 and March 23, 2020, it is classified as potentially affected by the Covid-19 crash. 226 unique filing dates ranging from February 25, 2019 to March 23, 2020 for 3,997 firm-year observations are included in the Covid-19 crash cohort, while 1,702 unique filing dates between August 12, 2011 and February 22, 2019 and between March 24, 2020 and August 27, 2021 for 18,204 firm-year observations are included in the Non-Covid-19 cohort.

Panel A of Table 9 presents results of estimating the effect of leverage components on equity risk in the pre- and post-adoption period. Using $Beta_{t+1}$ as the dependent variable, column 1 shows that the coefficient on $OL\_Leverage^{Estimated} \times POST$ is significant and positive when the post-filing risk measurement window overlaps with the Covid-19 crash period (coefficient = 1.1370; t-stat.=9.22). However, we also find a significantly positive coefficient on $OL\_Leverage^{Estimated} \times POST$ for the Non-Covid-19 period in column 2 (coefficient = 0.8757; t-stat.=2.02). The magnitudes of these two coefficients are not statistically different (χ^2-test's p-value =0.620). When we use $Stock\text{-}return\ Volatility_{t+1}$ as the

dependent variable in columns 3 and 4, we find similar results, except that the coefficient on $OL\_Leverage^{Estimated} \times POST$ in column 4 is marginally significant at the 10 percent level using a one-tailed test (coefficient = 0.0209; t-stat.=1.51), which is significantly lower than that in column 3 (χ^2-test's *p*-value =0.069).

Panel B of Table 9 presents results of estimating the effect of leverage components on equity risk in the post-adoption period. Columns 1 and 3 show that the coefficients on $OL\_Leverage^{Actual–Estimated}$ are both significant and positive when the post-filing risk measurement window overlaps with the Covid-19 crash period. For the Non-Covid-19 period, $OL\_Leverage^{Actual–Estimated}$ is insignificantly related to post-filing equity beta (in column 2) and significantly and positively related to post-filing stock-return volatility (in column 4). The two-tailed χ^2-test further shows that the difference between the magnitudes of the coefficients on $OL\_Leverage^{Actual–Estimated}$ is insignificant between the Covid-19 crash and Non-Covid-19 cohorts. We repeat the above analyses in columns 5–8 by refining the estimated operating lease leverage following equation 5. The coefficients on $OL\_Leverage^{Actual–Estimated(R)}$ are significant and positive in both of the Covid-19 crash and Non-Covid-19 cohorts and the magnitudes of the coefficients in the two cohorts are not statistically significant. This finding suggests that the incremental effect of the estimated and the additionally reported operating lease leverage on investors' risk assessment is not driven by the shock of the Covid-19 crash.

VI. CONCLUSION

This paper examines whether and how the adoption of ASC 842 affects market participants' assessment of firms' equity risk, measured by the post-filing equity beta and total stock-return volatility. We hypothesize that since ASC 842 has enhanced the lease disclosures, its adoption should improve the informativeness of estimated operating lease leverage for investors' assessment of equity risk. Moreover, ASC 842 requires formal recognition of operating lease assets and liabilities on the balance sheet, which should increase investors' awareness of the operating leases. Using a pre-post analysis, we find ASC 842 improved the informativeness of estimated operating lease leverage. We attribute these findings to

enhanced disclosures and investors' awareness of the underlying operating leases following the adoption of ASC 842.

We then evaluate if the reported operating lease leverage provides additional information over the estimated operating lease leverage in explaining variations in investors' risk assessment. We find that that investors' risk assessment increases with the difference between reported and estimated values of operating lease leverage. This finding is robust when we use both the level and changes analyses or use the refined estimate of operating lease leverage.

In additional analyses, we use two lease accounting reporting complexity measures as proxies for the potentially high estimation errors from parsimonious models. We find that, after the adoption of ASC 842, the effect of the differences in the reported and estimated operating lease leverage on equity risk is stronger for companies with greater lease accounting reporting complexity. These results are consistent with the notion that reported operating lease leverage plays an information role, especially when estimating the operating lease leverage is difficult.

Our findings are interesting that even though firms are required to formally recognize the operating lease liabilities on the balance sheet, the market, as a whole, still relies on estimated operating lease leverage to a large extent. However, the reported operating lease leverage becomes important when the market needs such information to verify the estimation. Furthermore, our findings suggest that, while recognition is necessary, footnote disclosures accompanying financial reporting cannot be ignored. This study also has implications for standard setters by confirming that the objectives set by the ASC 842 have been largely achieved, and both recognition and disclosures are essential to enhance the usefulness of accounting information.

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APPENDIX A

Background

The Development of Lease Accounting Standards

The previous accounting model for leases in U.S. GAAP (ASC 840) and IFRS (IAS 17) required lessees to recognize assets and liabilities arising from capital leases but not from operating leases. Operating leases also have committed future payments. Without formally recognizing operating lease obligations as liabilities leads to substantial off-balance-sheet financing amounts. The Securities and Exchange Commission (SEC) estimated that public companies in the U.S. might have approximately $1.25 trillion in non-cancelable future cash obligations committed under operating leases that were off-balance-sheet (SEC 2005). Listed companies using IFRS or U.S. GAAP disclose almost $3 trillion of off-balance-sheet lease commitments (IFRS 2016). In dealing with these large effects of omitting operating lease liability on the balance sheet, the FASB and IASB started to work together to revise the lease accounting standard.

The previous lease accounting has been criticized for at least two reasons. First, it is too reliant on subjective judgments (e.g., Deloitte 2020). According to the FASB, most financial statement users adjusted a lessee's financial statements to capitalize operating leases by estimating the present value of future lease payments. However, because of the limited information available, many users used techniques such as multiplying the lessee's annual lease expense by a factor that ranges from six to eight to approximate the fair value of the operating lease obligations (FASB 2016b). These different adjustment approaches varied significantly depending on the assumptions made by different users, which could create information asymmetry in the market (FASB 2016b). Second, as a result of the previous accounting model for leases, economically similar transactions were accounted for differently in the financial statements, i.e., the assets and liabilities associated with capital leases were recognized, but those associated with operating leases were not recognized. The different accounting models applied to capital leases and operating leases reduced the comparability of lessees' financial commitments (FASB 2016b, IFRS 2016).

In 2006, the FASB and the IASB initiated a joint project to improve the accounting for leases. In March 2009, the Boards published a joint Discussion Paper (the 2009 DP), set out the Boards' preliminary views on lessee accounting, and proposed a right-of-use accounting model for lessees (FASB 2009). In August 2010, the Boards published a joint Exposure Draft (the 2010 ED) and developed the guidance. The 2010 ED further developed the right-of-use accounting model for lessees and included lessor accounting in the proposals in response to feedback on the 2009 DP (FASB 2010). According to the feedback received on the 2010 ED, there was general support for recognizing assets and liabilities arising from leases. Still, many respondents were concerned about the costs, complexity, and the breadth of the scope of the proposals (FASB 2016b). Considering all of the feedback received on the 2010 ED, the Boards published a joint Revised Exposure Draft in May 2013 (the 2013 ED). They proposed a recognition and measurement model for expenses arising from leases (FASB 2013).

When developing the guidance in the new standard, the boards received significant input from a wide variety of industries, including 1,740 comment letters on the 2009 DP, the 2010 and 2013 EDs, and hundreds of outreach meetings with investors, analysts, preparers, regulators, standard-setters, auditors, and many other users of financial statements (FASB 2016a, IFRS 2016). Similar to feedback received on the 2010 ED, most financial statements users consulted stated that a lessee's proposed recognition of operating lease assets and liabilities would provide them with better information for their analyses (FASB 2016b). In contrast, a number of respondents disagreed with the proposed lessee accounting model. Some of them stated that the existing lessee accounting model did not need to be changed while others supported improving the disclosure requirements but not changing the recognition and measurement requirements.

The Boards considered all of the feedback received throughout the project and concluded that the expected benefits of the amendments (e.g., improvements in the relevance and transparency of reported financial information and disclosures) justify the anticipated costs imposed on financial statement preparers to implement the new standard and on users of financial statements to use the new information (FASB 2016a). Consequently, in February 2016, the FASB issued ASC 842 after joint deliberations with the IASB, which issued the new *Leases* Standard, IFRS 16, in January 2016. IFRS 16 is effective for annual reporting

periods beginning on or after January 1, 2019 for all entities that use IFRS, while ASC 842 is effective for fiscal years beginning after December 15, 2018 for public business entities and December 15, 2021 for private companies and not-for-profit organizations. The Boards required the lessee's recognition of lease liabilities and right-of-use assets for all leases with some exceptions. The FASB permitted the recognition and measurement exemption of short-term leases with a lease term of 12 months or less (FASB 2016b), while the IASB permitted the exception of short-term leases and leases of low-value assets (i.e., less than $5,000) (IFRS 2016).

Lessee Accounting: The Main Difference Between ASC 840 and ASC 842

The main difference between the previous U.S. GAAP (ASC 840) and the new standard (ASC 842) is the recognition of lease assets and lease liabilities by lessees for operating leases. Under the previous GAAP, firms need to classify their leases into capital or operating leases. For capital leases, firms need to formally recognize the leased assets and obligations on the balance sheet based on the present value of the obligations. For leased assets, long-term costs that occurred before or during the uses of the assets can be added to the asset accounts. Depreciation expenses of the leased assets and interest expenses of the lease liabilities would be reported on the income statement. No assets or liabilities would be formally recognized on the balance sheet for the operating leases. However, future lease payments (in nominal amount for each of the next five years, a sum for all years thereafter, and a total) were required to be provided in notes to the financial statements (SFAS 13/ASC 840) and in the MD&A section of the annual report (SEC 2003). In January 2003, the Securities and Exchange Commission (SEC) mandated via Final Rule No. 67 (FR-67) a tabular disclosure of "all known contractual obligations," including both on- and off-balance-sheet obligations, in a single location within the Management's Discussion and Analysis (MD&A) section of the registrant's annual reports. Rule FR-67 specifically requires the tabular disclosure of two types of off-balance-sheet obligations (i.e., purchase obligations and operating leases) and allows firms to provide additional information. As to the present value of operating lease obligations or the discount rate applicable to future payments, the disclosure was not mandatory. Operating lease payments would be recognized as rental expenses on the income statement.

ASC 842 requires all leases to be classified into finance leases and operating leases. IFRS 16 does not classify leases between operating and finance, but applies a single on-balance sheet accounting model that is similar to that of finance leases under IAS 17. That is, all recognized leases are treated similarly to finance leases under ASC 842. The criteria for finance leases are very similar to the criteria for capital leases required by ASC 840, with the requirement for finance leases less flexible. ASC 842 carried forward lease classifications that are generally consistent with ASC 840 (BDO 2018). However, some differences exist. First, under ASC 840, lease classification (i.e., as a capital or operating lease) was determined at lease inception (i.e., when the lease was executed), while ASC 842 requires the lease classification (i.e., as a finance or operating lease) to be determined at the lease commencement date (i.e., the date on which a lessor makes an underlying asset available for use by a lessee). Under ASC 842, an entity shall not reassess the lease classification after the commencement date unless the contract is modified and the modification is not considered as separate contract. Second, under ASC 840, to classify a lease as a capital lease, any one of the conditions must be met: (1) at the end of the period of lease, the ownership of the asset is transferred to the lessee, (2) the lessee has the option to purchase the leased asset at the price below the market price of the asset, (3) the lease period is at least 75% of the assets' economic/useful life, or (4) the minimum lease payment's present value is at least 90% of the asset's fair value. Under ASC 842, these four criteria generally remain to classify a lease as a finance lease but the bright lines related to the 75% and 90% criteria are removed. Instead, ASC 842 stated the abovementioned third criterion as: "the lease term is for the major part of the remaining economic life of the underlying asset. However, if the commencement date falls at or near the end of the economic life of the underlying asset, this criterion shall not be used for purposes of classifying the lease." The fourth criterion is stated as: "The present value of the sum of the lease payments and any residual value guaranteed by the lessee … equals or exceeds substantially all of the fair value of the underlying asset." ASC 842 adds a fifth criterion: "the underlying asset is of such a specialized nature that it is expected to have no alternative use to the lessor at the end of the lease term." If none of these five criteria are met, a lessee shall classify the lease as an operating lease. All leases that cannot be categorized

as finance leases are included as operating leases. Reporting operating leases on a balance sheet is similar to reporting finance leases with variations of terms. Assets (the rights of use) and liabilities of operating leases will be reported separately, while finance lease assets and obligations can be bundled with other assets (e.g., PP&E) and liabilities (e.g., long-term debt). Specifically, for both finance and operating leases, a lessee is required to recognize right-of-use assets and lease liabilities, which are initially measured at the present value of the lease payments, in the statement of financial position. For leases with a term of 12 months or less, a lessee is permitted to choose not to recognize the lease assets and liabilities, but to recognize the lease expense over the lease term. Under the lessee accounting model in ASC 842, the effect of leases in the statement of comprehensive income and the statement of cash flows is largely unchanged from ASC 840.

Disclosure Requirements

The required disclosures under the previous standard (ASC 840) are relatively limited. The required disclosures under ASC 840 include: a general description of the leases, the basis that is used to determine contingent rental payments, restrictions imposed by lease agreements, the existence and terms of renewal or purchase options, the nature of the residual value guarantee of operating leases, and the minimum future lease payments. Under the new standard (ASC 842), lessees must make additional or expanded qualitative and quantitative disclosures on the values of all right-of-use assets, lease liabilities, interest, and amortization expenses for leased assets for finance and operating leases separately. Specifically, lessees shall disclose additional qualitative information about leases that have not commenced but that create significant rights and obligations for the lessee, and information about significant judgments and assumptions made (e.g., the determination of whether a contract contains a lease, the allocation between lease and nonlease components in a contract, and the determination of the discount rate for the lease). Under ASC 842, lessees shall also disclose quantitative information about the lease costs and net gain or loss recognized in financial statements, the cash flows arising from lease transactions, supplemental noncash information on lease liabilities arising from right-of-use assets, weighted-average remaining lease term, weighted-average discount rate, separate maturity analyses of its finance lease liabilities and operating lease liabilities, and the amount of short-term lease commitments. In addition, if applicable, a lessee shall disclose lease transactions between related parties, the amount of short-term lease commitments, and the accounting policy election and which classes of underlying assets it elected to apply the practical expedient on not separating lease components from nonlease components (FASB 2016b).

Transition Methods

According to FASB, an entity can choose between a modified retrospective method (by restating comparatives) and an optional transition method (without restating comparatives) to recognize and measure leases in the financial statements in which an entity first applies the new lease accounting standard (FASB 2018). Under the modified retrospective method, an entity applies the new standard retrospectively to each prior reporting period presented in the financial statements. The cumulative effect of the application is recognized at the beginning of the earliest comparative period. The application date is the later of the beginning of the earliest period presented in the financial statements and the commencement date of the lease. As a result, starting from the application date that first applies the new standard, a lessee must recognize lease assets and liabilities and provide the new and enhanced disclosures for each period presented, including the comparative periods. Under the optional transition method, an entity applies the new standard at the beginning of the reporting period in which the entity first applies the new lease standard. This method allows entities to initially apply the new standard at the adoption date and recognize a cumulative-effect adjustment to the opening balance of retained earnings in the period of adoption. The FASB provided the optional transition method in the Accounting Standards Update No. 2018-11, issued in July 2018, allowing entities to apply the new standard either retrospectively or prospectively (FASB 2018).

APPENDIX B

Variable Definitions

	Variable definitions
$Beta_{t+1}$	The equity beta, estimated from the market model regressions of weekly stock returns on weekly value-weighted market returns, for a 52-week period beginning the first week after the firm's 10-K filing date for fiscal year *t*.
Stock-return Volatility$_{t+1}$	The standard deviation of weekly stock returns, measured for a 52-week period beginning the first week after the firm's 10-K filing date for fiscal year *t*.
$Beta_t$	The equity beta, estimated from the market model regressions of weekly stock returns on weekly value-weighted market returns, for a 52-week period ending one week prior to the firm's 10-K filing date for fiscal year *t*.
Stock-return Volatility$_t$	The standard deviation of weekly stock returns, measured for a 52-week period ending one week prior to the firm's 10-K filing date for fiscal year *t*.
$Leverage^{Exclude\ OL}$	The book leverage excluding operating leases, which is measured as $\frac{D^{Exclude\ OL}}{AT+\widehat{D^{OL}}}$ in the pre-adoption period and $\frac{D^{Exclude\ OL}}{AT-A^{ROU\ OL}+\widehat{D^{OL}}}$ in the post-adoption period. $D^{Exclude\ OL}$ is total on-balance-sheet liabilities in the pre-adoption period but is equal to total on-balance-sheet liabilities excluding reported operating lease liabilities ($LT - D^{OL}$) in the post-adoption period. $\widehat{D^{OL}}$ is the estimated operating lease liability. D^{OL} is the reported operating lease liability.
$OL\_Leverage^{Estimated}$	Estimated operating lease leverage. In the pre-ASC 842 adoption period, it is measured as the estimated present value of minimum lease payments, deflated by total on-balance-sheet assets plus the estimated present value of minimum lease payments. In the post-ASC 842 adoption period, it is measured as the estimated present value of minimum lease payments, deflated by total assets excluding net right-of-use (ROU) operating lease asset plus the estimated present value of minimum lease payments.
$OL\_Leverage^{Actual}$	Reported operating lease leverage, measured as the reported operating lease liabilities (including both current and long-term portions), deflated by total assets. This measure is only available in the post-ASC 842 adoption period.
$OL\_Leverage^{Actual–Estimated}$	The difference between reported and estimated operating lease leverage in the post-ASC 842 adoption period ($OL\_Leverage^{Actual} - OL\_Leverage^{Estimated}$).
POST	An indicator variable that takes a value of one for fiscal years after the firm first adopts ASC 842, and zero otherwise.
Size	The natural logarithm of total assets (Compustat annual item AT).
MB	Market-to-book ratio, measured as the market value of equity divided by the book value of equity.
Profit Margin	Profit margin, measured as net income divided by sales (Compustat annual items NI/SALE).
Free Cash Flow	Operating cash flows (OANCF) subtracting capital expenditures (CAPX), divided by lagged total assets.
Net Working Capital	Ratio of net working capital (WCAP) to total assets (AT).
Capital Expenditure	Ratio of capital expenditure (CAPX) to total assets (AT).
R&D	Ratio of R&D expenditure (XRD) to total assets (AT).
Advertising	Ratio of advertising expense (XAD) to total assets (AT).

Dividend Payout	Dividend payout ratio, measured as the common stock dividends plus preferred stock dividends, divided by net income.
Asset Turnover	Asset turnover ratio, measured as sales divided by the average of beginning and ending total assets.
Earnings Volatility	The standard deviation of quarterly income before extraordinary items divided by total assets for the past five years.
Acquisition activity	Ratio of acquisitions (AQC) to total assets (AT).
Foreign pretax income	Ratio of foreign pretax income (PIFO) to total assets (AT).
Market Return Volatility$_{t+1}$	The standard deviation of the value-weighted market return for a 52-week period beginning the first week after the firm's 10-K filing date for fiscal year *t*.
Market Return$_{t+1}$	The value-weighted market return for a 52-week period beginning the first week after the firm's 10-K filing date for fiscal year *t*.
Filing Return$_t$	The firm's stock returns over the three-day window [–1, +1] around its 10-K filing date for fiscal year *t*.
Absolute Filing Return$_t$	The absolute value of the firm's stock returns over the three-day window [–1, +1] around its 10-K filing date for fiscal year *t*.
Lease ARC	Following the Hoitash and Hoitash (2018) method used to measure accounting reporting complexity, we measure the lease accounting reporting complexity as the natural log of one plus the total number of distinct monetary XBRL tags containing the keyword "*Lease*" in a 10-K filing.
Operating Lease ARC	Following the Hoitash and Hoitash (2018) method used to measure accounting reporting complexity, we measure the lease accounting reporting complexity as the natural log of one plus the total number of distinct monetary XBRL tags containing the keyword "*OperatingLease*" in a 10-K filing.

APPENDIX C

Data Collection Procedure from 10-K Filings

1. Find the naming patterns in XBRL tag names

The SEC's Electronic Data Gathering, Analysis, and Retrieval system (EDGAR) provides ports for users to browse SEC filings directly in the Inline XBRL Viewer. When a particular text or number is clicked on, the Inline XBRL Viewer displays attributes such as Tag, Fact, Period, etc. In this paper, we seek to obtain information about (1) the lease term, (2) the discount rate, and (3) the cumulative effects of the adoption of ASC 842 on retained earnings, right of use assets and liabilities. To capture the target data in the above categories, we searched for keywords such as 2016-02, ASU 842, Topic 842, lease, lease term, retained earnings, right of use asset (ROU asset), and liability in the Inline XBRL Viewer of annual reports. We then found the tag name and the naming petterns of the target text or number.

2. Download the Financial Statement and Notes Data Sets

The data set of 'Financial Statement and Notes' module in the DERA Data Library mainly include the text and detailed numeric information, which is extracted from corporate financial reports filed with SEC using the eXtensible Business Reporting Language (XBRL). Because our research for this paper mainly covers the period before and after ASU 842 was adopted, we downloaded data from 2016 to 2021. Because the data sets are stored separately based on time and the data type, in the next section we describe how we parsed the data packets and filtered the target data for this paper.

3. Data set parsing, selection, and matching

Each data compression package obtained as described in Section 2 contains eight data sets, which contain information about submissions, numbers, plain text, and more. The target data with which we are concerned are mainly presented in the form of numbers and text, so we mainly parse the NUM and TXT data sets. We also parse the SUB data set so we can match it with our main research model's data set. To identify the data is from the section of the new accounting standard 2016-02 (ASC 842) in the annual report, we parse the DIM data set. We then filter all the tag names according to the target keywords to obtain the preliminary target data set. Because the above data set contains all XBRL tags either are defined in GAAP taxonomies or are user-defined, we perform further filtering according to the 2022 GAAP Taxonomy to make the data more representative and to capture the more frequently used XBRL tags.

4. Build the Target Data Set

Lastly, we build the final target data set. To facilitate matching the current data set with the corporate financial data, we combined the company-related information in SUB with the XBRL target data that were ultimately selected. For data with multiple values, there are two ways to filter and determine a unique value for each company each year. The first way involves screening according to the segments to which the tags belong and locking our target accounting standard 2016-02 (ASC 842). The other way is to filter the data through manual checking. For various similar but uncertain tags, we determine the value based on 2022 GAAP Taxonomy and how often companies use the tags selected as 1) officially published tags and 2) the most frequently used tags.

Table 1: Sample Selection, Summary Statistics, and Univariate Tests

Panel A: Sample Selection

	Number of observations
S&P Capital IQ database covering firm-year observations from 2011 to 2020, for firms listed and geographically located in the U.S.	129,970
(–)firm-year observations with missing Excel Company ID-Gvkey link between Capital IQ and Compustat.	(71,101)
(–)firm-year observations for firms with missing information regarding adoption of ASC 842 (i.e., the "ASU16-02" code for Compustat item ACCTCHG).	(26,315)
(–)firm-year observations with missing financial and industry information.	(10,353)
Final sample	22,201

Panel B: Summary Statistics

	N	Mean	STD	Q1	Median	Q3
Full Sample:						
Beta$_{t+1}$	22,201	1.1418	0.6628	0.7189	1.0854	1.4856
Beta$_{t}$	22,201	1.1427	0.6615	0.7240	1.0891	1.4933
Stock-return Volatility$_{t+1}$	22,201	0.0584	0.0379	0.0331	0.0466	0.0720
Stock-return Volatility$_{t}$	22,201	0.0584	0.0385	0.0330	0.0466	0.0714
Leverage$^{Exclude\ OL}$	22,201	0.5590	0.2599	0.3703	0.5511	0.7446
OL_Leverage^{Estimated}	22,201	0.0475	0.0750	0.0054	0.0211	0.0529
POST	22,201	0.2326	0.4225	0.0000	0.0000	0.0000
Size	22,201	7.3327	2.1117	5.9531	7.4396	8.7579
MB	22,201	3.2690	7.0865	1.2162	2.0411	3.8089
Profit Margin	22,201	–0.5265	3.0235	–0.0138	0.0524	0.1310
Free Cash Flow	22,201	0.0027	0.1894	–0.0054	0.0335	0.0833
Net Working Capital	22,201	0.1832	0.2286	0.0000	0.1114	0.3150
Capital Expenditure	22,201	0.0334	0.0437	0.0044	0.0193	0.0441
R&D	22,201	0.0427	0.1026	0.0000	0.0000	0.0290
Advertising	22,201	0.0089	0.0245	0.0000	0.0000	0.0039
Dividend Payout	22,201	0.0144	0.0275	0.0000	0.0022	0.0187
Asset Turnover	22,201	0.7873	0.7270	0.2198	0.6178	1.1214
Earnings Volatility	22,201	0.0406	0.1076	0.0053	0.0123	0.0308
Acquisition activity	22,201	0.0202	0.0555	0.0000	0.0000	0.0066
Foreign pretax income	22,201	0.0101	0.0323	0.0000	0.0000	0.0114
Market Return Volatility$_{t+1}$	22,201	0.0210	0.0092	0.0139	0.0169	0.0223
Market Return$_{t+1}$	22,201	0.1402	0.1481	0.0468	0.1305	0.2167
Filing Return$_{t}$	22,201	–0.0009	0.0697	–0.0254	0.0010	0.0254
Absolute Filing Return$_{t}$	22,201	0.0455	0.0566	0.0106	0.0254	0.0562
Lease ARC	22,199	2.9635	0.7306	2.3026	3.0445	3.4965
Operating Lease ARC	22,199	2.3752	0.6448	2.0794	2.1972	2.8332
POST-Adoption:						
OL_Leverage^{Actual}	5,163	0.0456	0.0739	0.0050	0.0202	0.0506
OL_Leverage$^{Actual–Estimated}$	5,163	0.0015	0.0337	0.0000	0.0015	0.0050

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Table 1 (Continued)

Panel C: Univariate Tests

	PRE-Adoption			POST-Adoption			(POST – PRE)		
	Mean	Median	*N*	Mean	Median	*N*	Difference in Mean	t-stat.	
Beta$_{t+1}$	1.1143	1.0680	17,038	1.2325	1.1513	5,163	0.1182	(10.78)	***
Beta$_{t}$	1.1129	1.0601	17,038	1.2408	1.1812	5,163	0.1279	(12.21)	***
Stock-return Volatility$_{t+1}$	0.0520	0.0424	17,038	0.0794	0.0685	5,163	0.0274	(37.89)	***
Stock-return Volatility$_{t}$	0.0505	0.0422	17,038	0.0848	0.0730	5,163	0.0343	(44.58)	***
Leverage$^{Exclude\ OL}$	0.5586	0.5517	17,038	0.5603	0.5467	5,163	0.0017	(0.40)	
OL_Leverage^{Estimated}	0.0484	0.0210	17,038	0.0445	0.0214	5,163	–0.0039	(–3.59)	***
Size	7.3033	7.4056	17,038	7.4299	7.5297	5,163	0.1266	(3.77)	***
MB	3.0365	2.0418	17,038	4.0365	2.0325	5,163	1.0000	(7.29)	***
Profit Margin	–0.4516	0.0555	17,038	–0.7737	0.0387	5,163	–0.3221	(–5.88)	***
Free Cash Flow	0.0073	0.0342	17,038	–0.0126	0.0303	5,163	–0.0199	(–5.93)	***
Net Working Capital	0.1862	0.1180	17,038	0.1734	0.0943	5,163	–0.0128	(–3.48)	***
Capital Expenditure	0.0356	0.0208	17,038	0.0262	0.0150	5,163	–0.0093	(–15.85)	***
R&D	0.0419	0.0000	17,038	0.0455	0.0000	5,163	0.0035	(2.15)	**
Advertising	0.0093	0.0000	17,038	0.0075	0.0000	5,163	–0.0018	(–5.07)	***
Dividend Payout	0.0152	0.0025	17,038	0.0119	0.0013	5,163	–0.0033	(–8.65)	***
Asset Turnover	0.8267	0.6521	17,038	0.6576	0.5056	5,163	–0.1690	(–16.31)	***
Earnings Volatility	0.0404	0.0117	17,038	0.0411	0.0141	5,163	0.0007	(0.47)	
Acquisition activity	0.0217	0.0000	17,038	0.0154	0.0000	5,163	–0.0063	(–8.01)	***
Foreign pretax income	0.0114	0.0000	17,038	0.0059	0.0000	5,163	–0.0054	(–11.48)	***
Market Return Volatility$_{t+1}$	0.0175	0.0164	17,038	0.0326	0.0356	5,163	0.0151	(97.75)	***
Market Return$_{t+1}$	0.1110	0.1190	17,038	0.2365	0.2192	5,163	0.1255	(39.30)	***
Filing Return$_{t}$	0.0041	0.0030	17,038	–0.0174	–0.0118	5,163	–0.0215	(–15.68)	***
Absolute Filing Return$_{t}$	0.0392	0.0223	17,038	0.0661	0.0413	5,163	0.0269	(25.23)	***
Lease ARC	2.7685	2.7081	17,036	3.6068	3.6376	5,163	0.8382	(97.81)	***
Operating Lease ARC	2.1545	2.1972	17,036	3.1034	3.1355	5,163	0.9489	(143.36)	***

This table presents sample selection, summary statistics, and univariate tests. Panel A shows the sample selection process. Panel B presents summary statistics for the main variables used in the analyses. Panel C presents the mean, median, and univariate tests on the difference between pre- and post-adoption periods for main variables used in the analyses. Definitions of all variables are reported in Appendix B.

Table 2: Equity Risk and Estimated Leverage Components

	Dependent variables:			
	$Beta_{t+1}$		$Stock\text{-}return\ Volatility_{t+1}$	
	(1)	(2)	(3)	(4)
$Leverage^{Exclude\ OL}$	0.0476*	0.0701**	0.0083***	0.0078***
	(1.76)	(2.36)	(4.08)	(5.27)
$OL\_Leverage^{Estimated}$	0.1735	0.0401	0.0203***	0.0106**
	(1.29)	(0.38)	(2.66)	(2.42)
$Leverage^{Exclude\ OL} \times POST$		–0.0193		0.0019
		(–0.31)		(1.19)
$OL\_Leverage^{Estimated} \times POST$		0.8853***		0.0509***
		(4.77)		(3.67)
$POST$		1.6420***		0.0394***
		(3.90)		(4.31)
$Beta_t$	0.2523***	0.2707***		
	(6.19)	(5.32)		
$Stock\text{-}return\ Volatility_t$			0.3504***	0.4996***
			(3.67)	(20.68)
Size	0.0412***	0.0482***	–0.0032***	–0.0024***
	(4.76)	(6.52)	(–5.76)	(–8.20)
MB	0.0021	0.0017	–0.0001	–0.0001
	(1.26)	(1.10)	(–1.22)	(–1.49)
Profit Margin	–0.0061**	–0.0067	–0.0003**	–0.0004***
	(–2.00)	(–1.40)	(–2.13)	(–3.26)
Free Cash Flow	–0.1543**	–0.0489	–0.0180***	–0.0179***
	(–2.06)	(–0.72)	(–4.04)	(–6.83)
Net Working Capital	0.1533***	0.1680**	–0.0048	–0.0017
	(2.63)	(2.57)	(–0.90)	(–0.88)
Capital Expenditure	0.3714	0.5599**	–0.0124	–0.0074
	(1.41)	(2.23)	(–0.90)	(–0.63)
R&D	0.066	0.2654*	0.0164**	0.0135**
	(0.42)	(1.66)	(2.08)	(2.57)
Advertising	0.0524	–0.0704	0.0050	0.0038
	(0.26)	(–0.33)	(0.79)	(0.60)
Dividend Payout	–1.2330***	–0.9662**	–0.0661***	–0.0387***
	(–2.96)	(–2.53)	(–2.87)	(–2.89)
Asset Turnover	–0.0058	–0.0003	0.0002	0.0003
	(–0.52)	(–0.02)	(0.31)	(0.90)
Earnings Volatility	0.2456***	0.1787***	0.0140**	0.0048
	(3.03)	(2.78)	(2.41)	(1.04)
Acquisition activity	0.2412**	0.2460*	–0.0080	0.0000
	(2.24)	(1.95)	(–0.99)	(0.00)
Foreign pretax income	–0.2740	–0.2590	–0.0347***	–0.0216***
	(–1.00)	(–0.84)	(–3.66)	(–4.71)
$Market\ Return\ Volatility_{t+1}$	1.9800	48.0700***	–0.6315**	–0.4042
	(0.30)	(2.98)	(–2.06)	(–1.36)
$Market\ Return_{t+1}$	0.1714*	0.3913	–0.0241**	–0.0046
	(1.88)	(0.97)	(–1.98)	(–0.39)
$Filing\ Return_t$	–0.1122	0.0334	–0.0209***	–0.0190***
	(–0.86)	(0.25)	(–3.75)	(–5.99)
$Absolute\ Filing\ Return_t$	1.3010***	1.1430***	0.0740***	0.0540***
	(6.30)	(4.22)	(9.23)	(18.73)
$Beta_t \times POST$		–0.1123**		
		(–2.10)		

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Table 2 (Continued)

	(1)	(2)	(3)	(4)
Stock-return Volatility$_t$ × POST				–0.3046***
				(–5.04)
Size × POST		–0.0351***		–0.0020***
		(–3.40)		(–5.85)
MB × POST		0.0002		–0.0001
		(0.07)		(–0.31)
Profit Margin × POST		0.0035		0.0005***
		(0.68)		(2.73)
Free Cash Flow × POST		–0.2391**		–0.0021
		(–2.51)		(–0.15)
Net Working Capital × POST		0.0158		–0.0108
		(0.10)		(–0.66)
Capital Expenditure × POST		–0.8269*		0.0070
		(–1.65)		(0.38)
R&D × POST		–0.6795*		–0.0063
		(–1.79)		(–0.37)
Advertising × POST		1.0890***		0.0024
		(4.44)		(0.38)
Dividend Payout × POST		–1.6140***		–0.1270***
		(–3.43)		(–6.55)
Asset Turnover × POST		–0.0065		–0.0006
		(–0.31)		(–1.19)
Earnings Volatility × POST		0.3250***		0.0308***
		(2.68)		(2.62)
Acquisition activity × POST		0.1106		–0.0375*
		(0.91)		(–1.90)
Foreign pretax income × POST		–0.5012		–0.0579**
		(–1.48)		(–2.18)
Market Return Volatility$_{t+1}$ × POST		–55.2100***		–0.1665
		(–3.46)		(–0.40)
Market Return$_{t+1}$ × POST		–0.3717		–0.0165
		(–0.94)		(–0.91)
Filing Return$_t$ × POST		–0.3073		0.0029
		(–1.18)		(0.40)
Absolute Filing Return$_t$ × POST		0.0446		0.0325***
		(0.12)		(8.57)
Intercept	0.2088	–1.2480**	0.0525***	0.0329***
	(0.76)	(–2.30)	(8.13)	(2.79)
Industry and Year FE	Included	Included	Included	Included
N	22,201	22,201	22,201	22,201
Adj. R^2	22.86%	26.11%	61.75%	63.53%

This table presents results of estimating the relation between equity risk and estimated leverage components. Industry fixed effects and year fixed effects are included in all regressions but not reported. The dependent variable is equity beta (*Beta$_{t+1}$*) in columns (1) and (2) and *Stock-return Volatility$_{t+1}$* in columns (3) and (4). Definitions of all variables are reported in Appendix B. *T*-statistics reported in parentheses are based on standard errors which are clustered by firm and year. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively, using a two-tailed test.

Table 3: Equity Risk and Leverage Components: POST-Adoption

	Dependent variables:					
	Beta$_{t+1}$			*Stock-return Volatility*$_{t+1}$		
	(1)	(2)	(3)	(4)	(5)	(6)
Leverage$^{Exclude\ OL}$	0.0540	0.0508	0.0575	0.0100***	0.0096***	0.0102***
	(0.92)	(0.86)	(0.93)	(16.09)	(15.18)	(17.20)
OL_Leverage^{Actual}	0.7078***			0.0493***		
	(11.77)			(2.91)		
OL_Leverage^{Estimated}		0.9254***	0.9012***		0.0615***	0.0594***
		(5.45)	(7.85)		(4.29)	(3.21)
OL_Leverage$^{Actual–Estimated}$			0.4171***			0.0354†
			(2.85)			(1.55)
Beta$_t$	0.1590***	0.1584***	0.1584***			
	(8.22)	(8.03)	(8.15)			
Stock-return Volatility$_t$				0.1972***	0.1951***	0.1957***
				(3.28)	(3.32)	(3.31)
Intercept	0.5543***	0.5669***	0.5570***	0.1000***	0.1009***	0.1000***
	(4.22)	(4.01)	(4.16)	(14.76)	(18.14)	(15.21)
Other Controls	Included	Included	Included	Included	Included	Included
Industry and Year FE	Included	Included	Included	Included	Included	Included
N	5,163	5,163	5,163	5,163	5,163	5,163
Adj. R^2	23.02%	23.03%	23.07%	54.26%	54.24%	54.29%
χ^2–tests [two-tailed p-value]:						
Leverage$^{Exclude\ OL}$= *OL_Leverage*^{Actual}	[0.000]***			[0.022]**		
Leverage$^{Exclude\ OL}$= *OL_Leverage*^{Estimated}		[0.000]***			[0.0004]***	

This table presents results of estimating the effect of leverage components on equity risk in the post-adoption period. The dependent variable is equity beta (*Beta*$_{t+1}$) in columns (1)–(3) and *Stock-return Volatility*$_{t+1}$ in columns (4)–(6). All standalone control variables as included in Table 2, industry fixed effects, and year fixed effects are included in all regressions but not reported. Definitions of all variables are reported in Appendix B. *T*-statistics reported in parentheses are based on standard errors which are clustered by firm and year. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively, using a two-tailed test. † denotes statistical significance at the 10 percent level using a one-tailed test.

Table 4: Leverage Components Model: Cross-sectional Variation Analyses

Panel A: Effects of Lease Accounting Reporting Complexity

	Dependent variables:					
	$Beta_{t+1}$			$Stock\text{-}return\ Volatility_{t+1}$		
	(1)	(2)	(3)	(4)	(5)	(6)
$Leverage^{Exclude\ OL}$	–0.2355	–0.1290	–0.2095	–0.0282	–0.0257	–0.0288
	(–0.67)	(–0.40)	(–0.68)	(–1.11)	(–1.01)	(–1.13)
$OL\_Leverage^{Actual}$	0.4450			–0.0800		
	(0.94)			(–1.26)		
$OL\_Leverage^{Estimated}$		3.2880***	3.8680***		–0.0225	0.0009
		(3.71)	(9.40)		(–0.43)	(0.01)
$OL\_Leverage^{Actual–Estimated}$			–5.1270***			–0.1962***
			(–2.96)			(–4.42)
$Leverage^{Exclude\ OL} \times Lease\ ARC$	0.0894	0.0574	0.0828	0.0110	0.0103	0.0112
	(0.78)	(0.53)	(0.80)	(1.53)	(1.43)	(1.55)
$OL\_Leverage^{Actual} \times Lease\ ARC$	0.0974			0.0346		
	(0.72)			(1.59)		
$OL\_Leverage^{Estimated} \times Lease\ ARC$		–0.6076**	–0.7757***		0.0235	0.0167
		(–2.22)	(–6.36)		(1.24)	(0.69)
$OL\_Leverage^{Actual–Estimated} \times Lease\ ARC$			1.5480***			0.0604***
			(3.60)			(8.55)
$Lease\ ARC$	0.4932**	0.5490**	0.3991**	0.0384*	0.0435*	0.0374*
	(2.32)	(2.51)	(2.30)	(1.87)	(1.76)	(1.78)
$Beta_t$	0.1571***	0.1430***	0.1519***			
	(2.80)	(2.59)	(2.85)			
$Stock\text{-}return\ Volatility_t$				–0.0397	–0.0421	–0.0435
				(–0.26)	(–0.27)	(–0.28)
Intercept	–1.0210	–1.1670	–0.6842	–0.0551	–0.0700	–0.0505
	(–1.38)	(–1.61)	(–1.16)	(–0.87)	(–0.93)	(–0.78)
Other Controls	Included	Included	Included	Included	Included	Included
All Controls × *Lease ARC*	Included	Included	Included	Included	Included	Included
Industry and Year FE	Included	Included	Included	Included	Included	Included
N	5,163	5,163	5,163	5,163	5,163	5,163
Adj. R^2	25.35%	25.38%	25.52%	56.06%	56.07%	56.12%
χ^2–tests [one-tailed p-value]:						
$OL\_Leverage^{Actual–Estimated} + OL\_Leverage^{Actual–Estimated}$ ×Median(*Lease ARC*) >0			Coeff.= 0.5036 [0.011] ††			Coeff.= 0.0237 [0.148]
$OL\_Leverage^{Actual–Estimated} + OL\_Leverage^{Actual–Estimated}$ ×Q3(*Lease ARC*) > 0			Coeff.= 1.0186 [0.000] †††			Coeff.= 0.0438 [0.019] ††
$OL\_Leverage^{Actual–Estimated} + OL\_Leverage^{Actual–Estimated}$ ×P90(*Lease ARC*) > 0			Coeff.= 1.4270 [0.000] †††			Coeff.= 0.0598 [0.001] †††

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Table 4 (Continued)

Panel B: Effects of Operating-lease Accounting Reporting Complexity

	Dependent variables:					
	Beta$_{t+1}$			*Stock-return Volatility*$_{t+1}$		
	(1)	(2)	(3)	(4)	(5)	(6)
Leverage$^{Exclude\ OL}$	–0.4290	–0.3576	–0.4236	–0.0614	–0.0577	–0.0624
	(–0.98)	(–0.88)	(–1.00)	(–1.47)	(–1.45)	(–1.49)
OL_Leverage^{Actual}	0.5164			–0.1749		
	(0.24)			(–1.13)		
OL_Leverage^{Estimated}		2.5820	3.0060		–0.1419	–0.1116
		(1.32)	(1.37)		(–1.13)	(–0.81)
OL_Leverage$^{Actual–Estimated}$			–4.2650***			–0.2989***
			(–5.06)			(–3.18)
Leverage$^{Exclude\ OL}$ × *Operating Lease ARC*	0.1603	0.1370	0.1595	0.0232*	0.0220*	0.0236*
	(1.03)	(0.94)	(1.05)	(1.80)	(1.78)	(1.80)
OL_Leverage^{Actual} × *Operating Lease ARC*	0.0585			0.0678		
	(0.09)			(1.32)		
OL_Leverage^{Estimated} × *Operating Lease ARC*		–0.4943	–0.6316		0.0626	0.0527
		(–0.88)	(–0.97)		(1.46)	(1.12)
OL_Leverage$^{Actual–Estimated}$ × *Operating Lease ARC*			1.4020***			0.0991***
			(4.50)			(2.90)
Operating Lease ARC	0.1665	0.2344	0.1203	0.0641	0.0723	0.0640
	(0.36)	(0.47)	(0.28)	(1.34)	(1.34)	(1.34)
Beta$_t$	0.3348***	0.3347***	0.3410***			
	(2.84)	(2.83)	(2.89)			
Stock-return Volatility$_t$				–0.0529	–0.0461	–0.0519
				(–0.16)	(–0.14)	(–0.15)
Intercept	0.1227	–0.0502	0.2823	–0.1241	–0.1469	–0.1228
	(0.08)	(–0.03)	(0.20)	(–0.86)	(–0.91)	(–0.85)
Other Controls	Included	Included	Included	Included	Included	Included
All Controls × *Operating Lease ARC*	Included	Included	Included	Included	Included	Included
Industry and Year FE	Included	Included	Included	Included	Included	Included
N	5,163	5,163	5,163	5,163	5,163	5,163
Adj. R^2	24.82%	24.88%	24.93%	56.02%	56.02%	56.08%
χ^2–tests [one-tailed p-value]:						
OL_Leverage$^{Actual–Estimated}$ + *OL_Leverage*$^{Actual–Estimated}$			Coeff.=0.1316			Coeff.=0.0116
×Median(*Operating Lease ARC*) >0			[0.2687]			[0.270]
OL_Leverage$^{Actual–Estimated}$ + *OL_Leverage*$^{Actual–Estimated}$			Coeff.=0.4074			Coeff.=0.0311
×Q3(*Operating Lease ARC*) > 0			[0.058] †			[0.100]
OL_Leverage$^{Actual–Estimated}$ + *OL_Leverage*$^{Actual–Estimated}$			Coeff.=0.6378			Coeff.=0.0474
×P90(*Operating Lease ARC*) > 0			[0.018] ††			[0.052] †

This table presents results of cross-sectional analyses based on sample characteristics relating to the difficulty for estimating operating lease leverage. Panels A and B present results using *Lease ARC* and *Operating Lease ARC* as proxies for the difficulty for estimation, respectively. All standalone control variables as included in Table 2, interactions terms of *All Controls* × *Lease ARC*, *All Controls* × *Operating Lease ARC*, industry fixed effects, and year fixed effects are included in all regressions but not reported. This table presents results on the regression analyses of equity beta (*Beta*$_{t+1}$) and *Stock-return Volatility*$_{t+1}$ for the post-adoption period only. Definitions of all variables are reported in Appendix B. *T*-statistics reported in parentheses are based on standard errors which are clustered by firm and year. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively, using a two-tailed test. †, †† , and ††† denote statistical significance at the 10, 5, and 1 percent level, respectively, using a one-tailed test.

Table 5: Equity Risk and Leverage Components: Refined Estimation Based on Operating Lease Weighted-average Discount Rate

Panel A: Equity Risk and Leverage Components

	Dependent variables:			
	$Beta_{t+1}$		$Stock\text{-}return\ Volatility_{t+1}$	
	(1)	(2)	(3)	(4)
$Leverage^{Exclude\ OL(R)}$	0.0680***	0.0702**	0.0088***	0.0078***
	(3.05)	(2.33)	(5.66)	(5.30)
$OL\_Leverage^{Estimated(R)}$	0.2512*	0.0453	0.0187***	0.0109**
	(1.76)	(0.44)	(2.68)	(2.49)
$Leverage^{Exclude\ OL(R)} \times POST$		–0.0005		0.0030
		(–0.01)		(1.63)
$OL\_Leverage^{Estimated(R)} \times POST$		0.5692***		0.0290*
		(3.69)		(1.83)
POST		1.7020***		0.0442***
		(4.11)		(4.01)
Intercept	0.2014	–1.2480**	0.0541***	0.0330***
	(0.71)	(–2.30)	(6.89)	(2.80)
All Controls	Included	Included	Included	Included
All Controls × *POST*	No	Included	No	Included
Industry and Year FE	Included	Included	Included	Included
N	21,555	21,555	21,555	21,555
Adj. R^2	23.33%	26.30%	62.04%	63.70%

Panel B: Equity Risk and Leverage Components: POST-Adoption

	Dependent variables:					
	$Beta_{t+1}$			$Stock\text{-}return\ Volatility_{t+1}$		
	(1)	(2)	(3)	(4)	(5)	(6)
$Leverage^{Exclude\ OL(R)}$	0.0535	0.0697	0.0864	0.0101***	0.0108***	0.0115***
	(0.97)	(1.20)	(1.32)	(16.95)	(7.91)	(5.61)
$OL\_Leverage^{Actual}$	0.6957***			0.0472***		
	(10.06)			(2.72)		
$OL\_Leverage^{Estimated(R)}$		0.6145***	0.7038***		0.0399**	0.0439*
		(4.55)	(10.83)		(2.19)	(1.84)
$OL\_Leverage^{Actual–Estimated(R)}$			0.8744***			0.0398**
			(8.02)			(2.12)
$Beta_t$	0.1589***	0.1561***	0.1557***			
	(8.18)	(9.98)	(10.50)			
$Stock\text{-}return\ Volatility_t$				0.1963***	0.2002***	0.2006***
				(3.30)	(2.99)	(2.97)
Intercept	0.5555***	0.9137***	0.8837***	0.1002***	0.1162***	0.1148***
	(4.20)	(24.22)	(52.26)	(14.98)	(15.77)	(21.32)
Other Controls			Included			Included
Industry and Year FE			Included			Included
N	5,163	4,517	4,517	5,163	4,517	4,517
Adj. R^2	23.02%	23.55%	23.67%	54.28%	54.90%	54.95%

	Mean	Median
$Absolute\ OL\_Leverage^{Actual–Estimated}$	0.0122	0.0029
$Absolute\ OL\_Leverage^{Actual–Estimated(R)}$	0.0075	0.0010

This table presents results of estimating the effect of a set of refined measures of leverage components on equity risk. Specifically, for the post-adoption period, we refine the estimated operating lease liability measure $\widehat{D^{OL(R)}}$ by using the operating lease weighted-average discount rate collected from 10-Ks. All leverage component measures are scaled by total assets (AT) for the post-adoption period. All standalone control variables as included in Table 2, industry fixed effects, and year fixed effects are included but not reported. Panel A presents results for the pre-post analysis. The dependent variable is equity beta ($Beta_{t+1}$) in regressions (1) and (2) and *Stock-return Volatility*$_{t+1}$ in regressions (3) and (4). Panel B presents results for the post-adoption analysis. The dependent variable is equity beta ($Beta_{t+1}$) in regressions (1)–(3) and *Stock-return Volatility*$_{t+1}$ in regressions (4)–(6). Definitions of all other variables are reported in Appendix B. *T*-statistics reported in parentheses are based on standard errors which are clustered by firm and year. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively, using a two-tailed test.

Table 6: Equity Risk and Leverage Components: Annual Changes Analyses

	Full Sample				POST-Adoption					
	Dependent variables:				Dependent variables:					
	$\Delta Beta_{t+1}$		$\Delta Stock\text{-}return\ Volatility_{t+1}$		$\Delta Beta_{t+1}$			$\Delta Stock\text{-}return\ Volatility_{t+1}$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\Delta Leverage^{Exclude\ OL}$	–0.1761*	–0.0801	–0.0007	0.0119***	–0.3503***	–0.4498***	–0.3508***	–0.0154	–0.0228	–0.0163
	(–1.79)	(–1.11)	(–0.08)	(2.87)	(–3.64)	(–3.21)	(–3.74)	(–0.80)	(–1.08)	(–0.82)
$\Delta OL\_Leverage^{Estimated}$	–0.5186	–0.2392	0.0261*	0.0172		–0.6367*	–0.3861		–0.0015	0.0150
	(–1.48)	(–0.49)	(1.93)	(1.19)		(–1.82)	(–1.19)		(–0.08)	(0.63)
$\Delta Leverage^{Exclude\ OL} \times POST$		–0.3034***		–0.0406**						
		(–3.29)		(–2.39)						
$\Delta OL\_Leverage^{Estimated} \times POST$		–0.2906		0.0165						
		(–0.53)		(0.52)						
$POST$		0.3349*		0.0196*						
		(1.69)		(1.74)						
$\Delta OL\_Leverage^{Actual}$					0.4768**			0.0430***		
					(2.47)			(3.02)		
$\Delta OL\_Leverage^{Actual–Estimated}$							0.6602***			0.0435**
							(3.62)			(2.41)
$\Delta Size$	0.1960**	0.1022	0.0005	–0.0016	0.4576***	0.4241***	0.4476***	0.0093	0.0074	0.0089
	(2.11)	(1.27)	(0.12)	(–0.70)	(21.67)	(11.74)	(16.36)	(1.08)	(0.80)	(1.02)
ΔMB	0.0017**	0.0016	–0.0000	–0.0000	0.0011	0.0012	0.0011	–0.0001**	–0.0001**	–0.0001**
	(2.23)	(1.29)	(–0.97)	(–0.19)	(1.47)	(1.45)	(1.44)	(–2.20)	(–2.03)	(–2.29)
$\Delta Profit\ Margin$	–0.0027	0.0034	–0.0000	–0.0002	–0.0127***	–0.0129***	–0.0131***	0.0001	0.0001	0.0001
	(–0.45)	(0.66)	(–0.07)	(–0.77)	(–5.38)	(–5.03)	(–5.07)	(0.47)	(0.43)	(0.39)
$\Delta Free\ Cash\ Flow$	0.1563**	0.0932	–0.0040	–0.0070***	0.2491***	0.2499***	0.2458***	0.0002	0.0004	0.0002
	(2.15)	(1.27)	(–0.89)	(–2.94)	(3.01)	(3.08)	(2.97)	(0.02)	(0.04)	(0.01)
$\Delta Net\ Working\ Capital$	–0.1387	–0.2060*	–0.0198*	–0.0038	–0.1705	–0.2102	–0.1866	–0.0617***	–0.0640***	–0.0625***
	(–1.46)	(–1.78)	(–1.70)	(–1.38)	(–1.21)	(–1.48)	(–1.30)	(–9.40)	(–9.24)	(–9.29)
$\Delta Capital\ Expenditure$	0.3200	0.0689	0.0163	0.0194	0.6174*	0.6606*	0.6336*	0.0250	0.0277	0.0260
	(0.71)	(0.12)	(0.65)	(1.07)	(1.75)	(1.95)	(1.68)	(0.33)	(0.37)	(0.34)
$\Delta R\&D$	–0.2150	–0.0700	0.0305	0.0116	–0.0803	0.0252	–0.0082	0.0672	0.0720	0.0698
	(–0.53)	(–0.12)	(1.37)	(0.75)	(–0.44)	(0.16)	(–0.05)	(1.29)	(1.39)	(1.34)
$\Delta Advertising$	0.0299	0.6284	–0.0411	–0.0753**	–2.0490	–1.6070	–1.9000	–0.2196	–0.1938	–0.2131
	(0.03)	(0.43)	(–1.04)	(–2.22)	(–1.31)	(–1.35)	(–1.30)	(–1.14)	(–1.09)	(–1.13)
$\Delta Dividend\ Payout$	0.8934**	0.5305***	0.0020	–0.0107	3.6880***	3.5990***	3.6980***	0.2421***	0.2355***	0.2421***
	(2.29)	(3.04)	(0.12)	(–1.58)	(6.00)	(6.15)	(6.23)	(8.07)	(7.12)	(8.06)
$\Delta Asset\ Turnover$	0.0980	.0683	0.0062*	0.0041	0.1811***	0.1819***	0.1875***	0.0096***	0.0094***	0.0098***
	(1.34)	(0.76)	(1.96)	(1.27)	(4.28)	(4.35)	(4.35)	(4.12)	(4.04)	(4.15)
$\Delta Earnings\ Volatility$	–0.3174	–0.0587	–0.0111	–0.0158	–1.0610***	–1.0790***	–1.0580***	0.0382	0.0368	0.0381
	(–0.95)	(–0.22)	(–0.80)	(–1.05)	(–2.78)	(–2.65)	(–2.61)	(1.57)	(1.44)	(1.46)

(Continued on next page)

Table 6 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ΔAcquisition activity	–0.1162	–0.1449	–0.0037	–0.0004	0.2732	0.2935*	0.2712	–0.0100	–0.0084	–0.0099
	(–0.93)	(–0.90)	(–0.90)	(–0.15)	(1.50)	(1.80)	(1.55)	(–0.63)	(–0.50)	(–0.60)
ΔForeign pretax income	0.1156	–0.3645	0.0174	–0.0032	0.7327***	0.7128***	0.7265***	0.0836***	0.0825***	0.0834***
	(0.31)	(–1.14)	(1.01)	(–0.26)	(4.67)	(4.67)	(4.66)	(16.98)	(16.20)	(15.96)
ΔMarket Return Volatility$_{t+1}$	0.0286	0.3713**	0.0114***	0.0155*	–0.1077	–0.1143	–0.1081	0.0079*	0.0073	0.0078*
	(0.28)	(2.56)	(4.95)	(1.87)	(–0.97)	(–1.02)	(–0.96)	(1.69)	(1.58)	(1.67)
ΔMarket Return$_{t+1}$	0.0775	0.8769**	–0.0057	0.0043	–0.0567	–0.0811	–0.0530	–0.0050	–0.0071*	–0.0052
	(0.30)	(2.31)	(–1.40)	(0.46)	(–0.27)	(–0.41)	(–0.25)	(–1.48)	(–1.83)	(–1.42)
Filing Return$_t$	–0.2329	–0.0259	–0.0199*	–0.0138***	–0.6259	–0.6266	–0.6342	–0.0288	–0.0285	–0.0290
	(–1.53)	(–0.16)	(–1.91)	(–3.62)	(–1.47)	(–1.45)	(–1.46)	(–0.84)	(–0.82)	(–0.84)
Absolute Filing Return$_t$	0.4465	–0.0030	0.0070	0.0028	1.2080***	1.1970**	1.2030**	–0.0168	–0.0172	–0.0169
	(1.28)	(–0.01)	(0.32)	(0.47)	(2.60)	(2.54)	(2.53)	(–0.26)	(–0.27)	(–0.26)
Intercept	–0.1025	–0.3409***	–0.0049	–0.0490***	–0.3918***	–0.3320***	–0.3533***	–0.0651***	–0.0624***	–0.0638***
	(–1.02)	(–2.68)	(–1.20)	(–22.68)	(–4.74)	(–4.84)	(–4.56)	(–3.70)	(–3.55)	(–3.74)
All Controls × *POST*	No	Included	No	Included	No	No	No	No	No	No
Industry and Year FE	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
N	20,818	20,818	20,818	20,818	3,353	3,353	3,353	3,353	3,353	3,353
Adj. R^2	8.18%	9.79%	40.51%	41.49%	17.14%	17.09%	17.21%	50.66%	50.55%	50.65%

This table presents results of estimating the effect of changes in leverage components on annual changes in equity risk. Columns (1)–(4) in this table presents full-sample results of estimating the relation between the change in equity risk and changes in estimated leverage components. Columns (5)–(10) presents results of estimating the effect of changes in leverage components on the change in equity risk in the post-adoption period. Industry fixed effects and year fixed effects are included in all regressions but not reported. The dependent variable is the change in equity beta (*ΔBeta*$_{t+1}$) in columns (1), (2), (5), (6), and (7) and *ΔStock-return Volatility*$_{t+1}$ in columns (3), (4), (8), (9), and (10). *ΔBeta*$_{t+1}$ is the change in equity beta between the 52-week period before and the 52-week period after the firm's 10-K filing date for fiscal year *t*. *ΔStock-return Volatility*$_{t+1}$ is the change in the standard deviation of weekly stock returns between the 52-week period before and the 52-week period after the firm's 10-K filing date for fiscal year *t*. To calculate *ΔOL_Leverage*^{Actual} and *ΔOL_Leverage*$^{Actual–Estimated}$, for the post-adoption period, the reported operating lease leverage *OL_Leverage*^{Actual} is defined the same as in equation (1), which is the ending balance of the reported operating lease liability recognized on the firm's balance sheet in the period of adoption, deflated by total assets ($\frac{D^{OL}}{AT}$). For the year prior to the first year of adoption (year –1), we refine reported operating lease leverage *OL_Leverage*^{Actual} by measuring $D^{OL(B)}$ and $A^{ROU\ OL(B)}$ as the cumulative-effect adjustments to the beginning balances of operating lease liabilities and assets in the period of adoption, respectively. That is, for year –1, $OL\_Leverage^{Actual} = \frac{D^{OL(B)}}{AT + A^{ROU\ OL(B)}}$. *ΔMarket Return Volatility*$_{t+1}$ is the change in the standard deviation of the value-weighted market return between the 52-week period before and the 52-week period after the firm's 10-K filing date for fiscal year *t*, multiplied by 100. *ΔMarket Return*$_{t+1}$ is the change in the value-weighted market return between the 52-week period before and the 52-week period after the firm's 10-K filing date for fiscal year *t*. Definitions of other variables are reported in Appendix B. *Δ* denotes annual change variables. *T*-statistics reported in parentheses are based on standard errors which are clustered by firm and year. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively, using a two-tailed test.

Table 7: Equity Risk and Leverage Components: Short-Window Changes Analyses

	Dependent variable: Δ*Stock-return Volatility*$_{[-60,+60]} \times 100$				
	Full Sample		POST-Adoption		
	(1)	(2)	(3)	(4)	(5)
$\Delta Leverage^{Exclude\ OL}$	–0.0941	–0.0997	0.4058**	0.5013***	0.4716***
	(–0.53)	(–0.66)	(2.02)	(2.94)	(2.86)
$\Delta OL\_Leverage^{Estimated}$	0.4597	–0.3047	0.2880		1.6770***
	(0.54)	(–0.49)	(0.24)		(3.01)
$\Delta Leverage^{Exclude\ OL} \times POST$		0.1009			
		(0.14)			
$\Delta OL\_Leverage^{Estimated} \times POST$		3.1310***			
		(4.01)			
POST		–2.4810*			
		(–1.75)			
$\Delta OL\_Leverage^{Actual}$				2.9710***	
				(6.50)	
$\Delta OL\_Leverage^{Actual–Estimated}$					1.9000**
					(2.32)
Δ*Size*	0.0401	0.0641	–0.2357	–0.1481	–0.1779
	(0.47)	(0.72)	(–1.33)	(–1.23)	(–1.22)
Δ*MB*	0.0013	0.0013	–0.0102***	–0.0112***	–0.0107***
	(1.16)	(0.59)	(–6.54)	(–5.44)	(–5.45)
Δ*Profit Margin*	–0.0137	–0.0054	–0.0636**	–0.0592**	–0.0624**
	(–1.52)	(–0.46)	(–2.37)	(–2.28)	(–2.31)
Δ*Free Cash Flow*	0.0797	–0.0466	0.8784***	0.8949***	0.9029***
	(0.59)	(–0.45)	(2.94)	(2.90)	(2.82)
Δ*Net Working Capital*	–0.2844**	–0.2596	–1.6550***	–1.4640**	–1.5480**
	(–1.99)	(–1.37)	(–2.71)	(–2.31)	(–2.34)
Δ*Capital Expenditure*	0.1579	0.8261***	–7.8780***	–7.8300***	–7.8680***
	(0.23)	(3.30)	(–20.37)	(–19.49)	(–19.63)
Δ*R&D*	–0.0166	–0.4241	–0.8106	–1.1710	–0.9902
	(–0.03)	(–1.00)	(–0.37)	(–0.58)	(–0.47)
Δ*Advertising*	2.5630	–2.1560	26.6600***	27.2000***	27.3900***
	(0.63)	(–1.53)	(4.28)	(4.40)	(4.05)
Δ*Dividend Payout*	0.3713	0.4738	4.8470***	4.7310**	4.7450***
	(1.08)	(1.06)	(2.89)	(2.54)	(2.76)
Δ*Asset Turnover*	–0.0271	0.0880	–0.5031	–0.4999	–0.5075
	(–0.13)	(0.50)	(–1.17)	(–1.14)	(–1.17)
Δ*Earnings Volatility*	0.5873**	0.3856	3.3810***	3.4670***	3.4230***
	(2.27)	(1.13)	(3.71)	(4.18)	(3.87)
Δ*Acquisition activity*	0.0437	0.0863	0.9895	1.0070	1.0040
	(0.38)	(0.61)	(1.12)	(1.19)	(1.13)
Δ*Foreign pretax income*	0.6023	0.2692	–1.3400***	–1.5700***	–1.4670***
	(0.80)	(0.50)	(–2.67)	(–4.75)	(–3.94)
$\Delta Sales\ Growth^{q}$	0.0246	0.0117	0.2069	0.2066	0.2096
	(0.55)	(0.22)	(1.48)	(1.38)	(1.47)
ΔROA^{q}	–0.7888	–0.1457	–2.3070***	–2.3070***	–2.3090***
	(–1.18)	(–0.35)	(–14.36)	(–15.00)	(–14.26)
$\Delta Loss^{q}$	0.1278	–0.0360	0.4010***	0.4039***	0.4066***
	(1.03)	(–0.88)	(9.12)	(9.69)	(8.76)
$\Delta Market\ Return\ Volatility_{[-60,+60]}$	1.3520***	0.9262***	1.1960***	1.1810***	1.1870***
	(17.84)	(6.79)	(150.16)	(95.27)	(100.96)
$\Delta Market\ Return_{[-60,+60]}$	2.5330***	1.2640**	2.2010***	2.1530***	2.1710***
	(5.46)	(2.19)	(91.18)	(52.11)	(58.24)
$Filing\ Return_{t}$	–1.2780***	–0.6393***	–2.8000***	–2.8150***	–2.8110***
	(–3.30)	(–2.60)	(–15.98)	(–18.05)	(–15.59)

(Continued on next page)

Table 7 (Continued)

	(1)	(2)	(3)	(4)	(5)
Absolute Filing Return$_t$	2.0390***	1.2070**	1.7850***	1.7700***	1.7810***
	(2.86)	(2.03)	(8.01)	(9.17)	(8.07)
Intercept	–0.1580	–0.2036	0.0396	0.3652*	0.2531
	(–0.99)	(–1.37)	(0.16)	(1.86)	(1.51)
All Controls × *POST*	No	Included	No	No	No
Industry and Year FE	Included	Included	Included	Included	Included
N	16,381	16,381	904	904	904
Adj. R^2	62.17%	66.02%	54.80%	54.85%	54.82%

This table presents results of estimating the effect of changes in leverage components on the short-window changes in equity risk. Columns (1) and (2) in this table presents full-sample results of estimating the relation between the change in 60-day stock return volatility and changes in estimated leverage components. Columns (3)–(5) presents results of estimating the effect of changes in leverage components on the change in 60-day stock return volatility in the post-adoption period. The dependent variable *ΔStock-return Volatility*$_{[–60,+60]}$ *×100* is the change in the standard deviation of the firm's daily stock returns between the 60 trading-day period before and the 60 trading-day period after (excluding the three-day period [–1, +1] around) the firm's 10-K filing date for fiscal year *t*, multiplied by 100. To calculate *ΔOL_Leverage*^{Actual} and *ΔOL_Leverage*$^{Actual–Estimated}$, for the post-adoption period, the reported operating lease leverage *OL_Leverage*^{Actual} is defined the same as in equation (1), which is the ending balance of the reported operating lease liability recognized on the firm's balance sheet in the period of adoption, deflated by total assets ($\frac{D^{OL}}{AT}$). For the year prior to the first year of adoption (year –1), we refine reported operating lease leverage *OL_Leverage*^{Actual} by measuring $D^{OL(B)}$ and $A^{ROU\ OL(B)}$ as the cumulative-effect adjustments to the beginning balances of operating lease liabilities and assets in the period of adoption, respectively. That is, for year –1, $OL\_Leverage^{Actual} = \frac{D^{OL(B)}}{AT+A^{ROU\ OL(B)}}$. *ΔSales Growth*^{q} is the change in seasonally adjusted sales growth from the fourth quarter of year *t* to the first quarter of year *t*+1, where the seasonally adjusted sales growth is measured as the sales in quarter *q* divided by the sales in quarter *q* – 4. *ΔROA*^{q} is the change in seasonally adjusted income from the fourth quarter of year *t* to the first quarter of year *t*+1, where the seasonally adjusted income is measured as the change in income before extraordinary items from the same fiscal quarter in previous year divided by total assets. *ΔLoss*^{q} is an indicator variable that equals one if the firm does not have a net loss in the fourth quarter of year *t* and has a net loss in the first quarter of year *t*+1, and zero otherwise. *ΔMarket Return Volatility*$_{[–60,+60]}$ is the change in the standard deviation of the value-weighted daily market return between the 60 trading-day period before and the 60 trading-day period after the firm's 10-K filing date for fiscal year *t*, multiplied by 100. *ΔMarket Return*$_{[–60,+60]}$ is the change in the value-weighted daily market return between the 60 trading-day period before and the 60 trading-day period after the firm's 10-K filing date for fiscal year *t*. Industry fixed effects and year fixed effects are included in all regressions but not reported. Definitions of other variables are reported in Appendix B. *Δ* denotes change variables. *T*-statistics reported in parentheses are based on standard errors which are clustered by firm and year. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively, using a two-tailed test.

Table 8: Difference-in-differences Analysis Using the Propensity Score Matching

	Dependent variables:	
	Beta$_{t+1}$	*Stock-return Volatility*$_{t+1}$
	(1)	(2)
Leverage$^{Exclude\ OL}$	0.2149	0.0164
	(0.93)	(1.56)
Treat	–0.056	–0.0093
	(–0.46)	(–1.52)
Leverage$^{Exclude\ OL}$ × *POST*	–0.4203	0.0428
	(–1.23)	(1.01)
Treat × *POST*	0.4632***	0.0243***
	(3.17)	(2.97)
POST	1.0600	0.0325
	(1.15)	(0.36)
Intercept	–1.0230	0.0193
	(–1.24)	(0.29)
All Controls	Included	Included
All Controls × *POST*	Included	Included
Industry and Year FE	Included	Included
N	1,628	1,628
Adj. R^2	46.47%	53.54%

This table presents results of the difference-in-differences regressions for a propensity-score-matched sample of firm-year observations with non-missing data in two years before and two years after the first year of adoption. *Treat* is an indicator variable that equals one if the firm is a High-OL firm and zero if the firm is a Low-OL firm, where High-OL is defined as the highest operating lease quintile in the year and Low-OL is defined as the lowest operating lease quintile in the year. Each High-OL firm is matched with one Low-OL firm (in the same Fama-French 12 industry classification and year) that has the nearest propensity score estimated using the logistic regression $\Pr(Treat) = \alpha + \gamma Match\ Variables + \varepsilon$. The match variables include *Leverage*$^{Exclude\ OL}$, *Size, MB, Profit Margin, Free Cash Flow, Net Working Capital, Capital Expenditure, R&D, Advertising, Dividend Payout, Asset Turnover, Earnings Volatility, Acquisition activity, and Foreign pretax income.* All standalone control variables (including *Beta*$_t$, *Stock-return Volatility*$_t$, and other controls) and interactions terms of *All Controls* × *POST* as included in Table 2, industry fixed effects, and year fixed effects are included but not reported. The dependent variable is equity beta (*Beta*$_{t+1}$) in regression (1) and *Stock-return Volatility*$_{t+1}$ in regression (2). *T*-statistics reported in parentheses are based on standard errors which are clustered by firm and year. Definitions of all other variables are reported in Appendix B. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively, using a two-tailed test.

Table 9: Equity Risk and Leverage Components: Before or After vs. During the Covid-19 Crash

Panel A: Equity Risk and Estimated Leverage Components

	Dependent variables:			
	$Beta_{t+1}$		*Stock-return Volatility*$_{t+1}$	
	(1) Covid-19 Crash	(2) Non-Covid-19	(3) Covid-19 Crash	(4) Non-Covid-19
Leverage$^{Exclude\ OL}$	0.1402***	0.0631**	0.0099***	0.0076***
	(2.61)	(2.19)	(3.50)	(4.98)
OL_Leverage^{Estimated}	0.2475*	–0.0021	0.0276***	0.0074*
	(1.78)	(–0.02)	(6.56)	(1.69)
Leverage$^{Exclude\ OL}$ × *POST*	0.0777	–0.0672*	–0.0000	–0.0015
	(1.62)	(–1.80)	(–0.01)	(–0.28)
OL_Leverage^{Estimated} × *POST*	1.1370***	0.8757**	0.0769***	0.0209†
	(9.22)	(2.02)	(9.90)	(1.51)
POST	0.3436***	1.5960***	–0.0844***	0.0691***
	(4.99)	(2.65)	(–23.73)	(3.05)
Intercept	0.1746**	–1.3440**	0.0788***	0.0341**
	(2.11)	(–2.31)	(25.87)	(2.42)
All Controls and All Controls × *POST*	Included	Included	Included	Included
Industry and Year FE	Included	Included	Included	Included
χ^2–tests [two-tailed p-value]:		(1) = (2)		(3) = (4)
OL_Leverage^{Estimated} × *POST*		[0.620]		[0.069]*
N	3,997	18,204	3,997	18,204
Adj. R^2	29.10%	29.21%	58.99%	63.86%

Panel B: Equity Risk and Leverage Components: POST-Adoption

	Dependent variables:							
	$Beta_{t+1}$		*Stock-return Volatility*$_{t+1}$		$Beta_{t+1}$		*Stock-return Volatility*$_{t+1}$	
	(1) Covid-19 Crash	(2) Non-Covid-19	(3) Covid-19 Crash	(4) Non-Covid-19	(5) Covid-19 Crash	(6) Non-Covid-19	(7) Covid-19 Crash	(8) Non-Covid-19
Leverage$^{Exclude\ OL}$	0.2235***	–0.0015	0.0103***	0.0071				
	(13.76)	(–0.09)	(12.16)	(1.45)				
OL_Leverage^{Estimated}	1.3700***	0.8591*	0.1036***	0.0227***				
	(41.81)	(1.90)	(76.61)	(4.42)				
OL Leverage$^{Actual–Estimated}$	0.9662***	0.1446	0.0644***	0.0561***				
	(7.48)	(0.33)	(19.87)	(7.61)				
Leverage$^{Exclude\ OL(R)}$					0.2085**	0.0250*	0.0101	0.0080***
					(2.42)	(1.73)	(1.51)	(3.46)
OL_Leverage$^{Estimated(R)}$					1.2320***	0.5258	0.0973***	0.0182***
					(3.41)	(1.60)	(4.11)	(3.76)
OL_Leverage$^{Actual–Estimated(R)}$					1.5220**	0.7131***	0.1026**	0.0388***
					(2.12)	(4.30)	(2.42)	(4.43)
Intercept	0.5240***	1.7760***	–0.0583***	0.0871***	0.3205	0.6274***	0.0086	0.1246***
	(5.04)	(27.99)	(–7.95)	(2.91)	(1.05)	(20.06)	(0.30)	(7.58)
All Controls	Included	Included	Included	Included	Included	Included	Included	Included
Industry and Year FE	Included	Included	Included	Included	Included	Included	Included	Included
χ^2–tests [two-tailed p-value]:	(1) = (2)		(3) = (4)		(5) = (6)		(7) = (8)	
OL_Leverage$^{Actual–Estimated}$	[0.283]		[0.856]					
OL_Leverage$^{Actual–Estimated(R)}$					[0.327]		[0.189]	
N	1,937	3,226	1,937	3,226	1,695	2,822	1,695	2,822
Adj. R2	30.43%	29.87%	50.97%	59.73%	26.91%	30.15%	48.87%	60.24%

This table presents results of estimating the effect of leverage components on equity risk before or after and during the Covid-19 crash. Following prior literature (e.g., Huang et al. 2021, Glossner et al. 2021), we define the period from February 24, 2020 to March 23, 2020 as the period during the shock of the Covid-19 crash. To exclude the overlap between the risk measurement window (i.e., a 52-week period beginning the first week after the 10-K filing date) and the Covid-19 crash period, if a firm's 10-K filing date is before February 24, 2019 or after March 23, 2020, it is classified into the Non-Covid-19 period. If a firm's 10-K filing date is between February 24, 2019 and March 23, 2020, it is classified as potentially affected by the Covid-19 crash. 226 unique filing dates ranging from February 25, 2019 to March 23, 2020 for 3,997 firm-year observations are included in the Covid-19 crash cohort, while 1,702 unique filing dates between August 12, 2011 and February 22, 2019 and between March 24, 2020 and August 27, 2021 for 18,204 firm-year observations are included in the Non-Covid-19 cohort. Panel A presents results of estimating the effect of leverage components on equity risk in the pre- and post-adoption period. Panel B presents results of estimating the effect of leverage components on equity risk in the post-adoption period. All standalone control variables (including $Beta_t$, *Stock-return Volatility*$_t$, and other controls) and interactions terms of *All Controls* × *POST* as included in Tables 2 and 3, industry fixed effects, and year fixed effects are included but not reported. Due to the data availability, *t*-statistics reported in parentheses in columns (5) and (7) in Panel B are based on standard errors which are clustered by firm. *T*-statistics reported in parentheses in other columns are all based on standard errors which are clustered by firm and year. Definitions of all variables are reported in Appendix B. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively, using a two-tailed test. † denotes statistical significance at the 10 percent level using a one-tailed test.