REIT Capital Structure Choices: When Does Preparation Matter?

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Abstract

Pavlov, Steiner, and Wachter (2018) find that REITs which prepared by reducing leverage and extending maturity prior to the 2007-2009 financial crisis outperformed their peers during the crisis, a result that holds in the presence of leverage and maturity level controls. While the authors document this finding, they are unable to identify its cause. The recent COVID-related market downturn and subsequent recovery offers a unique opportunity to extend this work and to test for why leverage adjustments before a crisis matter. Specifically, we document that the capital structure adjustments that have strong predictive power for the 2007-2009 financial crisis returns have no impact on the REIT returns during the COVID pandemic of 2020. The relevant difference between the two events is that the 2007-2009 financial crisis was largely predictable, especially for members of the real estate industry, while the COVID pandemic was truly unpredictable. Therefore, preparation prior to the 2007-2009 crisis was seen as a signal for managerial competence, but had no information value during the recent pandemic. In other words, managers are expected to prepare for changes in the external environment if and only if those changes are predictable.

Key words: Real estate investment; leverage; financial crisis

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1 Introduction

REIT managers add value to their firms in two fundamental ways - asset management and debt management. On the debt management side, REIT managers need to choose and manage the leverage level and the debt maturity. Sun, Titman, and Twite (2015) demonstrate the importance of this choice. They find that firms with a conservative capital structure prior to the 2007-2009 financial crisis outperformed their peers during the crisis. Pavlov, Steiner, and Wachter (2018) confirm this finding and further show that dynamic changes in leverage and maturity prior to the crisis had an additional effect on the crisis period returns, even when controlling for the levels of leverage and maturity used in Sun, Titman, and Twite (2015).

While Pavlov, Steiner, and Wachter (2018) identify and document that dynamic changes matter, they are not able to formally investigate its cause. The 2020 REIT market downturn and recovery offers a unique opportunity to investigate this finding and identify the cause of the observed phenomena. While the 2008 and the 2020 market downturns were both substantial and sudden, there is one very significant difference between them. The 2008 downturn was largely predictable, especially to industry insiders. While the exact timing and magnitude was difficult to quantify, there were numerous warning signs that the commercial real estate markets were over-extended and that the probability of a correction was high. This was recognized in numerous industry commentaries, and in some academic studies (*e.g.* Pavlov and Wachter (2006)). Even measures based on Google "Real Estate Investment Risk" searches showed unusually high levels in 2006, prior to the 2007-2009 real estate market downturn. (see Appendix Figure C.1)

The COVID-related downturn in early 2020, on the other hand, was a true surprise. Even in December, 2019, there was little concern about the COVID virus, and the risk of a pandemic and substantial economic downturn was essentially non-existent at that time.

We use this difference between the market downturns of 2008 and 2020 to examine why REIT preparation matters. If investors used changes in REIT leverage prior to the 2008 crisis as an indicator of managerial quality and skill, the exact same changes in leverage and maturity should have no impact on REIT performance during the 2020 downturn. If, on the other hand, debt changes prior to each crisis have the same effect on REIT performance in both periods, then it is not managerial

quality but something else that drives the documented result. In other words, if it is indeed managerial quality and signals about it that generate the result, then debt adjustment should matter only for the 2008 crisis, and not for the 2020 downturn. The COVID crisis offers an important falsification test, which we use to confirm the original hypothesis.

In this paper, we use the exact same methodology and data sample selection as Pavlov, Steiner, and Wachter (2018) to show that debt preparation mattered in 2008, as already documented by the original study, but has no impact on REIT performance in the COVID-related downturn of 2020. Both findings are robust to model specification and various data sub-samples. This empirically confirms the conjecture that active debt management prior to the 2008 crisis was indeed used as a proxy for managerial quality and skill.

This finding has far-reaching implications for REIT managers, investors, and researchers alike. Most importantly, this implies that REIT managers are expected to monitor risks and take specific actions to avoid or mitigate potential future negative events only if those events are predictable. REIT managers who prepare for predictable events are rewarded during the crisis periods that subsequently follow. However, if a negative event is truly unforeseeable, such as the COVID pandemic, then REIT managers are not expected to prepare, and, subsequently, are not rewarded for preparation. In other words, whether negative outcomes that a manager experiences are due to foreseeable or unforeseeable events makes a very big difference in how investors evaluate that manager.

Our findings also provide empirical support for the literature that links leverage and volatility. For instance, Chen, Wang, and Zhou (2014), among others, suggest that "firms will adjust their leverage downward (upward) when they expect that volatility has risen (fallen)" (p. 4). Stochastic volatility or regime switching of the volatility literature, such as Chen and Kou (2009) and Elliott and Shen (2015), confirm that firms reduce leverage when the expected *future* volatility of cash flows or underlying assets increases. Our findings suggest that the prescribed leverage adjustments are recognized and rewarded by investors if and only if the increase in future volatility was foreseeable. There is no expectation that firms adjust leverage prior to a crisis if that crisis is not foreseeable.

Our finding has implications for event and treatment studies in general. Most researchers recognize that only unexpected events and treatments can provide infor-

mation about the impact of those events on purely statistical grounds. Our findings add another reason not to use foreseeable events or treatments. Namely, economic agents prepare for events that are foreseeable, and that the extent of this preparation is used as a signal for their skill.

We proceed as follows. Section 2 reviews the related literature. Section 3 develops our testable hypotheses. Section 5 describes data and empirical method. Section 6 discusses our empirical results. Section 7 presents robustness tests. Section 8 concludes.

2 Empirical links between capital structure and firm performance

Starting with (Modigliani and Miller, 1958), the theoretical work that links leverage and equity returns is vast. This literature generally notes that leverage increases risk and, therefore, also increases the required equity returns. The significance of leverage for equity returns has also been well documented empirically (Bhandari, 1988; Choi, 2013; Fama and French, 1992; Garcia-Feijóo and Jorgensen, 2010; Garlappi and Yan, 2011; Gomes and Schmid, 2010; Obreja, 2013), among many others. Similarly, there is substantial literature that links leverage and returns for real estate firms (Cheng and Roulac, 2007; Giacomini, Ling, and Naranjo, 2015a,b; Ling and Naranjo, 2015; Pavlov, Steiner, and Wachter, 2015; Sun, Titman, and Twite, 2015).

While the above literature on the link between capital structure and firm performance is extensive, there is hardly any investigation of the potential impact of capital structure adjustments on firm performance. This is in part because the classical theory described above only models the level of the leverage. How a firm arrives at the observed level of leverage is largely irrelevant from this point of view. Furthermore, as discussed below, changes in leverage can be investigated in a meaningful way only when they occur prior to major and sudden changes in expected future volatility. It is very difficult to empirically detect the potential impact of changes in leverage due to gradual change in future volatility and/or due to small changes in future volatility.

Pavlov, Steiner, and Wachter (2018) investigate the impact of change in leverage on firm performance and find that leverage reduction and maturity reduction improves firm performance during the 2007-2009 financial crisis. This paper uses a predictable event, that of the 2008-2009 financial crisis, as a motivator of leverage adjustment.

But it does not offer a nocebo event to show the absence of such a finding. Our current work mitigates this by utilizing data from a crisis of similar magnitude but one that was entirely unpredictable. By identifying a differential return response to the same managerial action, we are able to shed light on the underlying causes of the Pavlov, Steiner, and Wachter (2018) phenomenon.

3 Hypothesis development

While the idea that managers need to prepare for potential increase in volatility is intuitive, capturing signals of changes in the future volatility of asset values or cash flows is not trivial. Following Pavlov, Steiner, and Wachter (2018), we consider a manager who receives a noisy signal about the future volatility, $\hat{\sigma}_{i,t+1}$:

$$\hat{\sigma}_{i,t+1} = \sigma_{i,t+1} + \tilde{\epsilon}_{i,t+1} \tag{1}$$

where i denotes a manager, t the current time period, $\tilde{\epsilon}_{i,t+1}$ is random noise and $\Delta\sigma_{i,t} = \sigma_{i,t+1} - \sigma_{i,t}$ is the true unobservable change in volatility going forward. The precision of the signal about future volatility, captured by the variance of the random noise, v_i^2, differs across managers and is not observable by shareholders. However, each manager knows the precision of their signal, that is, each manager knows their own skill level. Let $g(\Delta\hat{\sigma}_{i,t}, v_i^2)$ denote the function managers use to decide on the amount and direction of change in leverage in view of the signal about the future change in volatility. A key point is that managers who receive noisy signals adjust their capital structure very little even if their signal indicates a substantial change in the future:

$$\frac{\partial^2 g(\Delta\hat{\sigma}_{i,t}, v_i^2)}{\partial\Delta\hat{\sigma}_{i,t}\partial v_i^2} < 0 \tag{2}$$

Therefore, the change in leverage in response to a signal is a decreasing function of the noise variance. This generates the following hypothesis: Managers who adjust their capital structure more in response to a signal about a change in future volatility have more precise signals. However, this hypothesis is not directly testable because shareholders do not observe the signal each manager receives.

Instead, shareholders need to use the actual change in volatility as a proxy for the signal managers receive. Therefore, on average, managers who adjust their capital structure more in response to the actual change in volatility have more precise signals. Since the actual change in volatility is only observable after the change has

occurred, this is only testable ex-post.

The use of actual change in volatility as a proxy for the change in volatility signal means that only volatility changes that are large relative to the variance of the noise can be used to test the hypothesis. In other words, the proposed hypothesis can be tested only during a crisis period, not during periods of normal economic volatility. This way the noise in the signal is relatively small compared to the size of the signal, at least for the managers with precise signals.

We further note that managers with precise signals are likely to add more value to their firms. Thus, when the managers with precise signals are identified, they see an increase in investor demand for their firms. In other words, managers with precise signals are rewarded with higher cumulative returns when they are identified.

This discussion leads to the following testable hypothesis:

Hypothesis 1: Firms whose managers adjust capital structure more in response to large changes in expected future volatility have higher stock returns when the actual change in volatility is revealed.

The above hypothesis has the key requirement that there are large changes in expected future volatility. In other words, the heightened future volatility needs to be predictable. If the future volatility is not predictable, i.e., if there is no change in expected future volatility, then managers who adjust capital structure more do so for other reasons, perhaps chance, but not in response to a signal. Then, the stock returns of their firms when the volatility is revealed are not related to the capital structure adjustment prior to the crisis. This leads to our second hypothesis:

Hypothesis 2: Capital structure adjustments prior to a high volatility event that is not predictable are not related to stock returns when the actual change in volatility is revealed.

Note that both of the above hypotheses need to hold if investors use capital structure changes as an indicator of signal precision, and managerial quality in general. If one of the hypotheses does not hold, then investors do not use capital structure changes as a signal of managerial quality, and instead any empirically observed link is coincidental.

We frame the above discussion in terms of general capital structure adjustments.

Empirically, we use two types of adjustments - leverage reduction and maturity extension. Short of exiting the business altogether, these are the two primary tools available to a manager who is preparing for increased future volatility. This approach is consistent with Sun, Titman, and Twite (2015), who also focus on debt maturity and leverage.

4 Identification Strategy

The empirical identification strategy we propose rests on two primary factors:

(1) The 2008 financial crisis was predictable, at least for industry insiders, while the 2020 downturn was not.

(2) There are no other differences between the two events that can potentially explain the hypothesized difference in REIT performance during the two crises.

As discussed above, the first factor is clear and well established. In what follows, we focus the second potential concern that the two events are distinct in a number of ways other than their predictability. While the 2008 and 2020 events are indeed quite distinct, they share two important features that are particularly relevant for our analysis. Both events were accompanied by substantial increases in credit spreads, and reductions in credit availability in general, and both events generated substantial concerns over falling real estate prices. For instance, as Fuster, Hizmo, Lambie-Hanson, Vickery and Willen (2000) demonstrate, the spread between mortgage lending rates and treasury rates, a measure of credit availability, behaved in strikingly similar way before and during the two events. In particular, credit conditions were quite favorable prior to the two events, and they became very limiting during the events. This similarity also exists in the broader market for lower-quality corporate bonds.

We also consider the leverage and debt maturity of REITs in our sample prior to the two events. Table 3 compares the key variables of our analysis in two different ways. The first panel compares the variables using the entire sample of all REITs considered in 2008 and in 2020. The second panel restricts the sample to REITs that were in operation in both time periods. Both panels indicate that the financial characteristics of the firms were quite similar prior to the two events. Most importantly, on average the leverage levels and the debt maturity measures we use are nearly

identical prior to the two events. The distribution measures also reported in Table 3 show a slightly higher dispersion of some of the measures prior to the 2020 downturn, but event then the differences between the two events are very minor. This overall conclusion is confirmed by the quantile-quantile plots of REIT characteristics provided in the Appendix (see Appendix Figures C.4 and C.5).

In short, while the 2008 and the 2020 crisis were different in a number of ways, they are actually quite similar along the dimensions that matter for our analysis, namely, the evolution of the general credit conditions and in the financial state of the firms in our sample.

5 Data and method

5.1 Data set and descriptive statistics

We obtain the quarterly balance sheet and performance data of REITs from Bloomberg, which identifies 249 active or inactive REITs listed in the US. As of 2019Q4, we identify 208 REITs that are active for at least one year and have non-missing values on at least one measure of the capital structure. We exclude mortgage REITs to make consistent comparisons with the results in Pavlov, Steiner, and Wachter (2018), which leads to 180 REITs for the final sample size. Using the balance sheet data in 2019Q4, we analyze the capital structure choices by REIT managers before the Covid downturn in the early 2020. The S&P 500 Index reached a daily record of 3386.15 on February 19, 2020, followed by a 34% decline and a rebound starting on March 23, 2020. The Covid downturn in our analysis refers to the period from Thursday, February 20, 2020 to Friday, March 20, 2020.

The Covid downturn generated an eight-time spike in the price volatility of REITs and was not expected by REIT managers. Figure 1 shows the 30-day price volatility of REITs for the period January 2018-October 2020, which is defined as the annualized standard deviation of the relative price change in percentage point for the 30 most recent trading days closing price. The realized volatility doesn't experience large movements in 2019. The price volatility actually decreased in 2019 from the two-year peak in December 2018 before the Covid shock. It stayed in the range between 15% and 20% in 2019 after February, and later spiked to 250% at the end of March 2020. The volatility remained substantially higher than the pre-pandemic level, six month after the shock arrival.

In Table 1, we summarize the variables used in the analysis. Our definitions are similar to those in Sun, Titman, and Twite (2015) and Pavlov, Steiner, and Wachter (2018). The REIT performance during the Covid downturn is captured by the cumulative daily rates of the total return from February 20, 2020 to March 20, 2020. Besides the total return, we look at the percentage change in the 5-year credit default swap (CDS) spread from February 20 to March 20 for the change in the market perception of the credit risk. [1] We use the percentage change instead of the first difference, because we show below that REITs differ substantially in the levels of the CDS spread before the Covid downturn. The total return and the percentage change in the CDS spread are negatively correlated, with the cross-sectional correlation to be -0.23 (p-value < 0.01).

To ensure comparability to the Great Recession results (Pavlov, Steiner, and Wachter, 2018), our analysis focuses on the impact of the market leverage and the debt maturity. We include both the level and the change of the capital structure measures. The market leverage is defined as the ratio of the total debt to the market value of invested capital, using the statistics from the balance sheets in 2019Q4. The market value of invested capital is the sum of the total debt, preferred equity and hybrid capital, and the market capitalization on December 31, 2019. The debt maturity is measured by the share of debt due in 2-3 years. We define the capital structure adjustment as the first difference of the variables, relative to the values from a year ago (2018Q4).

Besides the capital structure variables, other control variables include the log firm size (the log of the market capitalization on December 31, 2019), Tobin Q (the firm's market value divided by the total asset), and the cash-asset ratio (cash or cash equivalent divided by the total asset). REITs are classified into 8 sectors (Diversified, Health Care, Hotel, Office, Residential, Retail, Industrial, Specialty), which are included as fixed effects in our analysis.

Figure 2(a) shows the time trend of the total return and the percentage change in the CDS spread for the period January-October 2020. The average year-to-date (YTD) total return is -46% on March 20, 2020, which is worse than the YTD return of S&P 500 (-29%) and is 1.83 times the cross-sectional standard deviation of the

[1] After March 20, 2020, the CDS spread additionally incorporated the belief that the Federal Reserve will do "whatever it takes" to keep the economy afloat amid Coronavirus. See: `https://www.usnews.com/news/economy/articles/2020-04-08/federal-reserve-doing-whatever-it-takes-to-keep-economy-afloat-amid-coronavirus`

total return in 2019. Large-cap REITs performed better in the Covid downturn. The YTD total return weighted by the market cap at the beginning of the year is -39%, better than the unweighted counterpart. By the end of October 2020, REITs haven't fully recovered from the negative shock in March. Figure 2(b) shows that the credit risk increased in the period of February 20-March 20, 2020, with the CDS spread increasing by about 80 bps or 1.79 times the cross-sectional standard deviation of the CDS spread before the Covid downturn. At the end of October, the CDS spread remained 50 bps higher than the pre-pandemic level.

Figures 3(a) and 3(b) show the YTD total return and the CDS spread by the type of REITs. Diversified and industrial REITs were the least impacted by the Covid shock in terms of the total return, leading the recovery and showing the lowest credit risk after March. Hotel and retail REITs performed the worst from February 20 to March 20. The credit risk of hotel and retail REITs remained the highest after March, with the YTD total return worse than -40% by the end of October. With those differences in mind, we note that all REIT sectors experienced substantial negative returns as of March 20, 2020, with even the least impacted REITs experiencing a price decline in the order of 25%.

Table 2 presents the summary statistics of the REIT performance and the control variables (summaries by the REIT sector are available in Appendix Table C.1). Figure 4 shows longer quarterly trends of the capital structure from 2015Q1 to 2020Q3. While the variability in some quarterly measures is substantial, there is no particular trend in the variables we use, other than perhaps a gradual long-term decline in CDS spreads prior to January 1, 2020.

5.2 Empirical method

To test the hypotheses, we examine how the capital structure adjustments by REIT managers in 2019, prior to the crisis, are related to the REIT performance during the Covid downturn. For a REIT indexed by i, we consider the following cross-sectional OLS model.

$$\begin{aligned} Y_i =& \beta_0 + \beta_1 CapStruct_i + \beta_2 \Delta CapStruct_i \\ &+ \beta_3 TobinQ_i + \beta_4 LgFirmSize_i + \beta_5 CashToAsset_i + sector_i + \epsilon_i \end{aligned} \tag{3}$$

where $CapStruct_i \in \{Leverage_i, DebtDue23_i\}$

where β_0 is a constant, β_j is the coefficient corresponding to the variable j, and ϵ_i is the residual term. Y_i represents either the total return for the period February 20-March 20, 2020, or the percentage change in the CDS spread (%) for the same period. The key explanatory variables are the capital structure ($CapStruct$) and its year-over-year adjustment ($\Delta CapStruct$). Depending on the specifications, capital structure refers to the market leverage ($Leverage$), or the share of debt due in 2-3 years ($DebtDue23$). Other control variables include Tobin Q, the log firm size, the cash-asset ratio, and the indicators of the REIT sectors.

6 Results

6.1 Unconditional Analysis

We begin by exploring whether capital structure variables are related to other REIT characteristics and how the capital structure adjustments are correlated with the REIT performance. Table 4 reports the mean performance and characteristics of REITs by the deciles of the capital structure levels and test for the differences between means of the bottom and the top deciles. We first sort REITs by the market leverage. On average, highly leveraged REITs are associated with less leverage reduction in 2019. REITs with the highest leverage increased leverage during 2019. This interaction is not surprising since we measure leverage at the end of 2019 and the change in leverage over the prior year. Analogously, REITs with a lower share of debt due in 2-3 years at the end of 2019 are related to larger reduction of the short-term debt share during 2019.

Table 4 also highlights the relationship between the levels of leverage and debt maturity and total returns. As documented by Sun, Titman, and Twite (2015) and Pavlov, Steiner, and Wachter (2018), and as discussed above, the levels of leverage and maturity have a clear impact on the crisis-period performance of REITs. Firms with high leverage or with high level of debt maturing soon prior to the downturn underperform during the downturn.

More relevant to the current analysis, Table 5 reports the performance and characteristics of REITs but is sorted by the deciles of the year-over-year change of the capital structure variables. Sorting on the change in leverage or change in maturity generates no particular pattern in total return during the crisis. This finding is a first indication of support for the hypotheses developed above.

Table 5 further suggests that changes in leverage or maturity are not associated with a particular patter in firm size or Tobin's q. On the contrary, the average size and Tobin's q across changes deciles are random. While we control for those and other firm characteristics in the regression analysis described below, the fact that no particular pattern in important firm characteristics exists provides some comfort that our main results capture changes in leverage rather than another, perhaps unobserved, variable.

Figures 5 and 6 show the scatter plots of the total return and percentage change in the CDS spread for the period February 20-March 20, with the capital structure or its year-over-year adjustment on the horizontal axes. The size of the circles represents the market cap of REITs. The scatter plots by REIT sector are available in Appendix Figures C.2 and C.3. Not surprisingly, REITs with lower leverage or REITs with lower share of short-maturity debt outperformed in terms of total return. This essentially replicates the Sun, Titman, and Twite (2015) results, already discussed in the introduction. The market leverage is positively correlated with the CDS spread before the Covid downturn (correlation = 0.77). However, REITs with lower leverage before the Covid downturn show larger percentage increase in the CDS spread. The evidence is robust, when we examine the perception change of the credit risk within REIT sectors (Appendix Figure C.3) or when we examine the change in the CDS spread using the first difference.

More relevant to this paper is the finding that the changes in leverage and in short-term debt maturity have little or no impact on returns or the CDS spread changes. While the change in leverage does produce a small negative slope on the total return and a small positive slope on the CDS spread, neither of these estimates are statistically significant and become even smaller when proper controls are introduced, as discussed in what follows.

6.2 Regression Results

Table 6 reports the main regression results for the total return of REITs for the period February 20-March 20, 2020. Our focus is on the capital structure variables and year-over-year adjustments. In Columns 1-2, we add one measure at a time. Column 1 examines the impact of the market leverage and leverage reduction. A higher leverage is negatively associated with the total return in the Covid downturn, which is significant at 5% level. More importantly for this analysis, as hypothesized,

leverage reduction does not have a significant impact on the total return.

In Column 2, we examine the impact of debt and maturity extension by looking at the debt share due in 2-3 years. As hypothesized, reducing the debt share before the Covid shock does not have a significant impact on the total return in the Covid downturn. We show the level of the debt share has a significant negative effect on the total return. Besides the debt due in 2-3 years, we consider other debt maturity variables, such as the share of debt due in 2-5 years, or due in 5+ years. These alternatives produce the same overall conclusion as the reported variables.

Column 3 considers a model of the total return, considering both capital structure variables in previous specifications. When analyzed jointly, the impacts of the capital structure variables and their year-over-year changes on the total return are consistent with the findings in Columns 1-2. Again, as hypothesized, leverage reduction and maturity extension before the Covid shock are not relevant to the REIT performance during the Covid downturn.

To summarize, the results in Table 6 support the hypothesis that capital structure adjustments before an unpredictable event are not related to the stock returns when the actual volatility is revealed. In Table 7, we compare the estimated effects of the capital structure variables in the Great Recession and in the Covid downturn. The estimated effects on the total return in the Great Recession comes from Table 5 in Pavlov, Steiner, and Wachter (2018), while the effects on the total return in the Covid downturn are from Table 6. In addition, we report the regression results using the standardized variables to reflect the estimated impact of one standard deviation change of a variable on the total return. This accounts for the distributional difference in the levels and the changes of the capital structure variables. The level of the leverage shows comparable effects on the total return in the Great Recession and in the Covid downturn. However, importantly for our hypothesis, the change of the leverage is highly significant and large during the Great Recession but is insignificant and has a magnitude that is ten times smaller during the Covid downturn.

Table 8 reports the regression results for the percentage change in the CDS spread for the period from February 20, 2020 to March 20, 2020, with the specifications similar to those in Table 6. The results for the CDS spread mirror the results for the total return. Columns 1 and 2 separately show respectively that leverage reduction or maturity extension before the Covid shock has no predictive power on the percentage change in the CDS spread. The level of the market leverage at the end of 2019 is

negatively correlated with the CDS spread change. The negative relationship comes from the within-sector correlation (Appendix Figure C.3). Across the REIT sectors, the spike of the CDS spread of mortgage REITs in the Covid downturn is the smallest in terms of both the percentage change and the first difference. Diversified REITs had moderate market leverage before the Covid shock, but its spike of the CDS spread in the Covid downturn is below the average. Column 3 reports a model of the percentage change in the CDS spread that considers both capital structure variables in previous specifications. The findings are consistent with Columns 1-2. Leverage reduction and Maturity extension before the Covid shock are not statistically relevant to the CDS spread change.

7 Robustness Check

We examine how the annual change of the capital structure from 2018Q4 to 2019Q4 on REIT performance in the main results and report the insignificant impacts of the leverage reduction and maturity extension. One explanation for the results is that there might be unobserved factors affecting the choices by REIT managers in a one-year window, thus attenuating the estimated impacts. To alleviate this concern, we examine the quarterly change of the capital structure from 2019Q3 to 2019Q4 instead, which reflects the change on the balance sheet, one quarter before the arrival of the Covid shock. Using the quarterly adjustment, we report the regression results for the total return from February 20-March 20, 2020 in Appendix Table C.2 and for the percentage change in the CDS spread in Appendix Table C.3. Quarterly changes of the capital structure variables remain statistically insignificant at 10% level, supporting our hypothesis that the stock returns are uncorrelated with the capital structure adjustments in face of an unpredictable event.

We consider the share of debt due in 2-3 years to examine the impact of debt maturity adjustment. We check whether the change of the debt with other debt schedules can predict the REIT performance. In Appendix Table C.4, we include share of debt due in 2-5 years or the share of debt due in 5+ years instead and report the results for the total return and the percentage change in the CDS spread. Consistent with the main findings, we do not find evidence that the maturity adjustment of the debt schedule before the Covid shock are correlated with the performance variables after the shock arrived.

We examine whether the distribution of leverage in 2019 contributes to the in-

significant effects of the capital structure adjustment before the Covid downturn. Appendix Figure C.4 shows that while the median leverage is lower in 2019 than in 2006 before the Great Recession, REITs in the right tail of the leverage distribution have higher market leverage (Table 3). To the robustness of our finding, we use the median leverage before the Great Recession as the threshold to split the 2019 sample into the low-leverage and high-leverage groups. In Appendix Table C.5, we report similar findings using the subsamples and find no evidence that capital structure adjustments before the unpredicted Covid shock have predictive power on the REIT performance in the Covid downturn.

Giacomini, Ling, and Naranjo (2015b) examine the concept of "target leverage" and show that the deviation from the target leverage affects REIT performance. Different from the variable of leverage reduction over time, this variable captures the level of over-leverage relative to an average REIT. This finding is potentially relevant for our work, as it is possible that the change in leverage we use as our main explanatory variable interacts with the adjustment towards target leverage. It is, therefore, plausible that our change in leverage variable captures two distinct effects - preparation and target leverage. To verify this possibility, we first compute target leverage following Giacomini, Ling, and Naranjo (2015b)'s methodology and add this variable to our estimation. We report the results in Appendix Table C.6. Adding deviation from target leverage does not alter the sign or significance level of the change in leverage coefficients of interest for our analysis. Therefore, our results are not driven by the adjustment to target leverage effect.

8 Conclusion

Our main finding is the same managerial action before a crisis (leverage reduction or maturity extension) generates very different investor response depending on whether the crisis is predictable or not. Leverage reduction and maturity extension prior to a predictable increase in volatility is recognized as a signal for managerial quality and rewarded accordingly. The same leverage reduction and maturity extension prior to an unpredictable event generates no response by investors as it does not signal managerial quality. In other words, preparation before a predictable crisis is recognized and rewarded, while preparation before an unpredictable event is attributed to random chance and is not recognized or rewarded.

In addition to offering an insight into the way investors monitor REIT managers

and measure their quality, this also suggests that REIT managers are expected to continuously monitor their business environment and take preparatory measures in the face of potential future increases in uncertainty. In other words, managers are expected to dynamically adjust their capital structure depending on the degree of future uncertainty, rather than adopt a permanent aggressive or defensive capital structure policy.

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Appendix A Tables

Table 1
Variable Definition

Variable Name	Variable Definition
Total Return	$TotRet_{t_1}/TotRet_{t_0} - 1$ ($TotRet_t$ is the total return index with gross dividends at date t; t_0 = February 20, 2020; t_1 = March 20, 2020)
Percentage Change in CDS Spread (%)	$100 \cdot (Spread_{t_1}/Spread_{t_0} - 1)$ ($Spread_t$ is the 5-Year credit default swap spread implied by the Bloomberg Issuer Default Risk Model at date t; t_0 = February 20, 2020; t_1 = March 20, 2020)
Market Leverage	Total debt divided by the market value of invested capital (total debt is the sum of the short-term and long-term borrowing; market value of invested capital is the sum of total debt, preferred equity and hybrid capital, and the current market capitalization on December 31, 2019)
Debt due in X Years (X: 2-3, 2-5 or 5+)	Debt payment due in X years divided by the total maturing debt (total maturing debt is the sum of debt due in 1 year, 2-5 years and beyond year 5)
Firm Size	Market capitalization in thousand USD (December 31, 2019)
Tobin Q	(Market capitalization + total asset - book value)/total asset
Cash-Asset Ratio	Cash and cash equivalents divided by the total asset

Note: variables except the total return and the percentage change in the CDS spread are reported quarterly and come from the balance sheets in 2019Q4.

Table 2
Summary Statistics of US REITs

	N	Mean	SD	P10	P25	P50	P75	P90
Total Return	180	-0.450	0.159	-0.670	-0.544	-0.445	-0.349	-0.247
Percentage Change in CDS Spread (%)	179	113.597	60.355	27.879	64.198	112.500	154.054	194.521
Market Leverage	178	0.389	0.174	0.204	0.269	0.359	0.489	0.643
Change in Market Leverage	178	-0.025	0.065	-0.093	-0.062	-0.024	0.009	0.041
Debt Share: due in 2-3 Years	168	0.197	0.161	0.014	0.101	0.165	0.265	0.408
Change in Debt Share: due in 2-3 Years	165	0.011	0.185	-0.160	-0.068	0.006	0.103	0.183
Debt Share: due in 2-5 Years	168	0.486	0.206	0.265	0.349	0.443	0.596	0.785
Change in Debt Share: due in 2-5 Years	165	0.005	0.180	-0.192	-0.074	-0.000	0.080	0.186
Debt Share: due in 5+ Years	168	0.463	0.209	0.117	0.334	0.510	0.619	0.690
Change in Debt Share: due in 5+ Years	165	-0.004	0.171	-0.202	-0.070	0.000	0.090	0.190
log Firm Size	180	7.861	1.603	5.854	7.068	7.948	8.948	9.732
Tobin Q	180	1.519	0.559	1.013	1.176	1.398	1.732	2.070
Cash-Asset Ratio	180	0.035	0.084	0.002	0.005	0.012	0.035	0.083

Note: variables except the total return and the percentage change in the CDS spread are reported quarterly and come from the balance sheets of US REITs in 2019Q4. The change of a variable is the difference of the 2019Q4 and 2018Q4 values.

Table 3
Comparison of REIT Characteristics in 2006 and 2019

	Pooled sample							
	N	Mean	SD	P10	P25	P50	P75	P90
Leverage (2006)	138	0.383	0.162	0.161	0.272	0.390	0.491	0.590
Leverage (2019)	178	0.389	0.174	0.204	0.269	0.359	0.489	0.643
Change in Leverage (2006)	134	-0.021	0.066	-0.094	-0.063	-0.023	0.005	0.062
Change in Leverage (2019)	178	-0.025	0.065	-0.093	-0.062	-0.024	0.009	0.041
Debt due in 2-3 Years (2006)	112	0.194	0.168	0.011	0.068	0.157	0.285	0.397
Debt due in 2-3 Years (2019)	168	0.197	0.161	0.014	0.101	0.165	0.265	0.408
Change in Debt due in 2-3 Years (2006)	106	-0.028	0.235	-0.266	-0.136	-0.020	0.101	0.224
Change in Debt due in 2-3 Years (2019)	165	0.011	0.185	-0.160	-0.068	0.006	0.103	0.183
Tobin Q (2006)	138	1.553	0.452	1.140	1.245	1.484	1.695	2.039
Tobin Q (2019)	180	1.519	0.559	1.013	1.176	1.398	1.732	2.070
Log Firm Size (2006)	144	14.2	1.56	12.0	13.6	14.3	15.2	15.9
Log Firm Size (2019)	180	14.8	1.60	12.8	14.0	14.9	15.9	16.6
Cash-Asset Ratio (2006)	144	0.030	0.051	0.001	0.005	0.011	0.032	0.075
Cash-Asset Ratio (2019)	180	0.035	0.084	0.002	0.005	0.012	0.035	0.083
	REITs Observed in both 2006 and 2019							
	N	Mean	SD	P10	P25	P50	P75	P90
Leverage (2006)	81	0.347	0.145	0.155	0.256	0.360	0.442	0.528
Leverage (2019)	81	0.343	0.154	0.196	0.239	0.319	0.411	0.560
Change in Leverage (2006)	80	-0.032	0.055	-0.102	-0.071	-0.036	0.000	0.040
Change in Leverage (2019)	80	-0.020	0.047	-0.070	-0.054	-0.023	0.001	0.028
Debt due in 2-3 Years (2006)	63	0.189	0.175	0.000	0.060	0.141	0.243	0.484
Debt due in 2-3 Years (2019)	63	0.235	0.196	0.020	0.107	0.167	0.328	0.487
Change in Debt due in 2-3 Years (2006)	60	-0.051	0.273	-0.302	-0.164	-0.031	0.103	0.238
Change in Debt due in 2-3 Years (2019)	60	0.018	0.207	-0.196	-0.099	0.018	0.102	0.253
Tobin Q (2006)	81	1.628	0.377	1.188	1.323	1.608	1.879	2.139
Tobin Q (2019)	81	1.641	0.567	1.132	1.269	1.519	1.865	2.081
Log Firm Size (2006)	86	14.354	1.441	12.366	13.770	14.478	15.309	16.087
Log Firm Size (2019)	86	15.061	1.596	13.224	14.295	15.205	16.206	16.885
Cash-Asset Ratio (2006)	86	0.029	0.058	0.001	0.004	0.011	0.027	0.073
Cash-Asset Ratio (2019)	86	0.046	0.116	0.002	0.004	0.012	0.030	0.097

Note: REIT characteristics in 2006 come from Pavlov, Steiner, and Wachter (2018). See Table 1 for the variable definitions.

Table 4
REIT Characteristics by Deciles of the Capital Structure Level

	Decile: Leverage											
	1	2	3	4	5	6	7	8	9	10	$Q_1 - Q_{10}$	t-stat
Total Return	-0.353	-0.393	-0.390	-0.400	-0.549	-0.511	-0.478	-0.493	-0.549	-0.464	0.111*	(1.99)
Percentage Change in CDS Spread (%)	141.2	148.2	138.6	141.8	130.8	123.2	96.71	48.30	40.57	25.67	115.5***	(4.19)
Leverage	0.157	0.237	0.280	0.325	0.362	0.404	0.483	0.588	0.721	0.833	-0.676***	(-26.43)
Change in Leverage	-0.0473	-0.0237	-0.0190	-0.0481	-0.0336	-0.0490	-0.0305	0.0203	0.00846	0.0523	-0.0996***	(-3.21)
Debt due in 2-3 Years	0.277	0.150	0.135	0.171	0.201	0.174	0.197	0.244	0.270	0.249	0.0284	(0.22)
Change in Debt due in 2-3 Years	0.0925	-0.0100	-0.00132	0.0187	0.000329	0.0401	-0.0693	0.0347	0.0719	-0.180	0.272*	(1.98)
log Firm Size	8.405	8.843	8.988	8.364	8.605	7.366	7.158	6.806	5.866	5.987	2.418**	(2.74)
Tobin Q	2.136	1.883	1.703	1.569	1.494	1.278	1.273	1.111	1.168	0.986	1.150***	(3.31)
Cash-Asset Ratio	0.0946	0.0324	0.0110	0.0147	0.0340	0.0393	0.0198	0.0413	0.0344	0.0209	0.0737	(0.89)
	Decile: Debt due in 2-3 Years											
	1	2	3	4	5	6	7	8	9	10	$Q_1 - Q_{10}$	t-stat
Total Return	-0.390	-0.457	-0.345	-0.435	-0.458	-0.462	-0.484	-0.458	-0.484	-0.476	0.0865	(1.43)
Percentage Change in CDS Spread (%)	115.8	120.9	106.8	112.8	114.2	132.7	130.5	116.9	95.25	95.30	20.52	(0.88)
Leverage	0.331	0.352	0.341	0.403	0.433	0.358	0.351	0.428	0.495	0.407	-0.0760	(-1.23)
Change in Leverage	-0.0249	-0.0517	-0.0338	-0.0281	-0.0273	-0.0163	-0.00530	-0.0325	-0.00384	-0.0139	-0.0110	(-0.54)
Debt due in 2-3 Years	0.00490	0.0421	0.0959	0.131	0.157	0.179	0.214	0.266	0.330	0.561	-0.556***	(-12.87)
Change in Debt due in 2-3 Years	-0.100	-0.124	-0.0327	-0.0718	-0.0245	0.0399	0.0128	0.0567	0.110	0.240	-0.340***	(-5.11)
log Firm Size	8.079	7.824	7.902	8.424	7.970	8.411	8.084	7.952	7.319	7.177	0.902*	(1.86)
Tobin Q	1.642	1.392	1.574	1.700	1.366	1.684	1.415	1.624	1.300	1.630	0.0114	(0.06)
Cash-Asset Ratio	0.0331	0.0169	0.0552	0.0246	0.0158	0.0140	0.0397	0.0162	0.0211	0.0863	-0.0531	(-1.05)

Note: variables except the total return and the percentage change in the CDS spread are reported quarterly and come from the balance sheets of US REITs in 2019Q4. $Q_1 - Q_{10}$ is the mean difference of the first and the last deciles, with the significance indicated as * $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$ and the t statistics reported in the last column.

Table 5
REIT Characteristics by Deciles of the Change in the Capital Structure

	Decile: Change in Leverage											
	1	2	3	4	5	6	7	8	9	10	$Q_1 - Q_{10}$	t-stat
Total Return	-0.438	-0.433	-0.433	-0.427	-0.419	-0.436	-0.460	-0.438	-0.551	-0.496	0.0574	(1.01)
Percentage Change in CDS Spread (%)	121.8	134.4	139.5	124.6	121.0	122.3	144.2	90.53	83.56	42.76	79.01***	(5.96)
Leverage	0.400	0.362	0.291	0.356	0.341	0.302	0.335	0.414	0.520	0.597	-0.197***	(-4.18)
Change in Leverage	-0.131	-0.0741	-0.0568	-0.0401	-0.0271	-0.0160	-0.00256	0.0108	0.0290	0.104	-0.235***	(-14.56)
Debt due in 2-3 Years	0.188	0.222	0.229	0.151	0.159	0.148	0.236	0.209	0.205	0.232	-0.0439	(-0.67)
Change in Debt due in 2-3 Years	-0.0298	0.0445	0.0119	0.0450	0.0139	0.0230	0.0711	0.0423	-0.0917	-0.0633	0.0335	(0.41)
log Firm Size	7.368	8.106	8.115	8.101	8.454	7.896	8.186	7.929	7.721	6.831	0.537	(1.14)
Tobin Q	1.287	1.637	1.721	1.500	1.733	1.606	1.615	1.422	1.399	1.270	0.0169	(0.28)
Cash-Asset Ratio	0.0137	0.0275	0.0813	0.0235	0.0116	0.0670	0.0315	0.0383	0.0218	0.0460	-0.0323	(-1.43)
	Decile: Change in Debt due in 2-3 Years											
	1	2	3	4	5	6	7	8	9	10	$Q_1 - Q_{10}$	t-stat
Total Return	-0.482	-0.437	-0.419	-0.446	-0.392	-0.402	-0.457	-0.479	-0.469	-0.458	-0.0320	(-0.61)
Percentage Change in CDS Spread (%)	110.2	110.7	118.6	101.4	107.3	111.9	131.2	132.4	116.3	114.5	-1.412	(-0.09)
Leverage	0.435	0.378	0.316	0.446	0.349	0.435	0.353	0.372	0.414	0.370	0.0730	(1.03)
Change in Leverage	-0.0199	0.00650	-0.0262	-0.0359	-0.0201	-0.0317	-0.0315	-0.0264	-0.0296	-0.0186	0.00490	(0.16)
Debt due in 2-3 Years	0.115	0.118	0.138	0.163	0.103	0.176	0.248	0.210	0.295	0.406	-0.276***	(-5.53)
Change in Debt due in 2-3 Years	-0.351	-0.118	-0.0698	-0.0226	-0.00133	0.0197	0.0609	0.103	0.154	0.320	-0.664***	(-12.20)
log Firm Size	7.433	8.760	8.810	7.799	7.630	7.953	8.286	8.058	7.354	7.648	-0.187	(-0.39)
Tobin Q	1.330	1.563	1.818	1.461	1.501	1.472	1.523	1.406	1.498	1.867	-0.553**	(-2.53)
Cash-Asset Ratio	0.0454	0.0173	0.0109	0.0234	0.0523	0.0212	0.0732	0.0207	0.0219	0.0268	0.0197	(1.07)

Note: variables except the total return and the percentage change in the CDS spread are reported quarterly and come from the balance sheets of US REITs in 2019Q4. $Q_1 - Q_{10}$ is the mean difference of the first and the last deciles, with the significance indicated as * $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$ and the t statistics reported in the last column.

Table 6
Main Result: Regression Results for the Total Return

	Total Return		
	(1)	(2)	(3)
Leverage	-0.304**		-0.225*
	(0.131)		(0.134)
ΔLeverage	-0.0218		0.0978
	(0.228)		(0.217)
Debt due in 2-3 Years		-0.361***	-0.332***
		(0.117)	(0.117)
ΔDebt due in 2-3 Years		0.117	0.0877
		(0.095)	(0.094)
log Firm Size	0.000347	-0.00197	-0.00837
	(0.011)	(0.012)	(0.012)
Tobin Q	0.0565**	0.0690***	0.0592**
	(0.023)	(0.021)	(0.024)
Cash-Asset Ratio	0.265*	0.719***	0.612***
	(0.136)	(0.149)	(0.176)
Constant	-0.360**	-0.397***	-0.244
	(0.157)	(0.128)	(0.167)
Sector Effect	Yes	Yes	Yes
Adjusted R^2	0.514	0.558	0.566
N	178	165	164

Note: Significance is indicated as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$. Robust standard errors in parentheses. *Total return* refers to the cumulative daily rates of return with dividend for the period February 20-March 20, 2020. The change of a variable (Δ) is the difference of the 2019Q4 and 2018Q4 values. *Sector effect* considers the fixed effect of 8 REIT sectors (Diversified, Health Care, Hotel, Office, Residential, Retail, Industrial, Specialty). See Table 1 for the definitions of all variables.

Table 7
Effects of the Capital Structure in the Great Recession and in the Covid Downturn on the Total Return

	Total Return							
	Great Recession (2007-2009)				Covid Downturn (2020)			
	(1)		(2)		(3)		(4)	
	1 unit	1 SD	1 unit	1 SD	1 unit	1 SD	1 unit	1 SD
Leverage	-0.455**	-0.0736**			-0.304**	-0.0529**		
	(0.197)	(0.0319)			(0.131)	(0.0228)		
ΔLeverage	-0.783**	-0.0521**			-0.0218	-0.0014		
	(0.379)	(0.0252)			(0.228)	(0.0148)		
Debt due in 2-3 Years							-0.361***	-0.0581***
							(0.117)	(0.0188)
ΔDebt due in 2-3 Years			-0.333***	-0.0556***			0.117	0.0216
			(0.115)	(0.0192)			(0.095)	(0.0176)
Sector Effect	Yes		Yes		Yes		Yes	
Adjusted R^2	0.293		0.350		0.514		0.558	
N	106		81		178		176	

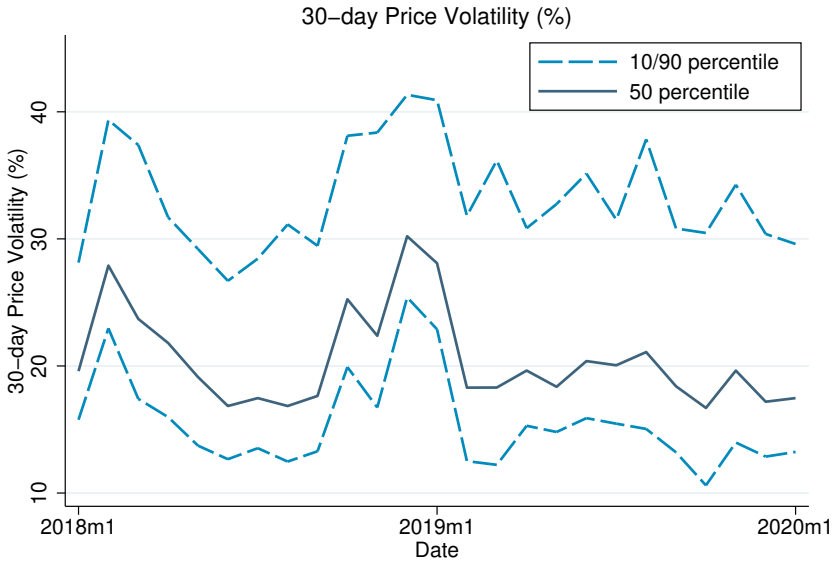
Note: Significance is indicated as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$. Robust standard errors in parentheses. The dependent variable is the total return. The columns of *1 unit* report the regression coefficients. The columns of *1 SD* report the estimated effect of a one standard deviation change of a variable. The specifications of *Great Recession* come from Table 5 of Pavlov, Steiner, and Wachter (2018). The specifications of *Covid Downturn* come from Table 6. *Sector effect* considers the fixed effect of REIT sectors. Unreported control variables include the log firm size, Tobin Q, and the cash-asset ratio. See Table 1 for the definitions of all variables.

Table 8
Regression Results for the Percentage Change in the CDS Spread

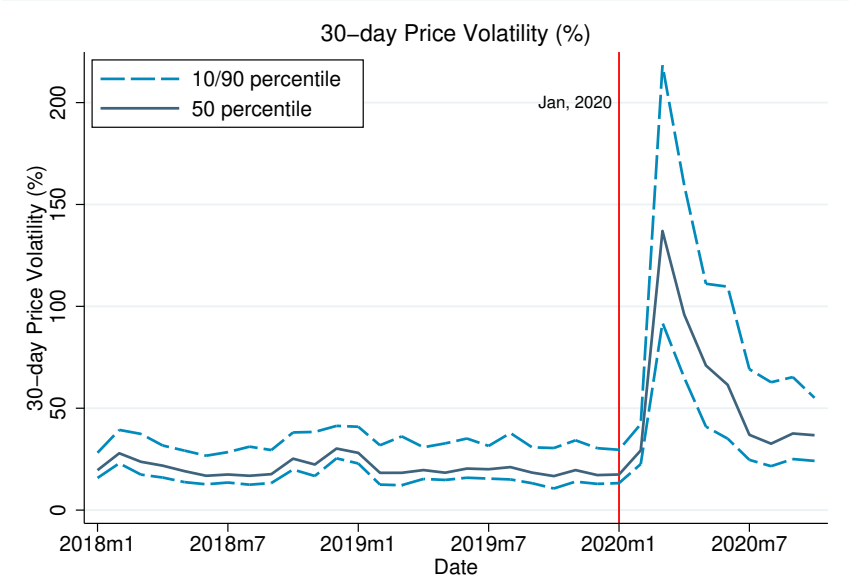
	Percentage Change in CDS Spread (%)		
	(1)	(2)	(3)
Leverage	-227.2***		-234.5***
	(39.060)		(43.242)
ΔLeverage	-121.9		-130.6
	(87.662)		(87.723)
Debt due in 2-3 Years		10.75	52.22
		(51.767)	(49.199)
ΔDebt due in 2-3 Years		43.90	18.37
		(42.457)	(38.420)
log Firm Size	-2.676	4.561	-0.836
	(3.631)	(4.292)	(3.882)
Tobin Q	-20.82**	-10.49	-20.34**
	(8.598)	(9.490)	(8.589)
Cash-Asset Ratio	-194.4***	-123.4**	-260.7***
	(46.278)	(61.964)	(64.501)
Constant	258.1***	90.23**	229.8***
	(51.122)	(39.949)	(52.538)
Sector Effect	Yes	Yes	Yes
Adjusted R^2	0.371	0.243	0.411
N	177	164	163

Note: Significance is indicated as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$. Robust standard errors in parentheses. The percentage change in the CDS spread is for the period February 20-March 20, 2020. The change of a variable (Δ) is the difference of the 2019Q4 and 2018Q4 values. *Sector effect* considers the fixed effect of 8 REIT sectors (Diversified, Health Care, Hotel, Office, Residential, Retail, Industrial, Specialty). See Table 1 for the definitions of all variables.

Appendix B Figures

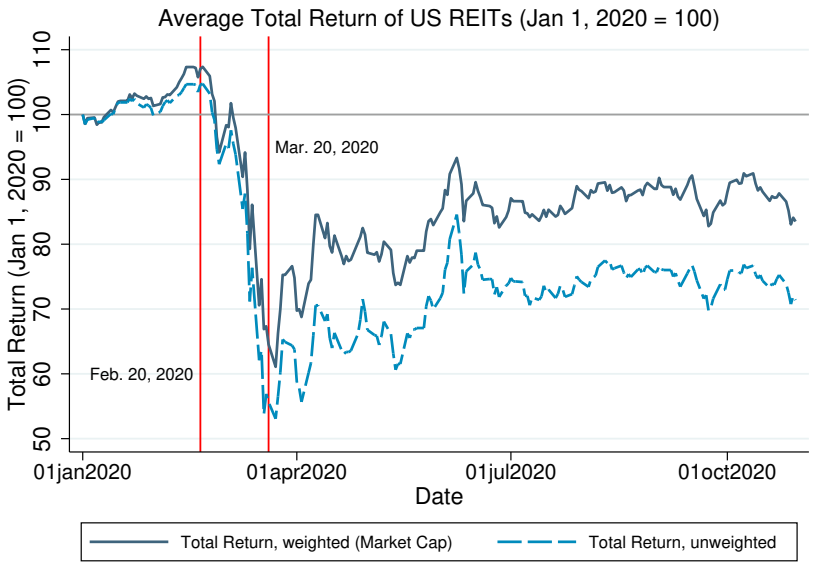


(a) Before Covid Downturn

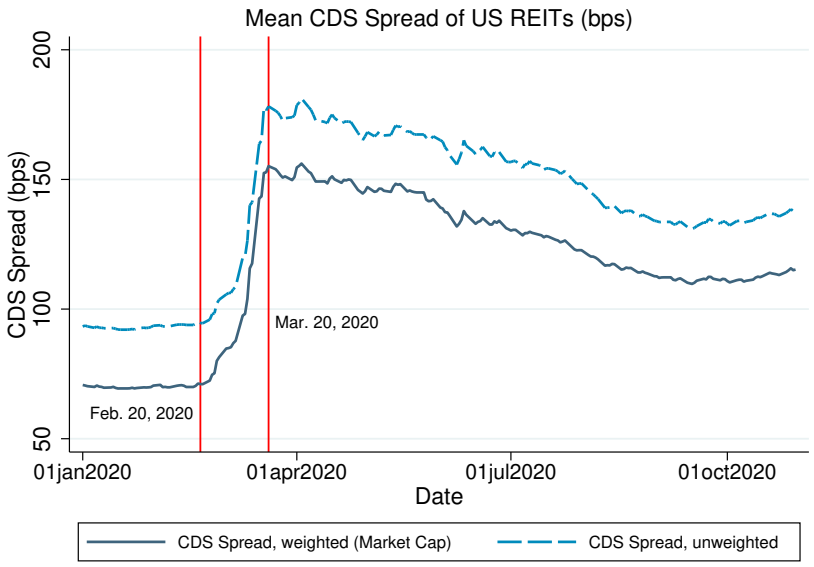


(b) With Covid Downturn and Aftermath

Fig. 1. 30-day price volatility of US REITs, January 2018-October 2020. The price volatility is defined as the annualized standard deviation of the relative price change in percentage point for the 30 most recent trading days closing price. Each data point represents the last trading day of a month.

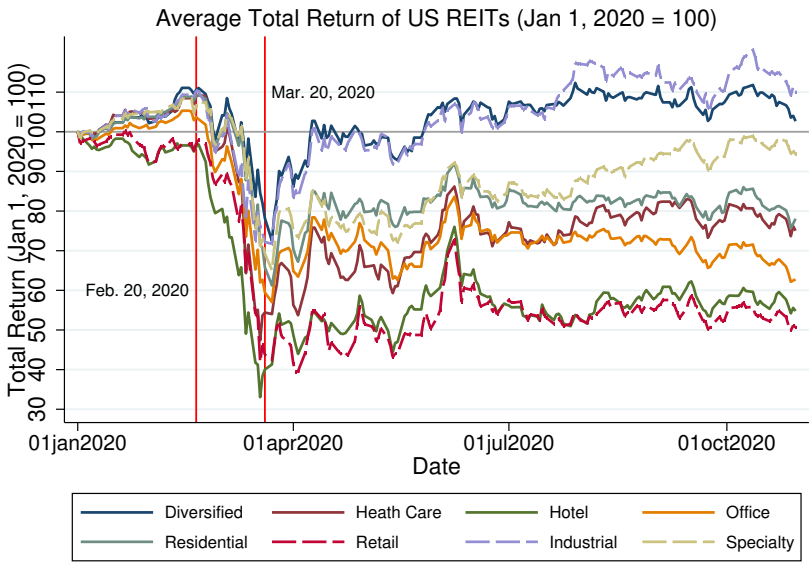


(a) Total Return (January 1, 2020 = 100)

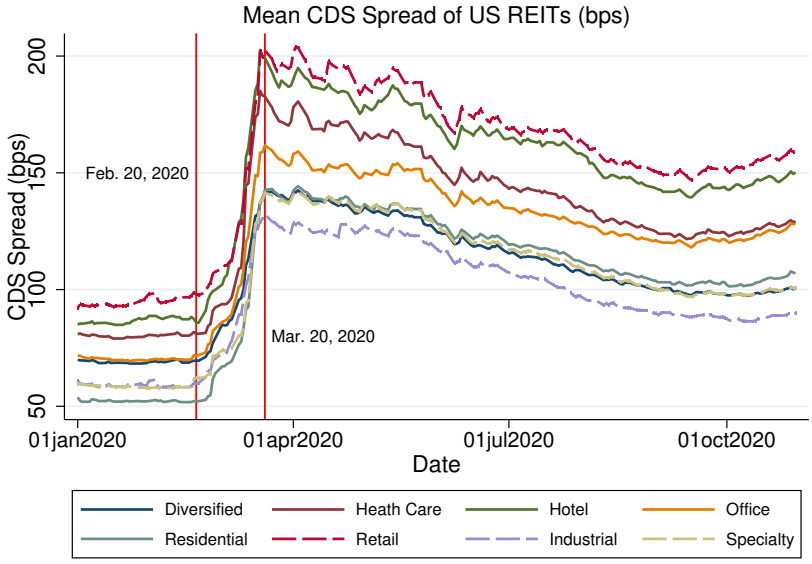


(b) CDS Spread (bps)

Fig. 2. Total Return and CDS Spread of US REITs, January-October 2020. The weighted means use the market capitalization on December 31, 2019 as the weight.

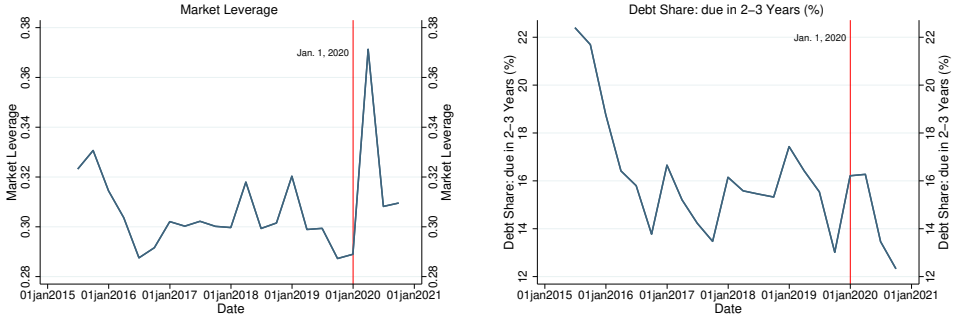


(a) Total Return (Jan 1, 2020 = 100)



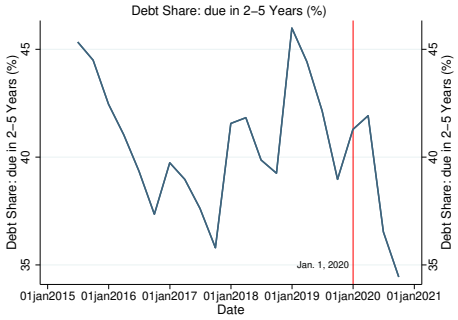
(b) CDS Spread (bps)

Fig. 3. Total Return and CDS Spread by the type of US REITs, January-October 2020. Mean statistics are plotted. The weighted means use the market capitalization on December 31, 2019 as the weight.

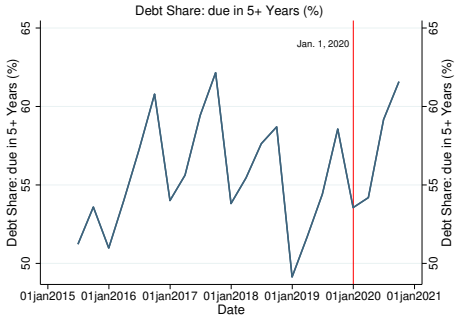


(a) Market Leverage

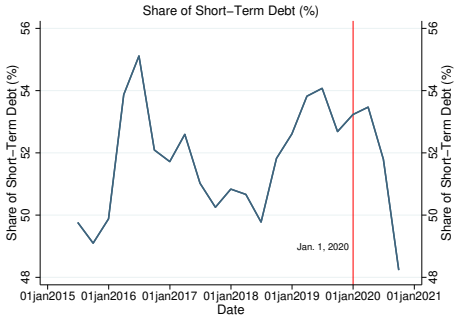
(b) Share of Debt Due in 2-3 Years



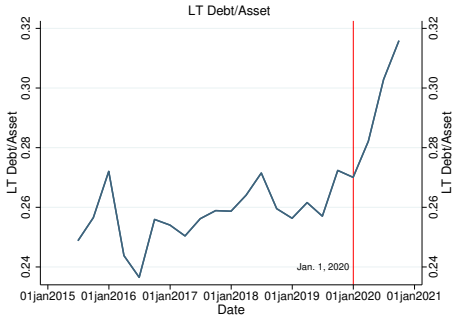
(c) Share of Debt Due in 2-5 Years



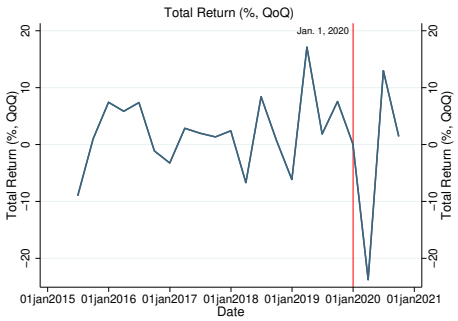
(d) Share of Debt Due in 5+ Years



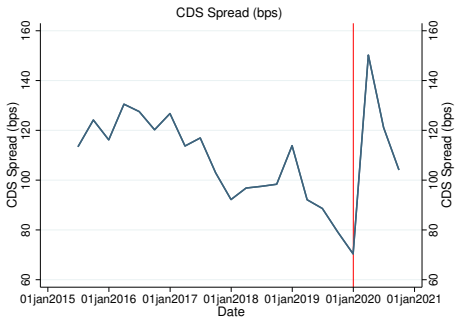
(e) Share of Short-Term Debt



(f) Long-Term Debt/Total Asset

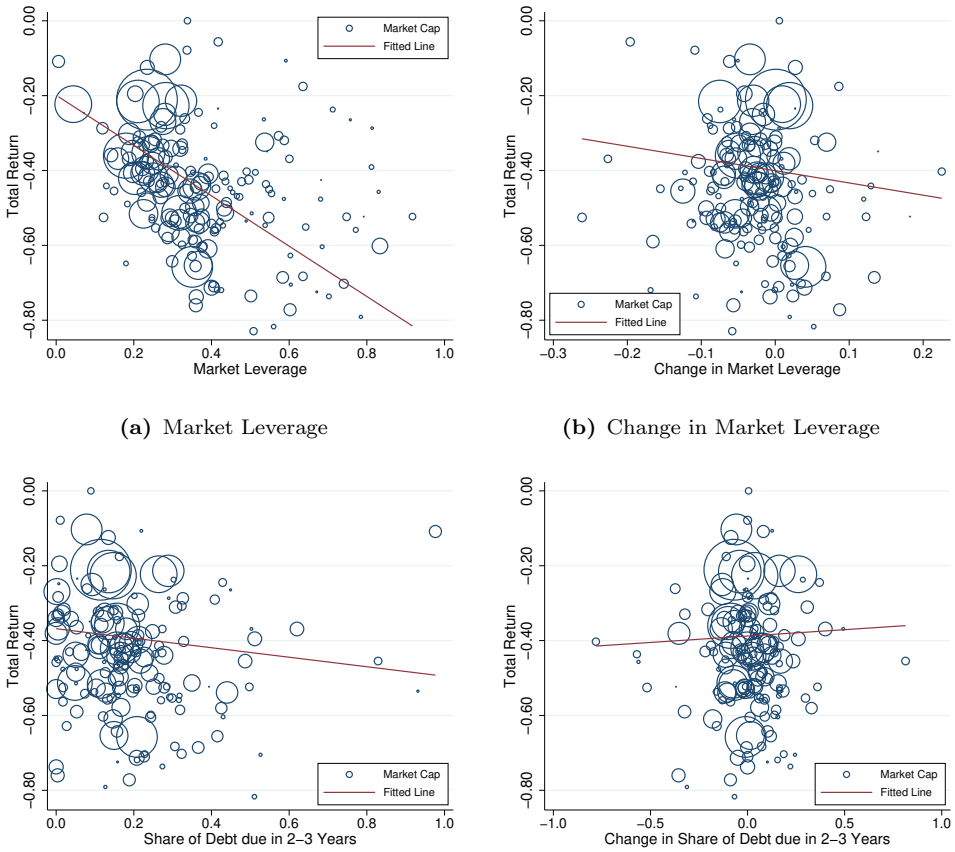


(g) Total Return



(h) CDS Spread

Fig. 4. Quarterly Trends of US REITs, 2015-2020. The quarterly means are weighted by the market cap of the last trading day in the last quarter. Variables are dated at the end of the quarters. Short-term debt refers to the debt due in one year.



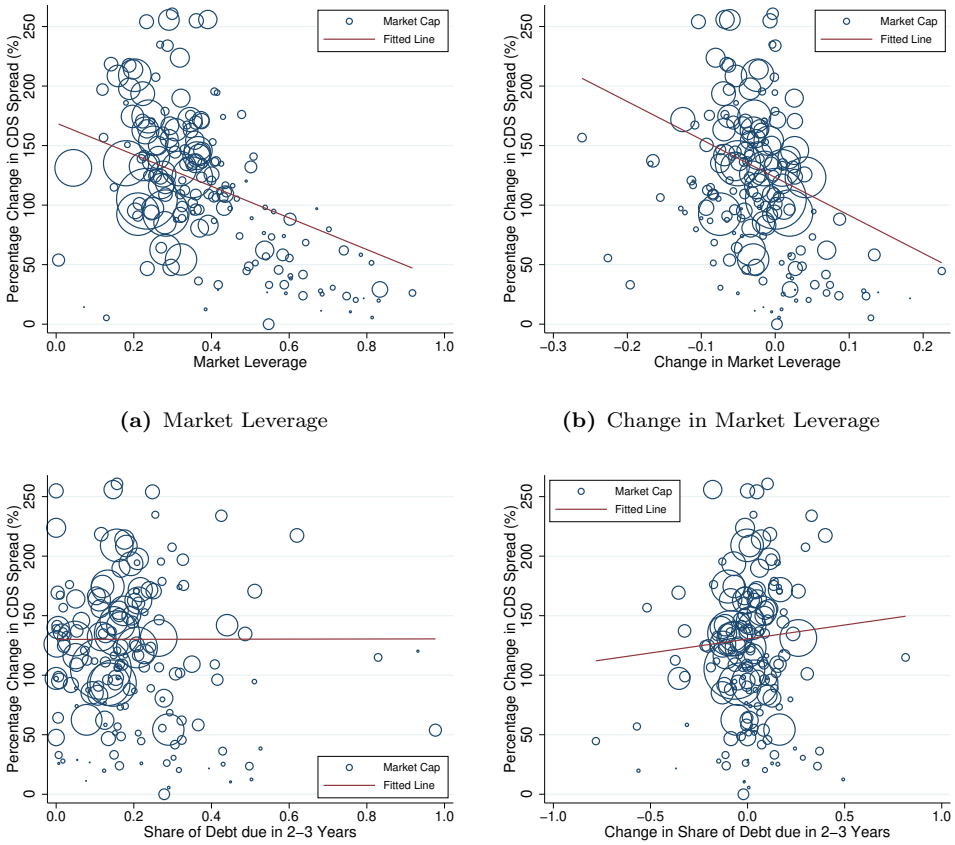
(a) Market Leverage

(b) Change in Market Leverage

(c) Debt Due in 2-3 Years

(d) Change in Debt Due in 2-3 Years

Fig. 5. Total return (February 20-March 20, 2020) and the capital structure of US REITs. The change in the capital structure is the difference of the 2019Q4 and 2018Q4 values. The circle size represents the market cap on December 31, 2019. See Table 1 for the variable definitions.



(a) Market Leverage

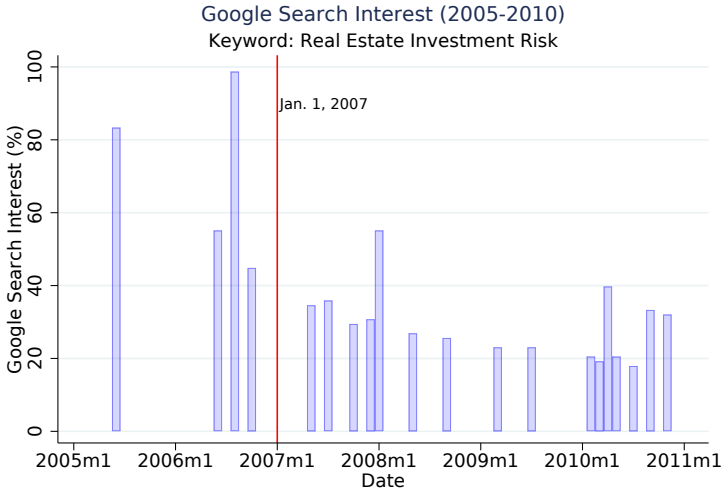
(b) Change in Market Leverage

(c) Debt Due in 2-3 Years

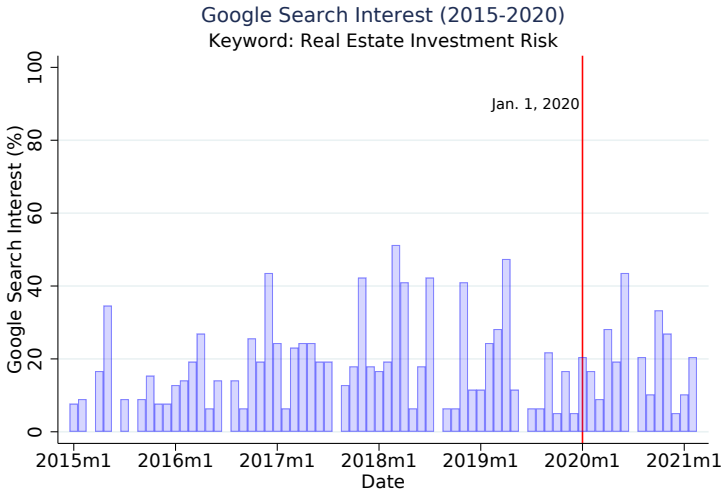
(d) Change in Debt Due in 2-3 Years

Fig. 6. Percentage change in the CDS spread (February 20-March 20, 2020) and the capital structure of US REITs. The change in the capital structure is the difference of the 2019Q4 and 2018Q4 values. The circle size represents the market cap on December 31, 2019. See Table 1 for the variable definitions.

Appendix C Additional Figures and Tables



(a) 2005-2010



(b) 2015-2020

Fig. C.1. Google search interest of "real estate investment risk". The index represents the search interest in a given month relative to its historical popularity from 2005 to 2020. A value of 100 is the peak popularity.

Table C.1
Summary Statistics of US REITs by Industry (Part 1)

	N	Mean	SD	P10	P25	P50	P75	P90
Diversified								
Total Return	44	-0.401	0.189	-0.627	-0.555	-0.422	-0.255	-0.125
Percentage Change in CDS Spread (%)	43	99	69	26	40	89	133	195
Market Leverage	43	0.424	0.192	0.211	0.283	0.391	0.543	0.741
Change in Market Leverage	43	-0.016	0.071	-0.083	-0.065	-0.030	0.022	0.053
Debt due in 2-3 Years	37	0.172	0.119	0.017	0.089	0.147	0.244	0.323
Change in Debt due in 2-3 Years	34	-0.014	0.182	-0.179	-0.086	0.000	0.098	0.162
Debt due in 2-5 Years	37	0.462	0.218	0.230	0.314	0.422	0.586	0.732
Change in Debt Share: due in 2-5 Years	34	-0.056	0.180	-0.350	-0.150	-0.029	0.048	0.158
Debt due in 5+ Years	37	0.478	0.214	0.157	0.353	0.513	0.625	0.730
Change in Debt due in 5+ Years	34	0.046	0.150	-0.121	-0.036	0.032	0.148	0.203
log Firm Size	44	7.562	2.037	5.318	6.415	7.586	8.955	10.169
Tobin Q	44	1.559	0.722	0.906	1.153	1.381	1.763	2.339
Cash-Asset Ratio	44	0.051	0.094	0.005	0.010	0.021	0.054	0.091
Health Care								
Total Return	17	-0.493	0.119	-0.683	-0.580	-0.458	-0.409	-0.342
Percentage Change in CDS Spread (%)	17	125	43	80	94	125	146	179
Market Leverage	16	0.340	0.146	0.183	0.262	0.318	0.362	0.636
Change in Market Leverage	16	-0.035	0.059	-0.122	-0.061	-0.020	-0.004	0.026
Debt due in 2-3 Years	15	0.196	0.215	0.020	0.048	0.149	0.274	0.425
Change in Debt due in 2-3 Years	15	0.076	0.266	-0.203	-0.112	0.073	0.189	0.330
Debt due in 2-5 Years	15	0.446	0.200	0.299	0.361	0.395	0.506	0.809
Change in Debt Share: due in 2-5 Years	15	-0.024	0.113	-0.207	-0.095	-0.027	0.042	0.080
Debt due in 5+ Years	15	0.526	0.196	0.190	0.490	0.574	0.624	0.695
Change in Debt due in 5+ Years	15	0.036	0.132	-0.080	-0.049	0.027	0.099	0.226
log Firm Size	17	8.241	1.210	6.453	7.484	8.184	9.133	9.977
Tobin Q	17	1.614	0.657	1.145	1.269	1.534	1.692	1.945
Cash-Asset Ratio	17	0.012	0.024	0.001	0.003	0.005	0.010	0.018
Hotel								
Total Return	18	-0.642	0.130	-0.791	-0.724	-0.679	-0.535	-0.429
Percentage Change in CDS Spread (%)	18	126	58	58	96	114	153	224
Market Leverage	18	0.449	0.174	0.249	0.350	0.402	0.560	0.785
Change in Market Leverage	18	-0.004	0.047	-0.081	-0.022	0.002	0.020	0.052
Debt due in 2-3 Years	18	0.224	0.223	0.000	0.124	0.197	0.228	0.510
Change in Debt due in 2-3 Years	18	-0.066	0.220	-0.355	-0.218	-0.032	0.120	0.176
Debt due in 2-5 Years	18	0.632	0.229	0.333	0.458	0.613	0.752	0.982
Change in Debt Share: due in 2-5 Years	18	0.045	0.224	-0.201	-0.050	0.067	0.140	0.240
Debt due in 5+ Years	18	0.280	0.216	0.000	0.025	0.295	0.402	0.554
Change in Debt due in 5+ Years	18	-0.065	0.173	-0.239	-0.103	-0.079	0.000	0.195
log Firm Size	18	7.398	1.447	4.880	6.331	7.905	8.295	9.204
Tobin Q	18	1.196	0.261	0.973	1.060	1.137	1.193	1.601
Cash-Asset Ratio	18	0.050	0.058	0.003	0.011	0.032	0.056	0.151

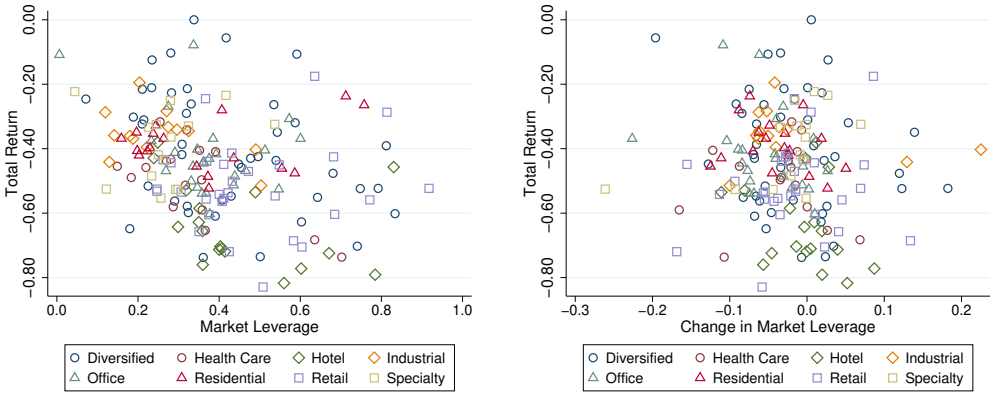
Table C.1
Summary Statistics by Industry (Part 2)

	N	Mean	SD	P10	P25	P50	P75	P90
Industrial								
Total Return	13	-0.356	0.078	-0.441	-0.395	-0.359	-0.333	-0.283
Percentage Change in CDS Spread (%)	13	120	70	45	64	121	171	217
Market Leverage	13	0.257	0.124	0.129	0.180	0.222	0.296	0.490
Change in Market Leverage	13	-0.019	0.091	-0.066	-0.062	-0.050	-0.036	0.129
Debt due in 2-3 Years	12	0.199	0.199	0.005	0.030	0.157	0.273	0.511
Change in Debt due in 2-3 Years	12	-0.011	0.284	-0.089	-0.073	-0.001	0.119	0.262
Debt due in 2-5 Years	12	0.485	0.237	0.312	0.355	0.479	0.590	0.727
Change in Debt Share: due in 2-5 Years	12	-0.066	0.141	-0.163	-0.093	-0.056	-0.017	0.106
Debt due in 5+ Years	12	0.436	0.189	0.221	0.357	0.452	0.587	0.625
Change in Debt due in 5+ Years	12	0.028	0.084	-0.064	-0.032	0.053	0.090	0.116
log Firm Size	13	8.137	1.281	6.802	7.287	8.370	8.570	8.910
Tobin Q	13	1.761	0.391	1.236	1.535	1.815	1.930	2.263
Cash-Asset Ratio	13	0.025	0.031	0.002	0.006	0.012	0.027	0.056
Office								
Total Return	25	-0.418	0.124	-0.539	-0.501	-0.442	-0.376	-0.269
Percentage Change in CDS Spread (%)	25	116	56	46	105	126	146	167
Market Leverage	25	0.373	0.120	0.269	0.336	0.362	0.436	0.547
Change in Market Leverage	25	-0.051	0.053	-0.104	-0.077	-0.041	-0.019	0.009
Debt due in 2-3 Years	25	0.251	0.201	0.065	0.127	0.202	0.324	0.487
Change in Debt due in 2-3 Years	25	0.055	0.130	-0.112	-0.003	0.035	0.103	0.160
Debt due in 2-5 Years	25	0.530	0.199	0.271	0.428	0.506	0.665	0.832
Change in Debt Share: due in 2-5 Years	25	0.037	0.189	-0.139	-0.066	0.041	0.097	0.216
Debt due in 5+ Years	25	0.436	0.216	0.106	0.312	0.452	0.566	0.715
Change in Debt due in 5+ Years	25	-0.036	0.193	-0.242	-0.093	-0.013	0.067	0.139
log Firm Size	25	8.201	1.033	6.822	7.802	8.099	8.917	9.449
Tobin Q	25	1.305	0.204	0.963	1.236	1.290	1.419	1.552
Cash-Asset Ratio	25	0.053	0.166	0.002	0.005	0.013	0.035	0.060
Residential								
Total Return	18	-0.390	0.079	-0.487	-0.455	-0.402	-0.350	-0.265
Percentage Change in CDS Spread (%)	18	134	62	31	87	167	175	209
Market Leverage	18	0.361	0.183	0.196	0.223	0.304	0.436	0.712
Change in Market Leverage	18	-0.038	0.047	-0.111	-0.070	-0.037	-0.005	0.027
Debt due in 2-3 Years	18	0.179	0.103	0.014	0.133	0.178	0.217	0.302
Change in Debt due in 2-3 Years	18	0.020	0.103	-0.101	-0.043	0.003	0.049	0.169
Debt due in 2-5 Years	18	0.427	0.141	0.283	0.355	0.376	0.501	0.607
Change in Debt Share: due in 2-5 Years	18	0.046	0.183	-0.132	-0.065	-0.012	0.082	0.398
Debt due in 5+ Years	18	0.525	0.140	0.307	0.498	0.581	0.621	0.638
Change in Debt due in 5+ Years	18	-0.039	0.188	-0.402	-0.123	0.006	0.108	0.150
log Firm Size	18	8.446	1.698	5.602	7.027	9.105	9.655	10.285
Tobin Q	18	1.757	0.627	1.159	1.377	1.646	1.999	2.296
Cash-Asset Ratio	18	0.014	0.023	0.002	0.003	0.006	0.014	0.038

Table C.1
Summary Statistics by Industry (Part 3)

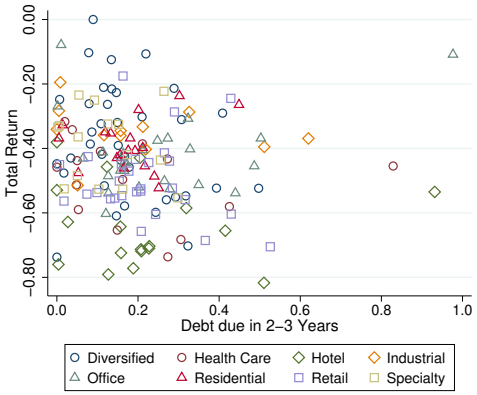
	N	Mean	SD	P10	P25	P50	P75	P90
Retail								
Total Return	30	-0.517	0.136	-0.695	-0.563	-0.533	-0.444	-0.350
Percentage Change in CDS Spread (%)	30	91	51	22	36	102	135	147
Market Leverage	30	0.476	0.171	0.272	0.368	0.423	0.583	0.728
Change in Market Leverage	30	-0.018	0.066	-0.103	-0.054	-0.019	0.011	0.072
Debt due in 2-3 Years	28	0.215	0.122	0.074	0.148	0.202	0.281	0.429
Change in Debt due in 2-3 Years	28	0.041	0.123	-0.114	-0.019	0.023	0.108	0.183
Debt due in 2-5 Years	28	0.507	0.188	0.268	0.371	0.466	0.609	0.806
Change in Debt Share: due in 2-5 Years	28	0.057	0.159	-0.092	-0.046	0.020	0.133	0.316
Debt due in 5+ Years	28	0.447	0.198	0.117	0.295	0.476	0.614	0.706
Change in Debt due in 5+ Years	28	-0.034	0.153	-0.235	-0.074	-0.004	0.051	0.133
log Firm Size	30	7.368	1.438	5.798	6.846	7.417	7.960	9.129
Tobin Q	30	1.388	0.347	1.014	1.132	1.326	1.504	1.938
Cash-Asset Ratio	30	0.031	0.051	0.002	0.005	0.011	0.023	0.088
Specialty								
Total Return	15	-0.390	0.114	-0.526	-0.525	-0.364	-0.324	-0.234
Percentage Change in CDS Spread (%)	15	132	54	62	94	142	164	207
Market Leverage	15	0.272	0.112	0.122	0.234	0.268	0.298	0.417
Change in Market Leverage	15	-0.026	0.074	-0.093	-0.034	-0.009	-0.001	0.027
Debt due in 2-3 Years	15	0.121	0.096	0.006	0.051	0.104	0.174	0.264
Change in Debt due in 2-3 Years	15	-0.028	0.199	-0.323	-0.065	-0.015	0.050	0.261
Debt due in 2-5 Years	15	0.370	0.145	0.189	0.305	0.333	0.434	0.510
Change in Debt Share: due in 2-5 Years	15	-0.013	0.190	-0.248	-0.080	0.004	0.033	0.168
Debt due in 5+ Years	15	0.608	0.152	0.436	0.508	0.657	0.695	0.810
Change in Debt due in 5+ Years	15	0.046	0.238	-0.113	-0.061	-0.003	0.248	0.323
log Firm Size	15	8.341	1.630	7.211	7.613	8.528	9.127	10.086
Tobin Q	15	1.799	0.642	1.300	1.525	1.690	1.853	2.306
Cash-Asset Ratio	15	0.013	0.016	0.002	0.004	0.008	0.016	0.036

Note: variables except the total return and the CDS spread are reported quarterly and come from the balance sheets of US REITs in 2019Q4. The change of a variable is the difference of the 2019Q4 and 2018Q4 values.

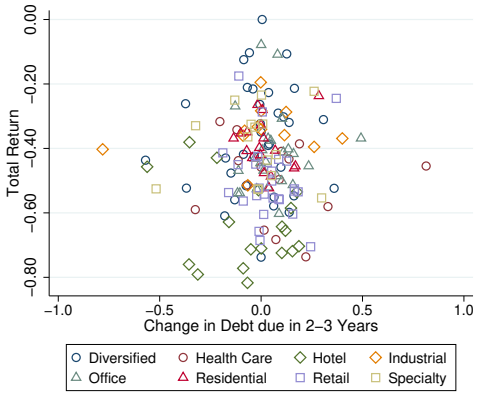


(a) Market Leverage

(b) Change in Market Leverage

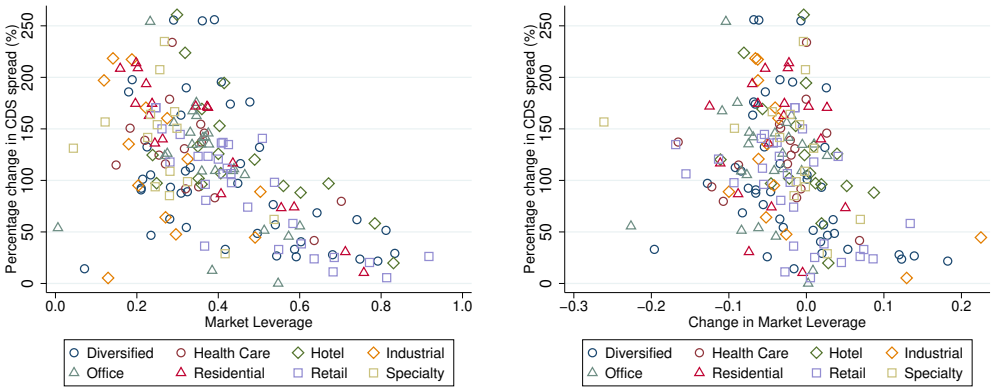


(c) Debt Due in 2-3 Years



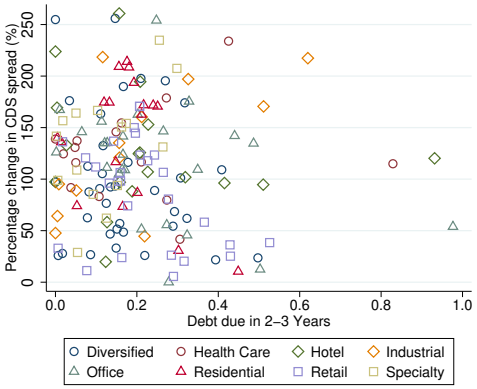
(d) Change in Debt Due in 2-3 Years

Fig. C.2. Total return (February 20-March 20, 2020) and the capital structure of US REITs. The change in the capital structure is the difference of the 2019Q4 and 2018Q4 values. REITs are grouped into 8 sectors. See Table 1 for the variable definitions.

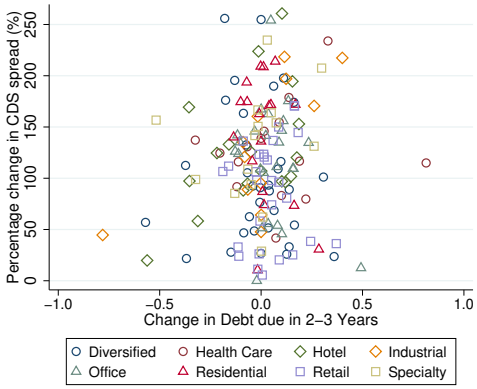


(a) Market Leverage

(b) Change in Market Leverage

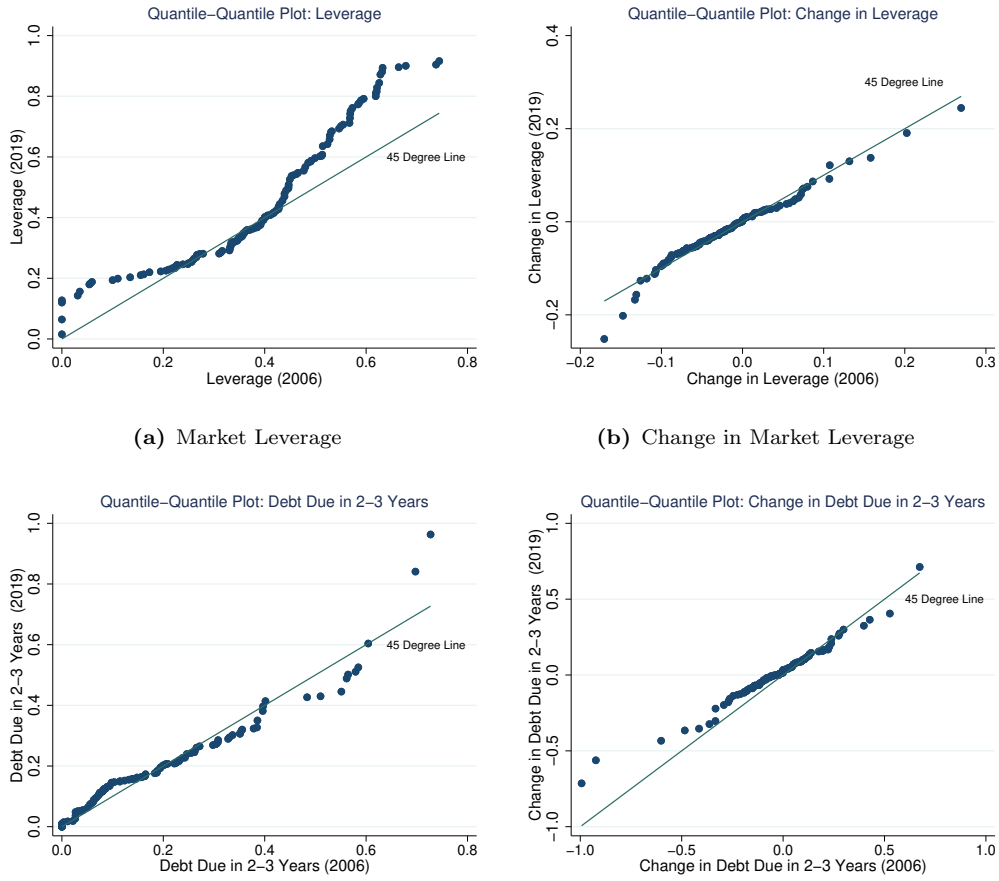


(c) Debt Due in 2-3 Years



(d) Change in Debt Due in 2-3 Years

Fig. C.3. Percentage change in the CDS spread (February 20-March 20, 2020) and the capital structure of US REITs. The change in the capital structure is the difference of the 2019Q4 and 2018Q4 values. REITs are grouped into 8 sectors. See Table 1 for the variable definitions.



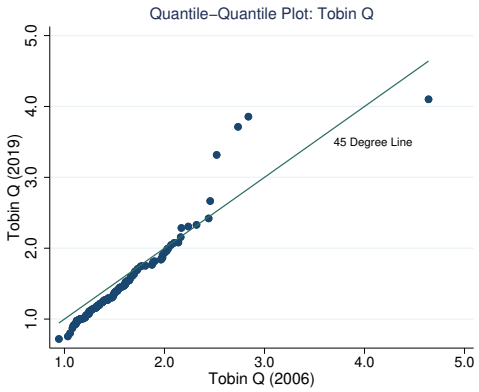
(a) Market Leverage

(b) Change in Market Leverage

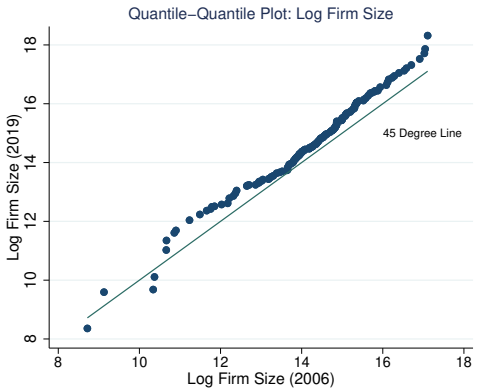
(c) Debt Due in 2-3 Years

(d) Change in Debt Due in 2-3 Years

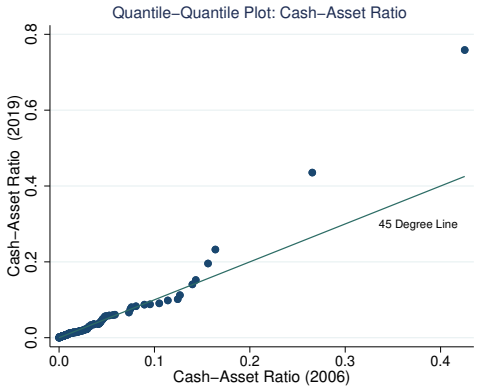
Fig. C.4. Quantile-quantile plots of the REIT capital structure in 2006 and 2019. The capital structure variables in 2006 come from Pavlov, Steiner, and Wachter (2018). See Table 1 for the variable definitions.



(a) Tobin Q



(b) Log Firm Size



(c) Cash-Asset Ratio

Fig. C.5. Quantile-quantile plots of the REIT characteristics in 2006 and 2019. The variables in 2006 come from Pavlov, Steiner, and Wachter (2018). The firm size is measured in 2019 USD. See Table 1 for the variable definitions.

Table C.2
Regression Results for the Total Return (with Quarterly Adjustment)

	Total Return		
	(1)	(2)	(3)
Leverage	-0.319**		-0.218
	(0.130)		(0.134)
ΔLeverage	0.311		0.372
	(0.591)		(0.602)
Debt due in 2-3 Years		-0.336***	-0.310***
		(0.115)	(0.114)
ΔDebt due in 2-3 Years		0.0990	0.0759
		(0.103)	(0.105)
log Firm Size	-0.000564	-0.00320	-0.00876
	(0.012)	(0.012)	(0.013)
Tobin Q	0.0560**	0.0715***	0.0617***
	(0.023)	(0.021)	(0.023)
Cash-Asset Ratio	0.259*	0.702***	0.594***
	(0.135)	(0.142)	(0.169)
Constant	-0.345**	-0.398***	-0.257
	(0.162)	(0.128)	(0.166)
Sector Effect	Yes	Yes	Yes
Adjusted R^2	0.516	0.557	0.566
N	178	166	164

Note: Significance is indicated as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$. Robust standard errors in parentheses. *Total return* refers to the cumulative daily rates of refers to the cumulative daily rates of return with dividend for the period February 20-March 20, 2020. The change of a variable (Δ) is the difference of the 2019Q4 and 2019Q3 values. *Sector effect* considers the fixed effect of 8 REIT sectors (Diversified, Health Care, Hotel, Office, Residential, Retail, Industrial, Specialty). See Table 1 for the definitions of all variables.

Table C.3
Regression Results for the Percentage Change in the CDS Spread (with Quarterly Adjustment)

	Percentage Change in CDS Spread (%)		
	(1)	(2)	(3)
Leverage	-240.2***		-253.3***
	(36.269)		(38.471)
ΔLeverage	-269.8		-288.7
	(192.924)		(200.541)
Debt due in 2-3 Years		20.27	59.36
		(45.121)	(42.505)
ΔDebt due in 2-3 Years		36.83	0.623
		(32.003)	(33.327)
log Firm Size	-3.506	4.160	-2.297
	(3.527)	(4.138)	(3.777)
Tobin Q	-22.45***	-9.549	-20.89**
	(8.470)	(9.288)	(8.024)
Cash-Asset Ratio	-191.6***	-130.5**	-266.6***
	(46.323)	(56.709)	(58.130)
Constant	277.8***	89.25**	253.7***
	(47.429)	(39.808)	(46.496)
Sector Effect	Yes	Yes	Yes
Adjusted R^2	0.372	0.242	0.411
N	177	165	163

Note: Significance is indicated as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$. Robust standard errors in parentheses. The percentage change in the CDS spread is for the period February 20-March 20, 2020. The change of a variable (Δ) is the difference of the 2019Q4 and 2019Q3 values. *Sector effect* considers the fixed effect of 8 REIT sectors (Diversified, Health Care, Hotel, Office, Residential, Retail, Industrial, Specialty). See Table 1 for the definitions of all variables.

Table C.4
Regression Results for the Total Return and Percentage Change in the CDS Spread (Other Debt Schedule)

	Total Return		Change in CDS spread (%)	
	(1)	(2)	(3)	(4)
Leverage	-0.255*	-0.231	-233.4***	-232.6***
	(0.144)	(0.144)	(46.890)	(48.591)
ΔLeverage	0.0636	0.0930	-111.6	-118.9
	(0.234)	(0.224)	(87.318)	(86.195)
Debt due in 2-5 Years	-0.0608		-1.879	
	(0.086)		(34.234)	
ΔDebt due in 2-5 Years	-0.0513		33.54	
	(0.091)		(34.077)	
Debt due in 5+ Years		0.0905		4.269
		(0.089)		(34.694)
ΔDebt due in 5+ Years		0.0245		-21.04
		(0.087)		(30.467)
log Firm Size	-0.00635	-0.00617	-2.525	-3.015
	(0.013)	(0.013)	(4.168)	(4.028)
Tobin Q	0.0506**	0.0529**	-16.63**	-16.24**
	(0.023)	(0.023)	(7.862)	(7.514)
Cash-Asset Ratio	0.376**	0.399***	-221.9***	-221.4***
	(0.147)	(0.144)	(49.144)	(49.531)
Constant	-0.256	-0.342**	246.8***	247.0***
	(0.186)	(0.164)	(59.852)	(53.020)
Sector Effect	Yes	Yes	Yes	Yes
Adjusted R^2	0.538	0.539	0.396	0.392
N	164	164	163	163

Note: Significance is indicated as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$. Robust standard errors in parentheses. *Total return* refers to the cumulative daily rates of return with dividend for the period February 20-March 20, 2020. The percentage change in the CDS spread is for the period February 20-March 20, 2020. The change of a variable (Δ) is the difference of the 2019Q4 and 2018Q4 values. *Sector effect* considers the fixed effect of 8 REIT sectors (Diversified, Health Care, Hotel, Office, Residential, Retail, Industrial, Specialty). See Table 1 for the definitions of all variables.

Table C.5
Regression Results for the Total Return by the Market Leverage in 2006

	Total Return					
	$Leverage_{2019} < Median(Leverage_{2006})$			$Leverage_{2019} \geq Median(Leverage_{2006})$		
	(1)	(2)	(3)	(4)	(5)	(6)
Leverage	-0.568**		-0.545**	-0.110		0.104
	(0.231)		(0.245)	(0.164)		(0.174)
ΔLeverage	0.0571		0.0521	-0.342		-0.0375
	(0.289)		(0.287)	(0.367)		(0.280)
Debt due in 2-3 Years		-0.319**	-0.273*		-0.329**	-0.355**
		(0.145)	(0.138)		(0.163)	(0.176)
ΔDebt due in 2-3 Years		0.103	0.0583		0.0814	0.0680
		(0.117)	(0.118)		(0.127)	(0.126)
log Firm Size	0.00328	-0.00126	-0.00558	-0.0273*	-0.0214	-0.0115
	(0.011)	(0.013)	(0.013)	(0.015)	(0.018)	(0.016)
Tobin Q	0.0449*	0.0657***	0.0475*	-0.0267	-0.0679	-0.0700
	(0.025)	(0.023)	(0.028)	(0.110)	(0.090)	(0.105)
Cash-Asset Ratio	0.120	0.679***	0.415	0.153	0.216	0.455
	(0.182)	(0.180)	(0.253)	(0.442)	(0.337)	(0.435)
Constant	-0.277	-0.391**	-0.157	-0.228	-0.177	-0.305
	(0.171)	(0.155)	(0.184)	(0.261)	(0.135)	(0.228)
Sector Effect	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.539	0.550	0.576	0.352	0.535	0.526
N	105	99	99	73	66	65

Note: Significance is indicated as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$. Robust standard errors in parentheses. *Total return* refers to the cumulative daily rates of return with dividend for the period February 20-March 20, 2020. The change of a variable (Δ) is the difference of the 2019Q4 and 2018Q4 values. *Sector effect* considers the fixed effect of 8 REIT sectors (Diversified, Health Care, Hotel, Office, Residential, Retail, Industrial, Specialty). See Table 1 for the definitions of all variables.

Table C.6
Role of Target Leverage

	Total Return			
	(1)	(2)	(3)	(4)
Leverage	-0.301**	-1.453	-0.236*	-1.607*
	(0.136)	(0.946)	(0.137)	(0.941)
ΔLeverage		-10.97		-13.07
		(7.995)		(8.021)
Deviation from Target Leverage	-0.0241	12.10	0.108	14.55
	(0.252)	(8.879)	(0.240)	(8.920)
Debt due in 2-3 Years			-0.332***	-0.332***
			(0.117)	(0.117)
ΔDebt due in 2-3 Years			0.0877	0.0877
			(0.094)	(0.094)
log Firm Size	0.000280	0.0340	-0.00807	0.0321
	(0.011)	(0.025)	(0.012)	(0.025)
Tobin Q	0.0566**	0.0415	0.0590**	0.0411
	(0.023)	(0.031)	(0.024)	(0.033)
Cash-Asset Ratio	0.267*	-0.947	0.601***	-0.845
	(0.140)	(0.966)	(0.172)	(0.951)
Constant	-0.360**	-0.538***	-0.245	-0.458***
	(0.157)	(0.113)	(0.167)	(0.118)
Sector Effect	Yes	Yes	Yes	Yes
Adjusted R^2	0.514	0.514	0.566	0.566
N	178	178	164	164

Note: Significance is indicated as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$. Robust standard errors in parentheses. *Total return* refers to the cumulative daily rates of return with dividend for the period February 20-March 20, 2020. The change of a variable (Δ) is the difference of the 2019Q4 and 2018Q4 values. *Deviation from Target Leverage* is defined as the residual of the leverage regression in which the the market leverage from last year, the log firm size, Tobin Q, the cash-asset ratio, and the sector dummies are the control variables. *Sector effect* considers the fixed effect of 8 REIT sectors (Diversified, Health Care, Hotel, Office, Residential, Retail, Industrial, Specialty). See Table 1 for the definitions of all variables.