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Navigating Real Estate Investment Trust Performance Dynamics: The Role of Style (Equity vs. Mortgage Real Estate Investment Trusts) and Diversification Amidst the COVID-19 Pandemic

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Abstract: In this paper, we investigate the impact of COVID-19 on different performance measures and the risk of US Real Estate Investment Trusts (REITs) with different styles. Our findings suggest a phenomenon with compelling evidence of reduced performance without any significant changes in risk profile amidst the COVID-19 pandemic. Particularly, mortgage REITs (MREITs) appear to be more adversely affected compared to equity REITs (EREITs). We further explore and analyze the performance of specialized REITs in contrast to diversified REITs in the distinctive conditions presented by COVID-19. We find that diversification creates value for the entire sample period, whereas, during the COVID-19 pandemic, property type specialization helps, although the results are weakly significant. The findings on risk suggest investors' short-run outlook on market reaction. These results remain robust to additional tests. The implications provide insight for investors as a reference to reallocate assets in their portfolios during uncertain times.

Keywords: COVID-19; equity REITs; mortgage REITs; diversification

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1. Introduction

The unprecedented impact of the new coronavirus disease, COVID-19, which surfaced in late 2019 and swiftly spread worldwide in 2020, had a profound effect on financial systems, especially global stock markets. The COVID-19 pandemic underwent a swift evolution, resulting in a complex catastrophe that affected not only the domain of public health but also had substantial ramifications for economic and financial stability.

The pandemic has significantly impacted the real estate market all around the world. Measures like social distancing, stay-at-home orders, and lockdowns to control the spread of the virus left the real estate investor in a state of skepticism about future expected cashflows. The real estate markets and stock markets capitalized on this information and eventually transmitted it to REITs. REITs are a type of publicly listed company that possess distinctive attributes. They are also considered hybrid investments, as they combine elements of equity and real estate. REITs exhibit distinct characteristics when compared to investments solely focused on real estate. These corporations provide financial resources, oversee operations, or possess ownership of real estate properties that generate income. Investors are provided with a means of diversification without the need to be concerned about the lack of liquidity. Krewson-Kelly and Mueller (2020) provide evidence that equity REITs produced higher compound annual returns than the S&P 500 Index over 20–30 years, notwithstanding boom-and-bust cycles. REITs serve as a hedge against inflation due to their dividend growth exceeding inflation. COVID-19 adversely affected the performance of REITS although the impact was asymmetric across different property types (Chiu et al. 2020; Akinsomi 2021; Cai and Xu 2022; Salami et al. 2023; Ampountolas et al. 2023).

The existing body of literature (Ling et al. 2020; Akinsomi 2021) regarding the impact of COVID-19 on the performance of REITs focuses on property type and geographical scope. The literature points to the asymmetric impact based on property type and geographic scope.

The spread of coronavirus and the measures to curtail the spread offered unique economic conditions. Some renters were not able to pay rent on time as they were on the verge of being out of business, and there was an unprecedented surge in online business activities. Interest rates were historically low. It makes the case for an extensive study of US REITs with different REIT styles. EREITs and MREITs are inherently different in terms of their income source (Hansz et al. 2017). Furthermore, the prior literature focuses on property type and geographical scope. To the best of our knowledge, no study focuses on the variation in the impact of COVID-19 on REIT performance based on REIT type[1]. Building upon the existing literature, we investigate the impact of REIT type (equity and mortgage) in explaining the risk and return of REITs during the pandemic.

EREITs mostly generate their income from rental payments obtained from their real estate holdings. Conversely, MREITs predominantly obtain their revenues from the interest earned on commercial mortgage loans or from investments made in real estate instruments associated with residential or commercial properties. Short-term debts dominate the capital structure of MREITs. The mismatch of maturity of loans and mortgages adds an additional layer of risk to the MREITs. At the same time, the FED's move to reduce the interest rates provided an opportunity to refinance.

We find strong evidence of lower performance and weakly significant low risk during the COVID-19 outbreak. The impact is more severe on the MREITs than on the EREITs using different measures of performance. The risk of mortgage REITs, on the other hand, is not significantly different from equity REITs during the COVID-19 pandemic.

The literature on the diversification benefits of REITs based on properties presents two competing hypotheses. On one hand, if a REIT specializes in one property type, then the manager becomes an expert and efficiently manages the properties, and thus, these REITs outperform the diversified REITs. On the other hand, diversified REITs offer the benefits of absorbing shocks and better managing cash flow variations. However, different property types require different skill sets on the part of the manager. So, the benefit of diversification comes at the expense of efficiency compromise or the cost of hiring an additional manager (Benefield et al. 2009; Anderson et al. 2015). It would be interesting to understand how specialized REITs perform compared to diversified REITs during the unique circumstances offered by COVID-19. We, therefore, seek to answer whether the performance and risk of REITs with property type diversification differ from the performance and risk of REITs that specialize in their real estate holding during the COVID-19 pandemic.

The results advocate the value-creating effects of diversification during our sample period. During the pandemic, specialized REITs perform better than diversified REITs, although the impact is weakly significant. Diversification helps to reduce the risk during our sample period, but the impact remains insignificant during the COVID-19 outbreak. Possibly, this can be attributed to the fact that a significant portion of the real estate holdings managed by REITs were already under lease agreements, potentially mitigating any immediate impact on cash flows. Investors, in general, are less concerned about extended future events. The theory of intertemporal discounting suggests differences in the strength and impacts of events on different temporal dimensions. Individuals tend to respond more strongly to concrete, near-term events rather than abstract, future events (Trope and Liberman 2003). Over the long term, people often exhibit a more positive and forward-looking perspective aligned with optimism (Weber 2006).

The rest of the paper is organized as follows: Section 2 presents the literature review, Section 3 describes the sample and methodology, Section 4 discusses the results, and Section 5 concludes this study.

2. Literature Review

The general impact that has been found in the literature is that COVID-19 had a negative impact on financial assets like stocks (Haroon et al. 2021; Chatjuthamard et al. 2021). Focusing on REITs, Ling et al. (2020) and Akinsomi (2021) document negative REIT returns for retail, lodging, diversified, and office REITs, whereas healthcare, technology REITs, and data center REITs report positive returns during COVID-19. Most studies focus on one country like China or the US, except Milcheva (2022), which uses a sample of selected developed Asian countries (Hong Kong, Japan, and Singapore) and the US. In our first hypothesis, we examine the impact of COVID-19 on REITs' performance and risk.

REITs offer a valuable way to balance and diversify portfolios. An intriguing aspect of REIT investing is the question of whether equity REITs and mortgage REITs can be seen as interchangeable. There are two competing hypotheses regarding whether EREITs and MREITs behave differently. The first hypothesis (Lee and Chiang 2004; Chen et al. 2005) supports that both REIT types are substitutable. In other words, both types should be considered as a single asset class while constructing a diversified portfolio. This implies that investors can maximize the performance benefits by including any of these REIT types, as the performance benefits result from unique REIT features such as high dividends and resistance to inflation.

The second hypothesis on the EREITs vs. MREITs literature supports the idea that EREITs and MREITs behave differently. Kuhle et al. (1986) show that EREITs outperform common stocks under the null hypothesis of the CAPM, while MREITs fail to do so. When a five-factor version of Fama and French is used, Peterson and Hsieh (1997) find that EREITs have a similar performance with respect to common stocks, but MREITs significantly underperform common stocks by an average of 6.8%. Based on a sample of REIT data from 1972 to 1996, Glascock et al. (2000) use cointegration and vector autoregressive models to explore the causality and long-run linkages of REITs (both equity and mortgage), bonds, and stock returns. This study found a causal relation and two-way feedback between EREITs and MREITs prior to 1992. The substitutability of EREITs and MREITs disappeared after 1992 because the structural changes to the REIT industry in the early 1990s caused EREITs to act more like stocks and MREITs to act more like bonds. Hansz et al. (2017) demonstrate that the economic factors influencing the return of EREITs are distinct from those of MREITs returns. The results contradict the idea of substitutability between the two.

The literature presents mixed results for the substitutability of EREITs and MREITs. Given this ambiguity in the literature, in our second hypothesis, we examine the impact of COVID-19 on REIT performance/risk for different REIT types.

In bridging the literature with our motivation, our study further provides perspective in the literature on the impact of diversification on REIT performance/risk. The theoretical foundations of corporate diversification offer competing perspectives for the motivation to diversify. It offers both value-creating and value-destroying explanations for diversification. The agency theory suggests that diversification decisions are taken opportunistically to reduce risk and raise private benefits (Jensen and Meckling 1976; Jensen 1986). This strand of the literature argues that diversification destroys value. Consistent with this theory, Lang and Stulz (1994) and Aggarwal and Samwick (2003), among others, provide evidence suggesting that diversification destroys firm value. On the other hand, efficiency theories on diversification argue that diversification reduces information asymmetry and, thus, the cost of contracting between firms and outsiders (providers of external financing), thereby improving efficiency (Stein 1997; Kaplan and Zingales 1997). The proponents of efficiency theories on diversification suggest that diversification creates value through efficiency gains. Thomas (2002) finds that diversified firms have lower forecasting errors and 3-day abnormal returns around earning announcements. However, Scharfstein and Stein (2000) find that diversification causes the inefficient allocation of funds and destroys value. Ataullah et al. (2014) find that only geographically diversified firms can reduce information asymmetry. Industrial diversification does not help to reduce information asymmetry.

The literature on corporate diversification provides mixed evidence on the value-creating vs. value-generating impacts of corporate diversification. In the REIT space, diversification pertains to owning different types of properties or holding properties at different geographical locations. Focusing on REIT diversification, Benefield et al. (2009) find that property-type diversified REITs outperform their specialized counterparts. They also analyze different sample periods and find that the performance depends on overall economic conditions. When the market conditions are good, diversified REITs tend to outperform specialized REITs. They further find that uneven distribution of property type could potentially affect the REIT performance in a specific period. The study focuses on equity REITs and uses performance ranking criteria of the Treynor Index, Double Sharpe Ratio, and Jensen's Alpha. They argue that the Double Sharpe Ratio adjusts for small sample bias when using annualized returns. Ro and Ziobrowski (2011) document that diversified REITs outperform specialized REITs, but the results are not statistically significant. They argue that Benefield et al. (2009) do not control for leverage, and the composition of specialized REITs does not change over time. Oikarinen (2015) provides strong evidence of the outperformance of diversified REITs compared to their specialized counterparts. The results of the study are partly explained by size, leverage, total operating expenses, and dividend yields.

Anderson et al. (2015) document a strong positive relationship between REIT performance and property-type diversification. The results are strongly associated with market conditions. The outperformance is the result of the availability of a larger investment opportunity set and the REIT manager's ability to select highly performing properties in hot markets and shield against property-specific risk in low markets.

Contrary to this, Capozza and Seguin (1998) document the value-destroying effects of REIT diversification. Using both geographic and property-type diversification, their results support the agency theory. They find that a diversified asset base reduces transparency and makes it difficult to monitor, which increases borrowing costs. Diversification positively affects property-level cashflows but offsets the benefits due to an increase in administrative costs. Consistently, Brounen and Koning (2012) document a positive relationship between REIT stock outperformance with geographical focus, property type specialization, and firm size. They argue that property type diversification adversely affects the returns because of a lack of knowledge of operating in different real estate segments. Overall, their findings suggest that a portfolio of REITs consisting of different properties destroys value. Demiralay and Kilincarslan (2022) highlight the importance of property types for REIT investors. They provide evidence of the asymmetric impact of uncertainties by property type in a regime-switching environment. Residential REITs are resilient to the impact of uncertainties and offer significant diversification benefits during periods of heightened uncertainty.

Overall, we find mixed evidence of value-creating or value-destroying properties of diversification in REITs space. The results indicate that market conditions play an important role in identifying the role of diversification in REIT performance. COVID-19 created unique economic conditions, leading to a dramatic increase in inequalities globally and within a country[2]. The economic policy response was different across countries and industries within a country[3]. Given the heterogeneity of COVID-19 impacts on different sectors of the economy, our third hypothesis focuses on value-creating vs. value-destroying effects of diversification during the pandemic.

3. Data and Methodology

This study uses a panel of publicly traded US equity and mortgage REITs from 2000 to 2021. To avoid survivorship bias, we keep all the REITs listed on the NYSE, Nasdaq, and Amex. We include observations with non-missing values on the Center for Research in Security Prices (CRSP) and Compustat. We retrieve returns data from CRSP to analyze the impact of COVID-19 on REIT performance and risk. Excess returns are calculated using CAPM models. Our data for beta and other risk measurements are from WRDS (beta suite by WRDS[4]), which calculates stocks' loading on market risk factors. Following Agrrawal

et al. (2022), we use an estimation window of 252 days. Beta is the systematic risk computed from the CAPM model using daily returns for the past 252 days.

Other performance measures include total dividend distribution, funds from operations (FFO), and return on assets (ROA), which are calculated from Compustat and available at quarterly frequency (Cai and Xu 2022; Feng et al. 2021).

Following Kizys et al. (2021) and Cai and Xu (2022), we construct our *COVID-19* variable as Quarter 1 of 2020 dummy variable (from 1 January 2020 to 31 March 2020)[5].

In order to test for the effect of specialized and diversified REITs, we obtain property-level data for REITs from S&P Global Market Intelligence. These data include company name, property name, property address, state, acquisition date, property size (in square footage), and acquisition price. We use these data to create our Herfindahl–Hirschman Index (HHI) variable:

$$\mathrm{HHI_t} = \sum_{i=1}^{N} S_{i,t}^2$$

$$s_{i,t}^2 = \frac{v_{i,t}}{\sum_{i=1}^{N} v_{i,t}}$$

where $v_{i,t}$ is the REIT company i's acquisition price or property size measured by square feet in year t, and N is the number of REITs eligible for inclusion in the industry. Thus, $s_{i,t}$ represents the market share of the REIT firm i in the industry in year t. HHI index proxies for property-type diversification. In theory, HHI spans a scale of 0 to 1, transitioning from numerous extremely small firms (HHI = 0) to a solitary monopolistic firm (HHI = 1). Higher HHI values mean lower diversification and higher specialization, while lower values indicate higher diversification.

We use various control variables, including REIT's specific characteristic variables such as SIZE (measured as the natural logarithm of total assets), leverage (LEV), and AGE (measured as the difference between the sample year and the year that a REIT was incorporated). Following Huang et al. (2009), we control the impact if a particular REIT is included in the S&P 500 (SP_Index).

In addition, we account for several capital market and macroeconomic variables. Specifically, we control for the debt capital market conditions using the values of term structure, defined as the difference in yield between a 10-year Treasury bond and a 3-month Treasury bill (TRM), following Ling et al. (2014) and Aroul et al. (2023). To control for investor sentiment in the general equity market, we include VIX index (Chicago Board Options Exchange, as known as volatility index), which measures implied volatility based on S&P500 options, and this captures the expectations of investor about future stock market volatility. We also include Nareit_return as monthly return from FTSE NAREIT US Real Estate Index to control for the overall REIT market (Lantushenko and Nelling 2020).

In addition to monitoring capital market conditions, we also consider Economic Policy Uncertainty within the market. We use Economic Policy Uncertainty (EPU) index, developed by Baker et al. (2016), as a measure of EPU. This index comprises three key elements. The first involves an index derived from search results related to economic and policy uncertainty across ten prominent newspapers. The second component gauges uncertainty surrounding temporary provisions in the federal tax code. The third component reflects policy-related uncertainty, sourced from the Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters. Our analysis incorporates this composite score (EPU) derived from these three components. Additionally, we account for the unemployment rate, using the seasonally adjusted monthly unemployment rate for the US (UNP) as another macroeconomic variable under consideration. Following the literature (An et al. 2011), since REITs specialize in various property markets, we control for property types (ptype), a variable that classifies different REITs' property types into ten categories[6].

We analyze the data using cross-sectional panel regression. We test our first hypothesis by examining and confirming the impact of COVID-19 pandemic on different performance and risk measurements.

$$Performance\ measurements_{i,t} = \alpha_{i,t} + \beta_1 \cdot COVID_t + Control\ variables_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$Risk\ measurement_{i,t} = \alpha_{i,t} + \beta_1 \cdot COVID_t + Control\ variables_{i,t} + \varepsilon_{i,t} \quad (2)$$

In models (1) and (2), β_1 measures the impact of COVID-19 on performance and risk of REITs.

Then, we test our second hypothesis for the impact of COVID-19 on different REIT types.

$$Performance\ measurements_{i,t} = \alpha_{i,t} + \beta_1 \cdot COVID + \beta_2 \cdot REIT\ type_i + \beta_3 \cdot COVID_t \cdot REIT\ type_i + Control\ variables_{i,t} + \varepsilon_{i,t} \quad (3)$$

$$Risk\ measurement_{i,t} = \alpha_{i,t} + \beta_1 \cdot COVID + \beta_2 \cdot REIT\ type_i + \beta_3 \cdot COVID_t \cdot REIT\ type_i + Control\ variables_{i,t} + \varepsilon_{i,t} \quad (4)$$

We include the interaction between COVID-19 indicator and REIT types to further dissect the impact of performance/risk in the context of COVID-19 and REIT types. In models (3) and (4), β_2 measures the performance and risk of mortgage REITs compared to the base group (equity REITs), while β_3 presents the impact of COVID-19 on performance and risk of MREITs compared to the EREITs.

In our test for the third hypothesis, we run the OLS regression models to test the impact of diversification (HHI) on different performance and risk measurements.

$$Performance\ measurements_{i,t} = \alpha_{i,t} + \beta_1 \cdot HHI_i + Control\ variables_{i,t} + \varepsilon_{i,t} \quad (5)$$

$$Risk\ measurement_{i,t} = \alpha_{i,t} + \beta_1 \cdot HHI_i + Control\ variables_{i,t} + \varepsilon_{i,t} \quad (6)$$

In models (5) and (6), β_1 examines the impact of property type diversification on the performance and risk of REITs.

Finally, we examine the impact of HHI during COVID-19 on REITs' performance/risk. In models (7) and (8), we include the interaction between the COVID-19 indicator and the HHI index. The beta coefficient of the interaction term (β_3) measures the impact of property type diversification on the risk and performance of REITs during COVID-19.

$$Performance\ measurements_{i,t} = \alpha_{i,t} + \beta_1 \cdot COVID + \beta_2 \cdot HHI_i + \beta_3 \cdot COVID_t \cdot HHI_i + Control\ variables_{i,t} + \varepsilon_{i,t} \quad (7)$$

$$Risk\ measurement_{i,t} = \alpha_{i,t} + \beta_1 \cdot COVID + \beta_2 \cdot HHI_i + \beta_3 \cdot COVID_t \cdot HHI_i + Controlvariables_{i,t} + \varepsilon_{i,t} \quad (8)$$

4. Results

4.1. Main Results

Tables 1 and 2 report the sample's descriptive statistics and correlation matrix, respectively. The dependent variables from the CAPM model (beta) are collected at a monthly frequency, while the other performance measures are collected at a quarterly frequency. We winsorize the data at the 1st and 99th percentile of each REIT. The average return from the CAPM model is −0.21%, with a standard deviation of about 10%; the average beta from the CAPM model is 0.7, with a standard deviation of about 46%. For independent variables, we present two proxies for COVID-19 (COVID and COVID2). The summary statistics of those variables are a little different due to the cut-off threshold for different proxies (the mean of COVIDis 0.01, and the mean of COVID2 is 0.03). There is a higher level of standard deviation for COVID2 (17%) compared to COVID (11%). For HHI, the average for the sample is 0.09, and the standard deviation is 17%. For our control variables, we report the summary statistics of the actual company age (age in terms of year) and total assets as size. In our analysis, we transform both variables into logarithmic form. We also

present summary statistics for other dependent variables in the robustness section at the end of Table 1.

Table 1. Descriptive Statistics. This table reports descriptive statistics of different dependent, independent, and control variables. The descriptive statistics include the number of observations, mean, standard deviation, and minimum and maximum values of all the variables. These are based on the time-series averages over the sample period.

Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent variables					
Excess return from CAPM	25,164	0.00	0.10	−2.01	1.27
Beta from CAPM	25,344	0.70	0.46	−0.08	2.93
ROA	48,423	0.01	0.03	−0.79	0.89
Total dividend	48,654	0.26	1.05	0.00	104.00
FFO	25,586	0.01	0.01	−0.78	0.15
Independent variables					
COVID	48,654	0.01	0.11	0.00	1.00
COVID2	48,654	0.03	0.17	0.00	1.00
HHI	17,070	0.09	0.17	0.00	1.00
Control variables					
ptype	48,654	5.53	2.62	0.00	10.00
AGE (year)	47,288	13.31	7.98	0.00	32.00
SIZE (total asset)	48,456	5179.12	9677.62	0.27	141,576.60
TRM	48,654	1.62	1.12	−0.70	3.69
UNP	48,654	5.80	1.85	3.50	14.70
EPU	48,654	121.98	44.97	57.20	350.46
SP_Index	48,654	0.06	0.24	0.00	1.00
LEV	48,456	0.60	0.21	0.00	4.57
NAREIT_return	48,654	0.01	0.05	−0.30	0.28
VIX	48,654	19.59	7.76	9.51	59.89
Other dependent variables for robustness					
Idiosyncratic risk from CAPM	25,344	0.08	0.03	0.03	0.24
Total risk from CAPM	25,344	0.09	0.04	0.03	0.24
raw return	48,646	0.01	0.11	−0.86	2.90

Table 2 presents the correlation matrix for the main variables of interest in Panel A and the control variable in Panel B. We do not observe any significant correlation level among our variables, except for COVIDand COVID2, where the coefficient is 0.65. These are two different proxies for COVID, and we do not use them in the same model.

Table 3 reports the impact of COVID-19 on REITs' performance and risk. In columns (1) through (4), we find a negative impact of COVID-19 on all performance indicators-excess return from CAPM, ROA, total dividend, and FFO. The declined return results are consistent with the prior literature. In column (5), we find a negative significant impact of COVID-19 on the CAPM beta although the results are weakly significant. The finding might be the result of the fact that many properties are already being leased, lessening the immediate financial strain. Generally, investors prioritize present concerns over distant ones, as evidenced by the theory of intertemporal discounting, which highlights our tendency to react more to immediate events than future possibilities. All the results are robust to the VIF test for multicollinearity[7].

Table 2. Correlation matrix. Panel A: Correlation for main variables of interest. Panel A of this table reports Pearson's correlation coefficients of Excess return from CAPM, Beta from CAPM, ROA, Total dividend, FFO, COVID, COVID2, and HHI. **Panel B: Correlation for control variables.** Panel B of this table reports Pearson's correlation coefficients of ptype, AGE, SIZE, TRM, UNP, EPU, SP_Index, LEV, NAREIT_return, VIX. Table A1 provides the definitions of the variables.

(A)

	Excess Return from CAPM	Beta from CAPM	ROA	Total Dividend	FFO	COVID	COVID2	HHI
Excess return from CAPM	1.00							
Beta from CAPM	−0.03	1.00						
ROA	0.04	−0.18	1.00					
Total dividend	0.01	−0.06	0.12	1.00				
FFO	0.04	−0.28	0.41	0.13	1.00			
COVID	−0.13	0.04	0.01	0.01	−0.01	1.00		
COVID2	−0.12	0.08	−0.03	0.00	−0.05	0.65	1.00	
HHI	−0.02	−0.07	−0.01	0.04	−0.16	−0.02	−0.04	1.00

(B)

	Ptype	AGE	SIZE	TRM	UNP	EPU	SP_Index	LEV	NAREIT Return	VIX
ptype	1.00									
AGE	0.00	1.00								
SIZE	0.01	0.15	1.00							
TRM	0.01	−0.03	−0.06	1.00						
UNP	0.01	0.06	−0.01	0.53	1.00					
EPU	−0.03	0.19	0.08	0.03	0.53	1.00				
SP_Index	0.00	0.27	0.31	−0.03	0.01	0.07	1.00			
LEV	0.14	−0.04	0.19	−0.03	−0.01	0.00	0.00	1.00		
NAREIT_return	0.00	−0.01	−0.01	0.02	0.09	−0.05	0.00	−0.02	1.00	
VIX	0.02	−0.02	−0.05	0.16	0.32	0.52	−0.02	0.03	−0.35	1.00

Table 3. Impact of COVID-19 on performance and risk measurement for REITs. This table presents the empirical results for models (1) and (2). We use different measures of REIT performance in columns (1) through (4) and market beta from CAPM model as a measure of risk in models (2) as dependent variables. Columns (1) through (5) examine the impact of COVID-19 on performance and risk measures for REITs. Table A1 provides definitions of variables. t-stat in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Excess Return from CAPM (1)	ROA (2)	Total Dividend (3)	FFO (4)	Beta from CAPM (5)
COVID	−0.058 ***	−0.013 ***	−0.097 ***	−0.002 *	−0.038 **
	(−4.151)	(−4.349)	(−3.032)	(−1.715)	(−2.397)
AGE	0.001	0.003 ***	0.037 **	0.002 ***	−0.130
	(0.421)	(5.675)	(2.429)	(4.072)	(−1.162)
SIZE	0.001	0.001 ***	0.033 ***	0.001 **	0.049 ***
	(1.250)	(2.646)	(3.229)	(2.053)	(3.254)
TRM	−0.006 ***	−0.001 ***	−0.000	−0.001	0.011 ***
	(−3.710)	(−2.629)	(−0.027)	(−1.339)	(4.915)
UNP	−0.009 ***	−0.001 ***	−0.044 ***	−0.001 ***	0.006 **
	(−8.113)	(−4.122)	(−5.723)	(−3.384)	(2.580)

Table 3. *Cont.*

	Excess Return from CAPM (1)	ROA (2)	Total Dividend (3)	FFO (4)	Beta from CAPM (5)
EPU	−0.000 ***	0.000	0.001 ***	0.000	−0.000
	(−5.183)	(1.338)	(4.154)	(0.817)	(−0.708)
SP_Index	0.001	−0.000	0.100 **	−0.001	−0.036
	(0.732)	(−0.406)	(2.053)	(−0.499)	(−0.624)
LEV	−0.016 ***	−0.015 ***	0.027	−0.012 ***	0.295 ***
	(−3.199)	(−4.772)	(0.361)	(−3.137)	(3.229)
NAREIT_return	0.727 ***	−0.001	0.239 ***	−0.001	0.025 *
	(24.803)	(−0.491)	(2.849)	(−0.596)	(1.966)
VIX	0.001 ***	−0.000 **	0.000	−0.000	0.002 ***
	(6.865)	(−2.138)	(0.738)	(−1.173)	(5.941)
Constant	0.026 **	0.065 ***	3.862 ***	0.019 ***	0.377
	(2.231)	(9.946)	(12.833)	(3.820)	(1.202)
Time fixed effect	YES	YES	YES	YES	YES
Number of REITs	205	429	430	240	207
Observations	24,662	47,113	47,142	25,071	24,834
R-squared	0.191	0.052	0.034	0.125	0.512
Adjusted R-squared	0.190	0.051	0.033	0.124	0.511
Mean VIF	1.63	1.5	1.5	1.72	1.63

Table 4 examines the impact of COVID-19 on REIT performance and risk for different REIT types (MREITs compared to EREITs). The coefficients of the interaction term for performance measures (except for FFO) are negative and significant. The results indicate that the negative impact of COVID-19 on REITs' performance is more pronounced for MREITs compared to EREITs. The results can be attributed to the divergence in the economic forces affecting EREIT returns compared to those influencing MREIT returns (Hansz et al. 2017; Kuhle et al. 1986). In column (5), though the beta risk is less for the MREITs as compared to the EREITs, it is not statistically significant.

Table 4. Impact of COVID-19 on performance and risk measurement for different REIT types. This table presents the empirical results for models (3) and (4). We use different measures of REIT performance in columns (1) through (4) and market beta from CAPM model as a measure of risk in models (4) as dependent variables. Columns (1) through (5) examine the impact of COVID-19 on performance and risk measures for different REIT types. Table A1 provides definitions of variables. t-stat in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Excess Return from CAPM (1)	ROA (2)	Total Dividend (3)	FFO (4)	Beta from CAPM (5)
COVID	−0.042 ***	−0.008 ***	−0.073 **	−0.002 *	−0.027
	(−3.248)	(−2.729)	(−2.248)	(−1.727)	(−1.380)
RTYPE	−0.003	0.003	0.019	−0.008 **	0.145
	(−1.247)	(1.601)	(0.561)	(−2.502)	(1.227)
COVID*RTYPE	−0.106 ***	−0.027 ***	−0.126 ***	0.002	−0.062
	(−3.376)	(−4.306)	(−4.298)	(0.616)	(−0.735)
AGE	0.001	0.003 ***	0.037 **	0.002 ***	−0.134
	(0.345)	(5.706)	(2.415)	(4.037)	(−1.181)
SIZE	0.001	0.001 ***	0.033 ***	0.001 **	0.048 ***
	(1.273)	(2.608)	(3.231)	(2.068)	(3.206)
TRM	−0.006 ***	−0.001 ***	−0.000	−0.001	0.011 ***
	(−3.716)	(−2.639)	(−0.029)	(−1.338)	(4.897)
UNP	−0.009 ***	−0.001 ***	−0.044 ***	−0.001 ***	0.006 **
	(−8.118)	(−4.124)	(−5.721)	(−3.386)	(2.575)

Table 4. *Cont.*

	Excess Return from CAPM (1)	ROA (2)	Total Dividend (3)	FFO (4)	Beta from CAPM (5)
EPU	−0.000 ***	0.000	0.001 ***	0.000	−0.000
	(−5.198)	(1.342)	(4.154)	(0.827)	(−0.725)
SP_Index	0.001	−0.000	0.100 **	−0.001	−0.034
	(0.570)	(−0.426)	(2.050)	(−0.515)	(−0.582)
LEV	−0.015 ***	−0.015 ***	0.026	−0.011 ***	0.282 ***
	(−3.063)	(−4.711)	(0.342)	(−3.132)	(3.040)
NAREIT_return	0.727 ***	−0.001	0.240 ***	−0.001	0.025 **
	(24.795)	(−0.462)	(2.853)	(−0.607)	(1.988)
VIX	0.001 ***	−0.000 **	0.000	−0.000	0.002 ***
	(6.880)	(−2.160)	(0.730)	(−1.178)	(5.966)
Constant	0.026 **	0.065 ***	3.863 ***	0.019 ***	0.395
	(2.235)	(9.944)	(12.838)	(3.831)	(1.240)
Time fixed effect	YES	YES	YES	YES	YES
Number of REITs	205	429	430	240	207
Observations	24,662	47,113	47,142	25,071	24,834
R-squared	0.194	0.054	0.034	0.127	0.513
Adjusted R-squared	0.192	0.053	0.033	0.126	0.512

In the next analysis, following Feng et al. (2021) and Ling et al. (2020), we include HHI as a proxy for property diversification and examine whether the effect of property diversification helps to reduce the impact of COVID-19 on REIT performance and risk. Table 5 presents the impact of property type diversification on the risk and performance of REITs. We use the HHI index to measure diversification. A higher value of the HHI index reflects more specialization and less diversification. The results indicate that as diversification increases, REIT returns improve. The results indicate that as diversification increases, REIT performance, as measured by excess returns from CAPM, improves, whereas the results remain insignificant for other measures of performance. Specialized REITs exhibit higher risk during the sample period, as evidenced by positive and significant beta from the CAPM model.

Table 5. Impact of diversification on performance/risk. This table presents the empirical results for models (5) and (6). We use different measures of REIT performance in columns (1) through (4) and in column (5) market beta from CAPM model as a measure of risk in model (6) as dependent variables. Columns (1) through (5) examine the impact of diversification as measured by HHI on performance and risk of US REITs. Table A1 provides definitions of variables. t-stat in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Excess Return from CAPM (1)	ROA (2)	Total Dividend (3)	FFO (4)	Beta from CAPM (5)
HHI	−0.004 *	0.002	0.004	−0.005	0.234 **
	(−1.780)	(0.813)	(0.020)	(−1.471)	(2.136)
AGE	−0.001	0.003 ***	0.086 ***	0.002 ***	−0.161
	(−0.304)	(4.592)	(2.991)	(2.905)	(−1.200)
SIZE	−0.001 **	0.000	0.045 ***	0.001	0.072 ***
	(−2.641)	(0.450)	(2.724)	(1.025)	(3.311)
TRM	−0.002	−0.001	0.010	−0.000	0.016 ***
	(−1.016)	(−1.584)	(1.574)	(−0.910)	(6.133)
UNP	−0.007 ***	−0.001 ***	−0.026 ***	−0.000 ***	0.007 ***
	(−4.999)	(−3.981)	(−5.936)	(−4.846)	(5.668)
EPU	−0.000 ***	0.000	0.001 ***	0.000 ***	−0.000 *
	(−3.653)	(1.322)	(3.811)	(2.874)	(−1.808)

Table 5. *Cont.*

	Excess Return from CAPM (1)	ROA (2)	Total Dividend (3)	FFO (4)	Beta from CAPM (5)
SP_Index	0.002	0.001	0.079	−0.000	−0.059
	(0.972)	(0.877)	(1.058)	(−0.096)	(−0.831)
LEV	−0.001	−0.018 ***	0.021	−0.005	0.077
	(−0.200)	(−5.697)	(0.115)	(−1.302)	(0.478)
NAREIT_return	0.829 ***	0.002	−0.045	−0.002	0.048 ***
	(29.457)	(0.842)	(−0.359)	(−1.204)	(5.488)
VIX	0.002 ***	−0.000	−0.001	−0.000 ***	0.002 ***
	(9.115)	(−0.904)	(−1.532)	(−2.637)	(6.595)
Constant	0.016	0.016 ***	−0.151	0.011 **	0.194
	(1.023)	(4.707)	(−0.976)	(2.316)	(0.565)
Time fixed effect	YES	YES	YES	YES	YES
Number of REITs	72	108	108	107	72
Observations	10,768	17,032	17,036	13,028	10,830
R-squared	0.302	0.110	0.037	0.201	0.581
Adjusted R-squared	0.300	0.108	0.035	0.199	0.580

Table 6 reports the impact of property type diversification on the risk and performance of REITs during COVID-19. Interestingly, we find that during the pandemic, specialized REITs perform better than diversified REITs, as reflected by the positive and significant coefficient of the interaction term in column (1). However, the results in column (4) suggest that diversified REITs perform better than specialized REITs as measured by FFO. Excess returns and FFO measure two distinct aspects of performance for REITs. FFO represents the short-term, immediate cash flows from fund operations, while returns reflect the long-term expectations. Our results indicate that during the COVID-19 pandemic, diversification helped in terms of cash flow generation. In other words, diversification helped to absorb cashflow shocks during the pandemic, whereas specialized REITs exhibit better performance in terms of excess return during turbulent times. Potentially, the results might be affected by property type focus within specialized REITs. Consistent with conventional wisdom, specialized REITs, in general, exhibit higher risk, but during the pandemic, there is no significant impact of the level of diversification (specialization) on REITs' risk exposure. Consistent with Benefield et al. (2009); Anderson et al. (2015); and Oikarinen (2015), our results support the value-creating effects of diversification for the entire sample period but not during the pandemic that reflects adverse economic conditions.

Table 6. Impact of COVID-19 and different levels of diversification on performance/risk. This table presents the empirical results for models (7) and (8). We use different measures of REIT performance in columns (1) through (4) and in columns (5) market beta from CAPM model as a measure of risk in models (8) as dependent variables. Columns (1) through (5) examine the impact of diversification as measured by HHI along with COVID-19 impact on performance and risk of US REITs. Table A1 provides definitions of variables. t-stat in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Excess Return from CAPM (1)	ROA (2)	Total Dividend (3)	FFO (4)	Beta from CAPM (5)
HHI	−0.005 **	0.002	0.004	−0.005	0.233 **
	(−2.094)	(0.757)	(0.020)	(−1.445)	(2.128)
COVID	−0.026 *	−0.002	−0.059	0.001	−0.006
	(−1.694)	(−0.852)	(−1.558)	(1.196)	(−0.276)
COVID*HHI	0.081	0.015	0.007	−0.019 **	0.109
	(1.347)	(0.517)	(0.016)	(−2.130)	(1.159)

Table 6. *Cont.*

	Excess Return from CAPM (1)	ROA (2)	Total Dividend (3)	FFO (4)	Beta from CAPM (5)
AGE	−0.001	0.003 ***	0.086 ***	0.002 ***	−0.161
	(−0.281)	(4.589)	(2.991)	(2.912)	(−1.200)
SIZE	−0.001 **	0.000	0.045 ***	0.001	0.072 ***
	(−2.551)	(0.461)	(2.737)	(1.012)	(3.313)
TRM	−0.002	−0.001	0.011	−0.000	0.016 ***
	(−0.953)	(−1.560)	(1.643)	(−0.914)	(6.031)
UNP	−0.009 ***	−0.001 ***	−0.031 ***	−0.000 ***	0.007 ***
	(−6.465)	(−2.864)	(−5.294)	(−4.241)	(3.134)
EPU	−0.000 ***	0.000	0.001 ***	0.000 ***	−0.000 ***
	(−3.438)	(1.468)	(3.602)	(2.893)	(−2.897)
SP_Index	0.002	0.001	0.079	−0.000	−0.059
	(0.936)	(0.870)	(1.055)	(−0.096)	(−0.832)
LEV	−0.001	−0.018 ***	0.021	−0.005	0.077
	(−0.215)	(−5.705)	(0.116)	(−1.299)	(0.477)
NAREIT_return	0.830 ***	0.002	−0.044	−0.002	0.048 ***
	(29.264)	(0.849)	(−0.354)	(−1.211)	(5.529)
VIX	0.002 ***	−0.000	−0.001	−0.000 **	0.002 ***
	(9.003)	(−0.744)	(−1.073)	(−2.574)	(7.246)
Constant	0.022	0.016 ***	−0.135	0.011 **	0.194
	(1.380)	(4.837)	(−0.869)	(2.319)	(0.570)
Time fixed effect	YES	YES	YES	YES	YES
Number of REITs	72	108	108	107	72
Observations	10,768	17,032	17,036	13,028	10,830
R-squared	0.303	0.110	0.037	0.202	0.581
Adjusted R-squared	0.301	0.108	0.035	0.199	0.580

4.2. Robustness Checks

For the robustness check, first, we tried a different proxy to measure COVID-19. One of the potential concerns is that the impact of the pandemic might not have normalized by the end of the first quarter of 2020. Therefore, following Bouri et al. (2021), we constructed a new COVID-19 variable (COVID2) that takes a value of one if the sample period is between 1 January 2020 and 10 August 2020 and zero otherwise. We report the results in Table A2. We find consistent results for Excess returns from CAPM, ROA, and Beta from CAPM.

Next, we used different proxies for both performance and risk measurements. First, we used excess raw return as the difference between the return of REITs and the risk-free rate. To further investigate the risk sides, we included both idiosyncratic risk and total risk (the sum of both idiosyncratic and systematic risks) from the CAPM model. We report our results in Table A3. Table A3A shows similar robust results for excess raw returns, as the difference between the returns of REITs and the risk-free rate. For risk measurements, we observed that all of our proxies (beta, idiosyncratic, and total risk) were negatively significant with COVID2, suggesting that due to the COVID-19 impact, not only does the return of REITs decrease, the risk level of REITs also reduce.

In the last robustness check, in Table A3B, we rerun the same set of different proxies for both performance and risk measurements in Table A3A with our original COVIDmeasurement. Overall, the results are robust and present similar stories for different REITs' performance and risk measurements during the pandemic.

5. Conclusions

Our study delves into the repercussions of the COVID-19 pandemic on various performance measures and risk factors associated with US REITs. We find evidence of reduced

performance without any significant changes in risk profile amidst the COVID-19 pandemic. Notably, mortgage REITs emerged as particularly vulnerable in contrast to equity REITs.

Moreover, our examination scrutinized the performance disparities between specialized and diversified REITs within the unique landscape shaped by COVID-19. Results of our study provide evidence that amid the pandemic, diversified REITs offer a buffer against the adverse effects on REIT cash flow as measured by FFO, but the impact on risk remains insignificant. However, consistent with Benefield et al. (2009), specialized REITs exhibit better performances in terms of excess return during turbulent times.

Our results suggest that REITs remain immune to systematic risk during the pandemic. This might be attributable to the fact that most of the real estate properties owned by REITs were already leased, which might not adversely affect near-term cashflows. People, in general, are more reactive to concrete, temporally close events compared to the abstract, temporally distant repercussions. In the long run, they tend to be more positive and forward-looking with optimism (Weber 2006). This is consistent with the basic time value of money paradigm that weighs near-term cashflows more than distant cashflows. Such insights can help significant implications on portfolio asset reallocation strategies amidst uncertain market conditions.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Variable definition and sources.

Variable	Description	Sources
Excess return from CAPM	Excess return from CAPM model	WRDS
Beta from CAPM	Beta from the market factor from CAPM model	WRDS
ROA	Quarterly return of assets	Compustat
Total dividend	Ordinary dividends + non-ordinary dividends	Compustat
FFO	Quarterly funds from operations/previous quarter total assets	Compustat
COVID	Quarter 1 of 2020 (1 January 2020 to 31 March 2020) dummy variable	(1) Kizys et al. (2021). (2) Cai and Xu (2022).
COVID2	1 January 2020 to 10 August 2020	Bouri et al. (2021).
HHI	Herfindahl–Hirschman Index proxy for property diversification using (1) acquisition price of the property or (2) property size	S&P Global Market Intelligent
Control variables		
Ptype	0: Unknown; 1: Unclassified; 2: Diversified; 3: Health Care; 4: Industrial/Office; 5: Lodging/Resorts 6: Mortgage; 7: Mortgage-Backed Securities; 8: Residential; 9: Retail; 10: Self Storage	WRDS

Table A1. *Cont.*

Control variables		
AGE	natural log of age of firms	Compustat
SIZE	natural log of total assets	Compustat
TRM	difference between the yields of the 10-year treasury bond and 3-month treasury bill	FRED website
SPR	default risk premium: difference between yield of BAA rated corporate bond and 1 year treasury bond	FRED website
UNP	average quarterly unemployment rate	Bureau of Labor Statistics
EPU	Economic Policy Uncertainty Index	Policy uncertainty website
SP_Index	Inclusion of REITs in SP500	NAREIT website
LEV	Quarterly total liabilities/quarterly total assets	Compustat
NAREIT_return	Monthly return from FTSE nareit US Real Estate Index	NAREIT website

Table A2. Impact of COVID-19 on performance and risk measurement for different REIT types. This table presents the empirical results for models (1) through (2) using different measures of COVID-19 (COVID2). We use different measures of REIT performance in columns (1) through (4) and in columns (5) market beta from CAPM model as a measure of risk in models (2) as dependent variables. Columns (1) through (5) examine the impact of COVID-19 on performance and risk measures. Table A1 provides definitions of variables. t-stat in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Excess Return from CAPM (1)	**ROA (2)**	**Total Dividend (3)**	**FFO (4)**	**Beta from CAPM (5)**
COVID2	−0.037 ***	−0.005 ***	−0.011	0.000	−0.028 ***
	(−5.021)	(−2.671)	(−0.769)	(0.485)	(−3.513)
AGE	0.002	0.003 ***	0.037 **	0.002 ***	−0.130
	(0.471)	(5.690)	(2.431)	(4.073)	(−1.160)
SIZE	0.001	0.001 ***	0.033 ***	0.001 **	0.049 ***
	(1.260)	(2.647)	(3.229)	(2.053)	(3.254)
TRM	−0.008 ***	−0.001 ***	−0.002	−0.001	0.010 ***
	(−4.502)	(−3.425)	(−0.182)	(−1.343)	(4.244)
UNP	−0.003 **	−0.000	−0.036 ***	−0.001 ***	0.010 ***
	(−2.298)	(−0.987)	(−5.958)	(−3.566)	(5.760)
EPU	−0.000 ***	0.000 ***	0.002 ***	0.000	−0.000
	(−5.216)	(2.669)	(4.309)	(1.157)	(−0.345)
SP_Index	0.001	−0.000	0.100 **	−0.001	−0.036
	(0.730)	(−0.391)	(2.055)	(−0.497)	(−0.624)
LEV	−0.016 ***	−0.015 ***	0.027	−0.012 ***	0.295 ***
	(−3.217)	(−4.779)	(0.360)	(−3.137)	(3.228)
NAREIT_return	0.724 ***	−0.001	0.237 ***	−0.001	0.023 *
	(24.782)	(−0.743)	(2.819)	(−0.629)	(1.801)
VIX	0.001 ***	−0.000 ***	0.000	−0.000	0.002 ***
	(6.126)	(−2.869)	(0.100)	(−1.282)	(5.560)
Constant	0.002	0.061 ***	3.833 ***	0.019 ***	0.361
	(0.198)	(9.326)	(12.785)	(3.724)	(1.147)
Time fixed effect	YES	YES	YES	YES	YES
Number of REITs	205	429	430	240	207
Observations	24,662	47,113	47,142	25,071	24,834
R-squared	0.191	0.051	0.034	0.125	0.512
Adjusted R-squared	0.19	0.050	0.033	0.124	0.511

Table A3. Impact of COVID-19 on performance and risk measurement. Panel A presents the empirical results for models (1) through (2) using different measures of COVID-19 (COVID2). We use different measures of REIT performance/risk as dependent variables. t-stat in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Panel B presents the empirical results for models (1) & (2). We use different measures of REIT performance/risk as dependent variables. t-stat in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

(A)

	Excess Raw Return	Idiosyncratic Risk from CAPM	Total Risk from CAPM
COVID2	−0.060 ***	−0.002 ***	−0.003 ***
	(−10.002)	(−3.435)	(−4.288)
AGE	0.001 *	0.004	0.002
	(1.963)	(0.568)	(0.206)
SIZE	0.000	−0.003 *	−0.002
	(0.545)	(−1.802)	(−1.257)
TRM	−0.009 ***	0.001 ***	0.001 ***
	(−8.005)	(3.223)	(3.674)
SPR	0.008 ***	0.001 ***	0.001 ***
	(7.092)	(5.530)	(6.356)
UNP	−0.000 ***	−0.000	−0.000
	(−4.286)	(−0.402)	(−0.124)
SP_Index	0.000	0.003	0.003
	(0.239)	(0.543)	(0.477)
LEV	−0.004	0.047 ***	0.049 ***
	(−1.548)	(4.759)	(4.883)
EPU	0.990 ***	0.002 ***	0.003 ***
	(33.052)	(2.719)	(2.976)
NAREIT_return	−0.000 ***	0.000 **	0.000 ***
	(−2.677)	(2.339)	(3.080)
Constant	0.006	0.067 ***	0.071 ***
	(1.088)	(2.819)	(2.832)
Time fixed effect	YES	YES	YES
Number of REITs	430	207	207
Observations	47,134	24,834	24,834
R-squared	0.265	0.283	0.315
Adjusted R-squared	0.264	0.282	0.314

(B)

	Raw Return	Idiosyncratic Risk from CAPM	Total Risk from CAPM
COVID	−0.102 ***	−0.001	−0.002 *
	(−9.783)	(−0.915)	(−1.695)
AGE	0.001 *	0.004	0.002
	(1.845)	(0.567)	(0.204)
SIZE	0.000	−0.003 *	−0.002
	(0.525)	(−1.802)	(−1.257)
TRM	−0.006 ***	0.001 ***	0.001 ***
	(−5.705)	(3.680)	(4.275)
UNP	−0.002 **	0.001 ***	0.001 ***
	(−2.379)	(3.380)	(3.498)
EPU	−0.000 ***	−0.000	−0.000
	(−5.186)	(−0.179)	(−0.016)
SP_Index	0.000	0.003	0.003
	(0.132)	(0.543)	(0.477)
LEV	−0.004	0.047 ***	0.049 ***
	(−1.518)	(4.759)	(4.884)
NAREIT_return	0.994 ***	0.002 ***	0.003 ***
	(33.149)	(2.855)	(3.157)

Table A3. *Cont.*

	(B)		
	Raw Return	**Idiosyncratic Risk from CAPM**	**Total Risk from CAPM**
VIX	−0.000	0.000 **	0.000 ***
	(−1.291)	(2.199)	(3.079)
Constant	0.044 ***	0.067 ***	0.072 ***
	(7.081)	(2.860)	(2.886)
Time fixed effect	YES	YES	YES
Number of REITs	430	207	207
Observations	47,134	24,834	24,834
R-squared	0.265	0.283	0.315
Adjusted R-squared	0.265	0.282	0.314

Notes

1 In our study, we use REIT types and REIT style interchangeably to refer to equity and mortgage REITs.

2 https://www.worldbank.org/en/publication/wdr2022/brief/chapter-1-introduction-the-economic-impacts-of-the-covid-19-crisis (accessed on 31 January 2024)

3 https://www.bls.gov/spotlight/2021/impact-of-the-coronavirus-pandemic-on-businesses-and-employees-by-industry/home.htm#:~:text=%E2%80%8B%20Source:%20U.S.%20Bureau%20of%20Labor%20Statistics.,-Percent%20of%20establishments&text=Forty-eight%20percent%20of%20establishments,mandated%20closures%20of%20any%20industry (accessed on 15 June 2023)

4 https://wrds-www.wharton.upenn.edu/pages/get-data/beta-suite-wrds/ (accessed on 17 August 2023)

5 We also use other proxies for measuring COVID-19 and find similar results.

6 Table A1 defines all variables.

7 In addition, we have addressed the stationarity concern using unit roots test in panel datasets, and the results strongly reject the null hypothesis that all the panels contain unit roots.

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