Master Thesis U.S.E

Managing U.S-based global data and communication infrastructure REITs through increasing interest rates

This paper aims to explore the implications of increasing interest rates on the financial performance of global data and communication infrastructure REITs based in the US. In order to analyze this impact, various financial metrics and indicators are employed to assess the potential risks and challenges faced by these specialized REITs. Additionally, the paper seeks to investigate whether there are disparities in the financial performance between data and communication infrastructure REITs. To motivate the analysis, a multiple linear regression model is presented, which highlights the influence of the 3-month and 10-year Treasury rates on the financial metrics and indicators. The findings of this study demonstrate that the financial performance of these REITs is significantly and negatively affected by both short-term and long-term interest rate increases, with the exception of the D/E and D/A ratios, which show a contrasting pattern. Furthermore, notable distinctions between the data and communication infrastructure REITs are not apparent, except for the observation that rises in both interest rates have a more prominent effect on rental revenues from data center real estate. Moreover, evidence suggests that global operating communication infrastructure REITs experience a more dominant impact on their financial performance do to rising interest rates, as their value increases. However, given the limited representation of the REITs in the dataset, the comparative results should be interpreted cautiously, as they may not accurately reflect the broader landscape. As the findings differ from existing literature that suggests the financial performance of the specialized REIT sector in the US remains unaffected by interest rate fluctuations, it is crucial for future research to underscore the vulnerability of foreign investment risk and the unique characteristics and market dynamics of data and communication infrastructure REITs that differentiate them from the broader specialized REIT sector.

JEL-codes: E43, F21, G32
Keywords: REITs, Interest Rates, Linear Regression Model

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1 Introduction

Real Estate Investment Trusts (REITs) have witnessed a substantial surge in popularity among investors over the past few decades. In the US alone, as of the end of last year, an estimated 150 million individuals held REIT stocks directly or indirectly through various investment vehicles (Nareit Research, 2022). This heightened demand can be attributed to the attractive long-term returns offered by REIT investments and the diversification benefits they bring to investment portfolios through exposure to a wide range of real estate assets. The appreciation of property values over time has played a important role in driving the long-term asset growth of these trusts (Kimmons, 2019).

Residential, retail, and office real estate emerged as the predominant investment sectors for REITs shortly after their establishment by the US Congress in 1960. During this initial phase, REITs primarily engaged in property ownership through financing arrangements. However, following the enactment of the Tax Reform Act of 1986, REITs gained the ability to operate and manage their real estate holdings, leading to a diversification of their income sources and greater flexibility in retaining earnings. This regulatory change facilitated the rapid expansion of REITs and heightened their appeal as investment vehicles within the real estate industry (What's a REIT?, 2023). As a result, the landscape of REITs underwent a significant transformation, with the emergence of various REITs specialized in specific real estate alongside diversified REITs that bundled investments across different property types. The classification of all existing REITs is now governed by The Global Industry Classification Standard (GICS), which entails eight distinct categories. Among these categories, the specialized REITs sector stands out as it includes trusts that focus on specific real estate sectors and property types that differ from one another. Examples of specialized REITs include those involved in self-storage, telecom towers, timber, data centers, and other specialized real estate assets (GICS®, 2023).

The recent expansion of specialized REITs can be attributed to their investments in niche markets that offer unique market opportunities within current economies. Factors such as globalization, infrastructure development, demographic trends, innovation, and technology have played significant roles in driving the outperformance of non-traditional REITs over traditional ones in less than a decade (Pennartz & Singh, 2022). The market capitalization of non-traditional REITs, which accounted for 56% of the total in 2020, primarily consists of specialized REITs. This rapid adoption of specialized property types reflects the expanding investment opportunities in logistics, telecom tower infrastructure, data centers driven by innovation and technology, and the growing demand for self-storage facilities resulting from increasing urbanization.

The demand for data and communication infrastructure, integrated with real estate assets such as data centers and telecom towers, has witnessed a significant surge due to their increasing importance in global society (Kamiya, 2022). Projections indicate that the next-generation wireless communication market, including the advancements in technologies such as the 5G communication standard, is expected to grow at an annual growth rate of 20.54% between 2021 and 2030 (Future, 2023). Similarly, the data center service market is projected to double in size within a span of six years, from 2020 to 2026, driven by remote work trends, digitization of processes, and the adoption of digital technologies (The Future of Data Centers, n.d.). These market dynamics present favorable conditions for specialized REITs that focus on data and communication infrastructure, specifically investing in telecom tower and data center real estate assets, as they benefit from the rising demand for these specialized properties in comparison to other types of specialized REITs. However, it is important to note that the investment in these types of real estate assets entails higher capital requirements, including upfront investments, ongoing maintenance costs, and expensive upgrades, making them more capital-intensive compared to other specialized REIT assets (Badri, 2017).

Numerous studies have been conducted over the years to assess the impact of interest rates on the returns of REITs, a subject of significant interest for several reasons. Firstly, REITs rely heavily on borrowing to finance their real estate investments, and as interest rates increase, the cost of borrowing rises, thereby employing a negative influence on the performance of REITs. Secondly, rising interest rates tend to negatively impact property values, which, in turn, increases the leverage of REITs. Lastly, income-seeking investors tend to shift their investments away from REITs, which typically offer relatively high dividend yields, towards safer assets as interest rates rise (Orzano & Welling, 2017). In the US, low interest rates have been a key factor contributing to the performance of US-based REITs since the Global Financial Crisis, with the implementation of quantitative easing as a monetary policy tool and the prevailing weakness in the US economy (Gamber, 2020). However, in response to the worldwide Covid-19 Crisis and the need to address the rapid increase in inflation resulting from supply-demand imbalances intensified by geopolitical tensions and the global pandemic, interest rates have experienced a significant surge (de Soyres et al., 2022).

Considering the current macroeconomic landscape, it is essential to develop a good understanding of the relationship between interest rates and the financial performance of REITs. Existing literature has significantly contributed to the empirical evidence regarding the sensitivity of REITs to interest rate fluctuations, as demonstrated by studies conducted by Caraiani et al. (2021), Giliberto & Shulman (2017), He et al. (2003), and Wong & Reddy (2018). Furthermore, recent research by the work of Lin et al. (2021) has attempted to bridge the literature gap by investigating the interest rate sensitivity of specialized REITs across different property sectors and countries. This research also adopted the GICS to categorize various types of REITs, which has resulted into an analysis of the specialized REIT sector. However, it is worth noting that specialized REITs exhibit distinct characteristics such as diverse underlying assets, varying market dynamics, revenue streams, lease structures, and regulatory frameworks. Therefore a gap in the literature regarding the vulnerability of specialized REITs to increasing interest rates still exists.

This paper addresses the existing literature gap by conducting an extensive assessment of the financial performance of specifically data and communication infrastructure REITs. As previously described, these specialized REITs distinguish themselves from other specialized REITs based on the vast increasing demand and the capital-intensive nature of their assets. In light of the increasing US interest rates over the past three years, with expectations of this trend continuing in the future, it is important to analyze their impact on the financial performance of REITs engaged in data center and telecom tower investments (Gamber, 2020). Given the crucial role of these property types as fundamental elements of modern infrastructure and therefore critical to society, vulnerability in the financial performance of their ownership should be intensively studied. Furthermore, interest rates also influence financial performance of global operating REITs through offshore investments, as increased home currency valuation resulting from rising interest rates diminishes overseas investment returns through the attraction of foreign investors (Lucas, 1982). Prior sensitivity analyses have overlooked the effects of this mechanism on the financial performance of global operating REITs by failing to distinguish between global and non-global REITs. Therefore, this study exclusively investigates US-based data and communication infrastructure REITs operating on a global scale, whereby the US serving as the home country will provide the most observations (EPRA, 2018). Lastly, previous research in this domain has only focused on assessing the vulnerability of REITs to interest rates by examining a singular financial metric or indicator, such as excess return, REIT index, or asset value. To produce more detailed results, this study employs a diverse set of financial metrics and indicators to evaluate the financial performance of US-based global data and communication infrastructure REITs. Therefore, the study contributes to the existing literature by addressing multiple research objectives by answering the following research question.

Q: "What is the effect of rising interest rates on the financial performance of US-based global data and communication infrastructure REITs?

In order to address the research question, this paper will employ various financial metrics and indicators that are relevant to US-based global data and communication infrastructure REITs. These metrics and indicators will be used to individually assess their sensitivity to short- and long-term interest rates. By doing so, this paper aims to identify potential risks and challenges in the financial performance of these REITs during periods of rising interest rates. Furthermore, through the analysis of multiple financial metrics and indicators for each individual REIT, this paper intends to examine whether there are differences in the financial performance between data and communication infrastructure REITs when interest rates are increasing. The outcomes of this research will contribute to a deeper understanding of the factors that influence the financial performance of these specialized REITs operating on a global scale, and will provide valuable insights to industry practitioners on how to effectively manage these REITs during periods of rising interest rates.

This structure of this paper is as follows: After this introduction, a critical literature review is provided highlighting the relevant existing knowledge gaps. Thereafter, the theoretical framework is presented, followed by the empirical strategy including the data collection and data analysis. The results and interpretation section will report on the empirical findings, followed by a discussion and analysis of the results. Finally, the paper draws conclusions based on the identified financial metrics and their response to increasing interest rates, as well as financial performance comparison between data and communication infrastructure REITs.

2 Literature review

2.1 Interest rate sensitivity of REITs

The existing literature examining the impact of interest rate changes on REITs widely agrees that these trusts are significantly affected by fluctuations in interest rates (Caraiani et al., 2021; Giliberto & Shulman, 2017; He et al., 2003; Lin et al., 2021; Wong & Reddy, 2018). Notably, a study conducted in 2003 investigated the vulnerability of REITs and found a distinct contrast in the reactions of mortgage and equity REITs to different interest rate variables. The findings revealed that equity REITs were primarily influenced by variations in the yields of long-term US government bonds and high-yield corporate bonds. On the other hand, mortgage REITs exhibited sensitivity to an additional five interest rate proxies over a 27-year period in the US (He et al., 2003).

A similar distinction between short-term and long-term interest rates and their effects on low-debt and high-debt REITs was observed in an Australian case study conducted in 2018. The research findings demonstrated that REITs with higher levels of debt displayed greater sensitivity to both short-term and long-term interest rates compared to those with lower debt levels. Specifically, short-term interest rates were found to offset a positive performance effect on the REITs, while long-term interest rates were found to significantly decrease their return. The positive impact of increasing short-term interest rates on REIT performance can be attributed to the robustness of the economy, wherein central banks aim to counter inflationary pressures. Consequently, the strength of the economy may lead to higher rental income for REITs. Conversely, the rise in long-term interest rates increases the cost of debt, which has a dampening effect on REIT returns (Wong & Reddy, 2018).

Additionally, conventional theory states that in the case of rising interest rates resulting from contractionary monetary policy measures, the bubble component of REITs should diminish. This is because increasing interest rates are expected to deflate the speculative element of REIT valuations attributed to

investor behavior, thus applying a negative influence on REIT performance, given their heavy reliance on stockholder equity. However, empirical evidence spanning the period from 1972 to 2018 in the US contradicts this theoretical expectation. It suggests that the speculative component of REIT valuations does not diminish and may even increase when interest rates rise due to contractionary monetary policy measures (Caraiani et al., 2021). It is established that current interest rate changes are primarily implemented by central banks as a means of countering inflationary pressures whereby quantitative tightening and the raising of the federal funds rate have proven to be effective measures in increasing interest rates in the US since the onset of 2022 (Adrian et al., 2022). As these contractionary monetary policy measures are currently increasing the interest rates in the US, the contradiction to the 'leaning against the wind' effect is therefore important to analyze in this paper.

Additional research conducted in the US REITs market reveals a similar pattern, wherein the returns of these trusts were not negatively affected but instead exhibited positive effects during the period known as the "Taper Tantrum" spanning from 2013 to 2016. The start of this period coincided with the Federal Reserve's announcement of its intent to gradually reduce its quantitative easing program, resulting in the anticipation of increasing interest rates by investors who foresaw a tightening of the US economy. Surprisingly, the examined REITs did not experience a decline in returns; rather, their returns actually increased during this period of rising interest rates. One explanation for this contradictory phenomenon may be attributed to heightened investments in US REITs during this period, driven by their ability to yield higher returns compared to traditional fixed-income investments (Giliberto & Shulman, 2017).

2.2 Global operating REITs

Globalization has facilitated the expansion of REITs into various real estate markets, enabling them to capitalize on the advantages of geographic diversification (Louargand, 2007). Operating on a global scale, REITs seek to decrease risks associated with localized market conditions and economic fluctuations. However, such global operations present their own set of challenges, including operational complexities, the need for specialized expertise, strict regulations on foreign real estate, and geopolitical risks (Sokol, 2008). Additionally, to safeguard against the potential negative impact of exchange rate fluctuations, global REITs must properly manage currency risk. This risk management becomes crucial for REITs operating globally to minimize any negative effects arising from such fluctuations.

As currency risk is sensitive to interest rate fluctuations through the attraction of foreign investors seeking increased returns on their investments, global operating REITs, in relation to other REITs, experience more interest rate related risks when domestic interest rates increase (Lucas, 1982). Currently, research on the vulnerability of REITs to interest rates has not addressed this particular type of interest rate risk, nor has it differentiated between global operating REITs and locally operating REITs. In order to account for this additional form of interest rate risk, this paper thereby analyzes solely global operating REITs.

2.3 Data and communication infrastructure REITs

The emergence of non-traditional REITs has provided investors with opportunities to engage in specialized asset investments, leading to a substantial surge in demand for real estate sectors presenting distinctive growth prospects and income streams over the past decade. Specialized REIT investments offer advantages such as alignment with emerging markets and technological advancements in modern society. However, these specialized REITs also encounter challenges, including limited access to leverage, difficulties in forecasting cash flows, and a lack of consistent long-term performance metrics (McIntosh et al., 2017).

Data infrastructure REITs, characterized by their ownership of data centers as real estate assets, experience the advantages associated with non-traditional REITs by leasing cloud storage facilities that play a crucial role in modern infrastructure. These REITs specialize in the ownership, development, and operating of data center facilities, capitalizing on the expansion of data consumption and the vast increasing demand for data storage within the current digital economy (Kamin et al., 2014). The unique market drivers behind this sector's growth led data infrastructure REITs to exhibit a remarkable positive return of 17.66% during the initial three months of the Global Covid-19 Crisis, in contrast to other (traditional) REIT sectors that experienced significant negative returns (Akinsomi, 2020).

Communication infrastructure REITs, characterized by their ownership of telecom towers as real estate assets, share similarities with data infrastructure REITs as both types of trusts allocate their investments to high-tech assets. These common characteristics result in volatility reduction and enhanced overall returns within investor portfolios (Pacholec, 2022). Communication infrastructure REITs capitalize also on the global transition to a digital economy, as their assets provide wireless connectivity. The increasing network densification and the continuous demand for network upgrades driven by technological innovation further contribute to the growth prospects of this REIT subtype (Badri, 2017).

The existing literature on data and communication infrastructure REITs is limited, with only one notable study focusing on specialized REITs and their vulnerability to interest rates (Lin et al., 2021). This study revealed that the excess return of specialty REITs, including data and communication infrastructure REITs, found no evidence of sensitivity to fluctuations in short- and long-term interest rates in the US, starting from the GFC onwards. However, the vulnerability of global operating data and communication infrastructure REITs to short- and long-term interest rates remains uncertain due to their unique characteristics and market dynamics, as well as their adaptability to current industry trends (Kamiya, 2022). These REITs experience a a more dominant demand for their assets, which are more capital-intensive due to substantial upfront investments and high operating costs (Badri, 2017). Distinct differences between the interest rate sensitivity of data and communication infrastructure REITs seems thereby inapplicable, considering the shared underlying technologies in data transmission and connectivity that form the core values of their assets (Kamin et al., 2014).

3 Theoretical framework

The effects on the financial performance of global REITs specialized in data center and telecom tower real estate can be explained by examining the interaction between interest rates and their influence on various mechanisms.

3.1 Impact on borrowing costs

The financial performance of the specific global REITs can be influenced by changes in interest rates through the impact on borrowing costs. Given their dependency on debt financing for property acquisition and development, higher interest rates translate to increased borrowing expenses. As a consequence, the REITs face increase interest payments, which impact their profitability. Moreover, the increased cost of borrowing can cause limitations to fund new investments, expand operations, or to manage existing debt obligations (Brounen et al., 2016). Therefore, the financial performance of these specialized REITs can be negatively affected through rising interest rates, even more so in comparison to other specialized REITs as data center and telecom tower property require higher capital requirements in the form of upfront investments (Badri, 2017).

3.2 *Impact on property valuation*

Changing interest rates can also influence the valuation of properties held by the global REITs. Specifically, increasing interest rates contribute to a rise in the discount rate used in property valuation models, which leads to diminished future cashflows. Therefore, increasing interest rates can lead to a decline in property valuations, thereby potentially impacting the net asset value of the REITs (Brounen et al., 2016). As a result, the financial performance of these specialized REITs can be negatively affected through rising interest rates.

3.3 *Impact on investor behavior*

The third explaining mechanism for the influence of interest rates on the global REITs is produced by investor behavior. Alternative investments like government bonds are comparatively becoming more appealing when interest rates increase, thereby potentially removing capital from the REITs in the form of stockholder equity. Investors may in this case decide to reposition their investments towards securities offering higher yields while providing less risk, which reduces the demand for shares of these specialized REITs. The share price thereby diminishes impacting the equity of the trusts (Chen & Tzang, 1988). As a result, the financial performance of these REITs can be negatively affected through rising interest rates.

3.4 *Impact on tenant behavior*

Next to the impacts on investor behavior, rising interest rates also affect tenant behavior. Increasing borrowing costs from rising interest rates can potentially decrease the financial capacity of tenants to make strategic investments or to create expansion initiatives. This results in a slowdown in demand for data center and telecom tower property. As a direct consequence, specialized REITs operating within these sectors may experience a negative effect on their rental revenues when interest rates increase, which negatively impacts the financial performance of the REITs (Das, 2020).

This negative effect in the financial performance of data and communication infrastructure REITs may be diminished in comparison to other specialized REITs, as the demand for data center and telecom tower property exceeds the demand for other specialized property (The Future of Data Centers, n.d.; Future, 2023).

3.5 Impact on foreign investment valuation

Finally, changes in interest rates can influence the valuation of foreign investments held by the global REITs. Rising interest rates are often accompanied by a strengthening of the home currency, an outcome influenced by mostly the attraction of foreign investors. This appreciation in the domestic currency can diminish the worth of overseas investments when they are converted back into the home currency, thereby negatively affecting the financial performance of these specialized REITs through rising interest rates (Lucas, 1982).

3.6 Measuring financial performance

To measure the financial performance of the US-based global data and communication infrastructure REITs, this paper will analyze various financial metrics and indicators. As each metric and indicator captures distinct facets of the REITs financial performance, an comprehensive evaluation is produced regarding their overall financial health.

The *debt to equity ratio* (D/E ratio) and *debt to assets ratio* (D/A ratio) provide insights into the REITs' leverage levels. These ratios provide valuable insights into the extent to which debt is employed in relation to equity and total assets. Such evaluation of the REITs' capital structure is essential in understanding their capacity to fulfill debt obligations effectively (Husna & Satria, 2019; Nuryani & Sunarsi, 2020). Similarly, the *interest coverage ratio* (ICR) measures the REITs' ability to meet interest expenses using their operational income. A higher ICR indicates a greater ability to service debt obligations, thus indicating enhanced financial stability and reduced risk of default (Dothan, 2006). *The cash ratio* and *current ratio* evaluate the liquidity position of the REITs. These ratios compare the cash reserves and current assets of the REITs with their current liabilities, providing insights into their capacity to fulfill short-term obligations and effectively manage the needs for liquid assets. A higher cash ratio and current ratio indicate a stronger ability to meet these short-term obligations, thereby providing a favorable liquidity position (Lawrence et al., 2021; Nuryani & Sunarsi, 2020).

In addition, the *debt service coverage ratio* (DSCR) serves as a vital metric for assessing the REITs' capability to generate cash flows to meet their debt service obligations. A higher DSCR implies a stronger financial capacity to fulfill debt payments, thereby also reducing the risk of default (Findlay & Williams, 1975). Furthermore, the *fixed debt ratio* (FDR) provides insights into the REITs' exposure to fixed-rate debt, which can help evaluate interest rate risk. A lower FDR may indicate a reduced vulnerability to changes in interest rates, thereby diminishing associated risks. On the other hand, a higher FDR impacts the REITs future borrowing and investment capacity (Oberoi, 2018). Finally, *rental revenue* and *net income* reflect the REITs' financial performance from their core operations. Rental revenue represents the income generated from leasing properties to tenants, while net income reflects the overall profitability of the REITs (Lockert, 2022).

3.7 Hypotheses

The hypotheses regarding the impact of rising interest rates on various financial metrics and indicators are derived from the following observations.

a. Increasing interest rates contribute to a rise in total debt for REITs. This is due to the higher cost of borrowing associated with obtaining new debt or refinancing existing debt. As federal rates increase, REITs may encounter higher interest rates on their total debt, leading to increased interest expenses and potentially greater debt service obligations. Debt instruments with an extended duration will consequently incur higher costs due to the absence of risk premiums currently factored into the federal interest rates. (EMEA Real Estate, 2022; He et al., 2003).
b. Rising interest rates result in an increase in the current liabilities, including short-term loans and other credit facilities which are often tied to variable interest rates. As interest rates climb, the interest expenses of these current liabilities also increase. Consequently, the REITs experience higher interest payments and encounter increased current financial obligations (García-Teruel & Solano, 2007).
c. Increasing interest rates may contribute to a decline in property valuations, thereby potentially impacting the net asset value of the REITs (Brounen et al., 2016).
d. Rising interest rates may result in investors in deciding to reposition their investments towards securities offering higher yields and subsequently providing less risk in comparison to REIT stock (Chen & Tzang, 1988).
e. Increasing interest rates may potentially decrease the financial capacity of tenants to undertake strategic investments in technological advancements or expansion initiatives (Das, 2020).

Following observations (a) and (d), the D/E ratios of the data and communication infrastructure REITs are expected to decline when measuring the effect of rising interest rates. Similarly, the D/A ratio is expected to decline following observations (a) and (c). Furthermore, the ICR is expected to decline following observations (a) and (e), and the cash and current ratio are expected to decline following observation (b). Lastly, the DSCR is expected to decline following observations (a) and (e), and the rental revenue and net income are expected to decline following observation (e).

To conclude the effects on the financial metrics and indicators, the FDR is expected to increase when interest rates rise, reflecting the anticipation of an extended period of increasing interest rates. However, It is important to note that the motives of REITs can vary as neither fixed nor floating rate debt can be unconditionally classified as risk increasing in the evolving macroeconomic landscape (Oberoi, 2018). Finally, it is expected that their will be no significant difference in the financial performance impact of rising interest rates between data and communication infrastructure REITs. Both types of specialized REITs share similar characteristics and market dynamics, as well as a comparable alignment to current industry trends (Kamiya, 2022). Additionally, they share underlying technologies in data transmission and connectivity that form the core values of their assets (Kamin et al., 2014).

4 Empirical strategy

4.1 Data collection and description

Global operating data and communication infrastructure REITs based in the US were selected for this study due to the historical low levels of short- and long-term federal rates since the GFC and their upward surge in the past three years. Furthermore, US-based specialized REITs dominate the market in terms of both the number of REITs and their market capitalization, thereby offering the biggest pool of observations for assessing the financial performance of global data and communication infrastructure REITs (EPRA, 2018; Lin et al., 2021).

Five US-based data and communication infrastructure REITs operating on a global level were identified using the Nareit REIT Directory (REIT and Publicly Traded Real Estate Company Directory, n.d.). However, Cyxtera Technologies, the third data infrastructure REIT, was excluded from the analysis as it only provided data from the third quarter of 2020 onwards (EDGAR Entity Landing Page, n.d.). Therefore, the analysis focused on two infrastructure REITs, Equinix Inc. (EQN) and Digital Realty Trust (DRT), and two communication infrastructure REITs, American Tower Corporation (ATC) and SBA Communications Corporation (SBA), in relation to their financial performance in response to increasing interest rates.

To gather the necessary financial data for the analysis of the REITs' financial performance, the quarterly (10-Q) and yearly reports (10-K) of the trusts were obtained from the company filings available on the website of the US Securities and Exchange Commission (SEC, n.d.) via the EDGAR database. Three out of the four REITs have been filing their reports with the SEC since the conversion of reports from txt to html format, which started in the second quarter of 2002. The transition to the new format facilitates a cleaner analysis of the data compared to the previous txt format. The first observation for the research will be the 10-Q report from June 2002, while the most recent available report at the time of this paper is the 10-Q report from March 2023, serving as the final observation. Without the use of time lags in the analysis, this timeframe allows for a total of 84 observations for each financial metric and indicator for the three REITs. However, in the case of Digital Realty Trust, the reports available produce only 75 observations, as they began filing their reports with the SEC starting from September 2004. *Tables 1* and *2* in the appendix present the descriptive statistics of the data and communication infrastructure REITs including indicative market capitalizations.

In the context of interest rates, the 10-year US Treasury rate is selected as a suitable indicator of historical long-term interest rates encountered by US-based global REITs. This benchmark interest rate holds significant relevance in the real estate market and is closely tied to the cost of borrowing for REITs, making it an appropriate representation. Additionally, the 10-year Treasury rate serves as a long-term benchmark for analyzing the financial health of equity REITs over an extended period (Lorey, 2017). On the other hand, the 3-month US Treasury rate is utilized to reflect historical short-term interest rates. This widely used short-term interest rate benchmark captures rapid changes in short-term borrowing costs. Its immediate impact on interest rates is closely associated with changes in monetary policy (Beckworth et al., 2010). Previous studies investigating the interest rate sensitivity of REITs have incorporated these two federal rates in their analyses. Interestingly, evidence was found regarding the negative impact of short-term interest rates being inconsistent with the negative impact of long-term interest rates (Akimov et al., 2020; Stevenson et al., 2007).

Other research has indicated a positive impact of short-term interest rates and a negative impact of long-term interest rates on REIT returns, which can be attributed to the robustness of the economy during periods of increasing short-term interest rates (Wong & Reddy, 2018). In contrary, an analysis focused on the specialized REIT sector in the US found no evidence of excess return sensitivity to short- or long-term interest rates (Lin et al., 2021). Given the uncertain impact of rising interest rates on the financial performance of US-based global data and communication infrastructure REITs, this paper incorporates both the 3-month US Treasury rate and the 10-year US Treasury rate in the analysis.

4.2 Data analysis

Numerous studies investigating the relationship between interest rates and the performance of Real Estate Investment Trusts (REITs) have employed the GARCH-M framework. This framework is favored due to its capability to simultaneously model the level and volatility of the return series (Akimov et al., 2020; Devaney, 2001; Lee, 2017; Lee et al., 2014a; Lin et al., 2021; Liow and Huang, 2006; Stevenson et al., 2007). By pooling together sector-specific REITs, GARCH models enable the estimation of parameters with greater accuracy through the utilization of large sample sizes. Moreover, these models primarily focus on capturing the effects of volatility or conditional variance rather than the average or mean effects of interest rates (Ng & Lam, 2006). However, given the nature of this paper which concentrates on analyzing a limited sample incorporating only four globally operating trusts within the specialized REIT sector, and aims to assess the impact of increasing interest rates on various financial metrics and indicators, a different approach is preferred. In this context, a multiple linear regression model is more suitable than the GARCH-M model. The choice of a multiple linear regression enables the examination of direct relationships between the independent variables (short- and long-term interest rate) and the dependent variables (financial metrics and indicators), while accounting for the effects of other control variables (Taylor, 2023).

The analysis of the financial performance of REITs involves the utilization of Stata 16, a statistical software for data science (Stata, 2023). In order to assess the different financial metrics and indicators, various control variables ware selected alongside the short- and long-term interest rate. These control variables aim to increase the overall explanatory power of the regression models. Recognizing the diverse relationships between the financial metrics and indicators and the independent variables, different control variables are employed for each regression to ensure a good fit. The selected control variables commonly utilized in the regressions exist out of the total assets of the REITs, in addition to the share price, total stockholder equity, total debt, net income, and the gross domestic product of the US. To address the presence of heteroscedasticity, the Breusch-Pagan test is implemented. Next, robust standard errors are incorporated in the models to account for the necessity of constant standard deviations of the predicted variables. Moreover, a Variance Inflation Factor (VIF) analysis is conducted to address multicollinearity. To counter the impact of linearly related predictor variables in the regressions, control variables most relevant to the research question are selected, while considering possible correlation effects. Furthermore, the regressions includes time lags for the short- and long-term interest rate. This enables the models to capture the influence of past interest rates on the financial metrics and indicators of the REITs. Previous literature suggested that capital market movements might have a lagged response of approximately six months to both short- and long-term interest rate changes (Mueller & Pauley, 1995; Reddy & Wong, 2017).

The following multiple linear regression equations are presented below to examine the impact of both the 3-month US Treasury rate ($3M.TR$) and the 10-year US Treasury rate ($10Y.TR$) on the different financial metrics and indicators (Y_i) of the REITs. These equations incorporate two control variables ($CV_{1/2}$), along with the error term (ϵ), to account for other potential influencing factors.

$$Y_i = \beta_0 + \beta_1 * 3M.TR_{t-x} + \beta_2 * CV_1 + \beta_3 * CV_2 + \epsilon$$

Model 1: *Multiple linear regression incorporating the lagged 3-month US Treasury rate.*

$$Y_i = \beta_0 + \beta_1 * 10Y.TR_{t-x} + \beta_2 * CV_1 + \beta_3 * CV_2 + \epsilon$$

Model 2: *Multiple linear regression incorporating the lagged 10-Year US Treasury rate.*

5 Results and interpretation

Table 3 presents the results of analyzing the impact of the rising 3-month and 10-year Treasury rates on the *D/E ratio* of data and communication infrastructure REITs. The findings indicate that both rates significantly affect the D/E ratio of DRT and ATC. However, unlike ATC, the ratio of DRT is positively influenced by the increase in interest rates. Additionally, the ratio of EQN is significantly negatively affected only by the rise in the 10-year Treasury rate. Further analysis reveals that the D/E ratio of ATC is more strongly influenced by both Treasury rates compared to EQN and DRT. Interestingly, the D/E ratio of SBA is not significantly affected by either rate, and a suitable model fit for the ratio could not be found. Moreover, the results from *Table 3* do not provide evidence of lagged effects of the Treasury rates on the ratios.

Moving on to *Table 4*, it examines the impact of the rising interest rates on the *D/A ratio*. The analysis reveals that only the ratios of DRT and ATC are significantly negatively affected by both rates. The 3-month Treasury rate shows a lagged period of 1.25 and 0.75 years for DRT and ATC, respectively, while the 10-year Treasury rate exhibits a lagged period of 1.5 and 1.25 years. Furthermore, the ratio of ATC is more strongly and negatively influenced by both Treasury rates compared to the ratio of DRT. In contrast, the D/A ratio of EQN and SBA is not significantly affected by both rates, although the 10-year Treasury rate does impact the ratios of EQN and SBA to a greater extent than that of DRT.

Examining *Table 5*, it becomes apparent that an increase in the 10-year Treasury rate significantly decreases the *ICR* for all four REITs. Additionally, the ratio of ATC is also significantly negatively impacted by a rise in the 3-month Treasury rate. The long-term interest rate exhibits a lagged period of 0.5 years and 0.25 years for DRT and ATC, respectively. Moreover, the ratio of ATC is more dominantly affected by both Treasury rates compared to the other REITs.

Table 6 focuses on the *cash ratio* and reveals that none of the four REITs shows a good fit to the model, with the highest fit explaining only 21% of the ratio. Specifically, an increase in the 3-month Treasury rate significantly and negatively affects the cash ratio of DRT and ATC, while both interest rates positively impact the cash ratio of EQN. The short-term interest rate exhibits a lagged period of 0.5 years for ATC, which, along with EQN, is more dominantly affected by this rate compared to DRT.

Turning to *Table 7*, it examines the impact of both the 3-month and 10-year Treasury rates on the *current ratio*. The results indicate that only EQN and SBA are significantly affected by both rates, with EQN experiencing a negative impact and SBA observing a positive impact from the rise in interest rates. Furthermore, the current ratio of ATC is only significantly negatively affected by the increase in the short-term interest rate. The lagged period for the short-term interest rate is 1.25 years, 0.25 years, and 1 year for EQN, ATC, and SBA, respectively. Similarly, the 10-year Treasury rate exhibits a lagged period of 1.5 years and 1 year for EQN and SBA, respectively. Moreover, the current ratio of SBA is more dominantly affected by both interest rates compared to the other REITs.

The results in *Table 8* indicate that an increase in the 3-month Treasury rate has a significant negative effect on the *DSCR* of EQN and DRT, whereas an increase in the 10-year Treasury rate also significantly decreases the ratio of SBA. Specifically, the DSCR of EQN is more dominantly affected by both interest rates compared to the other REITs. Moreover, *Table 8* does not provide evidence of a lagged effect of the rates on the ratios.

Table 9 provides the results for the *FDR* affected by both interest rates. Only the FDR of EQN is not significantly negatively influenced by an increase in the 3-month Treasury rate, which exhibits a lagged effect of 0.25 and 0.5 years for DRT and ATC, respectively. The FDR of EQN is also poorly explained by other variables for both interest rates, as only approximately 8.5% of the ratio is accounted for by the recession. Furthermore, a rise in the 10-year Treasury rate significantly and negatively impacts the FDR of ATC and SBA. The lagged effect for ATC is 0.5 years. Notably, the FDR of SBA is more dominantly affected by both interest rates in comparison to the other REITs.

The findings presented in *Table 10* reveal that the *rental revenues* of all four REITs are significantly and negatively affected by increases in both the 3-month and 10-year Treasury rates. Only ATC does not demonstrate a lagged effect of the interest rates. Specifically, the short-term interest rate exhibits lagged effects of 1, 0.5, and again 0.5 years on the revenues of EQN, DRT, and SBA, respectively. Turning to the 10-year Treasury rate, the rental revenues are impacted by a lagged period of 1.5, 0.5, and 1 year for EQN, DRT, and SBA, respectively. Since the dependent variable is not a ratio, in order to measure the most dominant impact on the revenues, they should be proportionate to the average rental revenues of the REITs, as documented in *Tables 1* and *2*. *Table 12* provides the assigned weights to measure the impacts of the interest rates proportionally using the "inverse ratio" formula. Based on the calculations presented in *Table 13*, it can be concluded that the rental revenues of DRT are more dominantly negatively affected by the 3-month Treasury rate, while the rental revenues of EQN are more dominantly negatively affected by the 10-year Treasury rate compared to the other REITs.

Finally, the findings in *Table 11* reveal that both the 3-month and the 10-year Treasury rate have a significant impact on the *net income* of DRT and SBA. It can be concluded that only the net income of DRT is negatively affected by the increase in both interest rates, while the net income of SBA experiences a positive impact from the short-term interest rate and is negatively affected by the long-term interest rate. The lagged effect for the net income of DRT and SBA is observed at 0.5 and 1 year respectively for the 10-year Treasury rate. Additionally, the net income of ATC is only significantly and negatively influenced by the rise in the 3-month Treasury rate, while the net income of EQN is not significantly impacted by either interest rate. Similar to the analysis of rental revenues, it is essential to consider the impacts on net incomes proportionally to the average incomes of the REITs, as documented in *Tables 1* and *2*. To achieve this, *Table 12* provides the assigned weights for measuring the impacts of the interest rates proportionally using the "inverse ratio" formula. Based on the measurements calculated in *Table 14*, it can be concluded that the net income of ATC is more dominantly and negatively affected by the 3-month Treasury rate, while the net income of DRT is more dominantly and negatively influenced by the 10-year Treasury rate compared to the other REITs.

The research findings demonstrate that the financial metrics and indicators of the data and communication infrastructure REITs are significantly impacted more by the 10-year Treasury rate as compared to the 3-month Treasury rate. In many instances, these heightened impacts are multiplied by a factor of two or three when considering the long-term interest rate, although certain cases indicate a multiplication effect as high as five times. Moreover, when a financial metric or indicator is influenced by both interest rates over a lagged period, the duration of this lag is generally equal to or longer for the 10-year Treasury rate in contrast to the 3-month Treasury rate.

6 Discussion and Conclusion

Existing literature most closely aligned with the analytical framework employed in this paper concludes that the excess returns of specialized REITs based in the US exhibit insignificant sensitivity to fluctuations in the 3-month and 10-year Treasury rates (Lin et al., 2021). Consequently, it can be concluded that the financial performance of this REIT sector remains unaffected by changes in federal interest rates. However, alternative investigations have identified significant impacts of short- and long-term interest rates on the performance of REITs in general, as well as sector-specific REITs (Caraiani et al., 2021; Giliberto & Shulman, 2017; He et al., 2003; Wong & Reddy, 2018). This paper, which takes into account the unique characteristics of data center and telecom tower real estate within the specialized REIT sector and their influence on foreign investment valuation, came across significant vulnerabilities of the majority of examined financial metrics and indicators to rising short- and long-term interest rates in the case of the four global operating data and communication infrastructure REITs situated in the US.

Throughout the study's entire duration, substantial variations were observed in the responses of the REITs' financial metrics and indicators to changes in the 3-month and 10-year Treasury rates. For instance, the D/E ratios of EQN and ATC exhibited contrasting impacts compared to the D/E ratio of DRT. This outcome aligns with the hypothesis that rising interest rates lead to increased borrowing costs, resulting in greater debt service obligations, and investors reallocating their investments to less risky and higher-yielding securities (Chen & Tzang, 1988; EMEA Real Estate, 2022; He et al., 2003). On the other hand, the decrease in the D/E ratios of EQN and ATC when interest rates rise could be attributed to reduced borrowing by the REITs to limit debt accumulation, along with the increase of equity funds to explore alternative capital sources, leading to historically low leverage ratios (Funari, 2022; Wong & Reddy, 2018). Alternatively, the negative impact of the 3-month Treasury rate on ATC's D/E ratio could also be attributed to the robustness of the economy, prompting central banks to counter inflationary pressures. This economic environment may attract investors seeking higher corporate profits, business growth, and increased dividend income (Caraiani et al., 2021; Giliberto & Shulman, 2017; Wong & Reddy, 2018). Lastly, the analysis of SBA's data presented in *Table 2* indicates that the REIT's D/E ratio remained largely unaffected by interest rates due to the inclusion of negative equity on the balance sheet resulting from extensive stock repurchasing plans, thereby creating extreme D/E ratios (EDGAR Entity Landing Page, n.d.).

Similar outcomes were observed in the impact of rising interest rates on the D/A ratio. In this case, both the 3-month and 10-year Treasury rates negatively affected the D/A ratios of DRT and ATC. Consequently, the hypothesis regarding this ratio is incorrect, suggesting that the historically low leverage of REITs can also explain this phenomenon through a reduction in debt service obligations relative to the assets. Furthermore, the negative impact of the 3-month Treasury rate on the D/A ratios of both DRT and ATC can again be attributed to the economic robustness that encourages asset growth for the REITs, driven by higher profits and expansion within the real estate sector. Additionally, the ratios of DRT and ATC were only significantly impacted after a lagged period ranging from 0.75 to 1.5 years. These findings align reasonably well with the direct impact of interest rates on the D/E ratio, as the real estate market exhibits greater strength to rising interest rates compared to investor sentiment (Okunev et al., 2000). The analyzed data of EQN and SBA did not reveal a significant impact of interest rates on the D/A ratios, while these ratios exhibited a greater impact in contrast to the D/A ratio of DRT. The lack of a significant effect can currently not be explained. Nevertheless, upon analyzing the data presented in *Tables 1* and *2*, a significant difference in ratio volatility emerges between EQN/SBA and DRT, potentially accounting for the differing impact of short- and long-term interest rates.

An examination of the responses of the current ratios of the REITs to changes in the 3-month and 10-year Treasury rates revealed also noteworthy variations. Specifically, the ratios of EQN and ATC were significantly and negatively impacted, while the ratio of SBA experienced a significant positive impact. The outcomes for EQN and ATC align with the hypothesis that rising interest rates result in an increase in current liabilities due to higher interest expenses, primarily stemming from variable interest rates associated with a majority of current liabilities (García-Teruel & Solano, 2007). On the other hand, the increase in SBA's current ratio resulting from the rise in both interest rates could be attributed to the stronger cash position of SBA, enabling effective management of potential interest rate risks during certain periods, as indicated by the analysis. Additionally, the significant positive impact of the 3-month Treasury rate on SBA's current ratio could be similarly explained by a robust economy, leading to an increase in the current asset value of the REIT. Finally, the current ratios of EQN and SBA were significantly impacted after a lagged period ranging from 1 to 1.5 years. This observation is somewhat unexpected, considering that current liabilities typically consist of debt tied directly to market rates. In this context, the significant negative impact of the 3-month Treasury rate on ATC's current ratio, with a lagged period of 0.25 years, appears to be more accurate.

Next, both the DSCR and the FDR were significantly and negatively affected by the rise in interest rates for most of the REITs. Notably, ATC was the only REIT whose DSCR remained unaffected by changes in the 3-month and 10-year Treasury rates, while only EQN's FDR showed no significant impact from the interest rates. The evidence of a negatively impacted DSCR aligns with the hypothesis that rising interest rates lead to increased borrowing costs, resulting in greater debt service obligations and diminished financial capacity for tenants to undertake investments thereby reducing the operating income of REITs (EMEA Real Estate, 2022; Das, 2020; He et al., 2003). However, the lack of significant impact on ATC's DSCR cannot be readily explained. In contrast, the evidence of a negatively impacted FDR for most REITs due to rising interest rates deviates from the hypothesis. Nevertheless, given that the choice of an appropriate fixed/ variable debt ratio is company-specific and both types of debt cannot be unconditionally classified as increasing risk in an evolving macroeconomic landscape, a deviance from the hypothesis is not unexpected (Oberoi, 2018). An increasing FDR may be favored in anticipation of an extended period of rising interest rates. However, considering the analysis timeframe of the past 20 years, these FDR movements are not based on predictions by the REITs for the upcoming years.

Furthermore, the ratio of DRT showed significant impact after a lagged period of 0.25 years, while ATC's FDR was significantly impacted after a lagged period of 0.50 years. This delay may be attributed to the time-intensive process of debt restructuring undertaken by the two REITs, wherein existing debt agreements are transformed to secure new financing. The lack of significant impact on EQN's FDR from the rise in the 3-month and 10-year Treasury rates may be attributed to the shortage of the model in capturing a sufficient expression of the ratio.

The analysis of the ICR and rental revenues provided the most convincing findings. Both the ICR and rental revenues experienced negative impacts due to the rise in interest rates across all four REITs. The ICR was more dominantly influenced by the 10-year Treasury rate, while rental revenues were affected by both short- and long-term interest rates. These outcomes align with the hypotheses that firstly the ICR, similar to the DSCR, is affected by an increase in interest expenses resulting from higher debt service obligations. And secondly, the rental revenues are affected as rising interest rates diminish tenants' financial capacity to undertake investments, subsequently reducing the rental revenues of the REITs (Das, 2020). Furthermore, the rental revenues of EQN, DRT, and SBA exhibited significant impacts only after a lagged period ranging from 0.5 to 1.5 years. These results appear reasonable since data center and telecom tower tenants are bound by lease agreements and cannot immediately respond to market conditions (Damiani, n.d.; GMA, n.d.). The ICR of DRT and ATC was significantly impacted by the 10-year Treasury rate after a lagged period of 0.5 and 0.25 years, respectively. These lagged effects on the ICR align with tenant behavior, as described for rental revenues.

The net income, similar to the FDR, was significantly and negatively affected by the rise in the 3-month and 10-year Treasury rates for all REITs except EQN. This outcome supports the hypothesis that rising interest rates not only decrease rental revenues but also reduce the net income of REITs. Notably, the net income of SBA was uniquely impacted by the 3-month Treasury rate, providing a positive effect. Similar to the cases of the D/E and D/A ratios, this positive impact on SBA's net income can be attributed to the strength of the economy, leading to increased demand for the REIT's assets. Moreover, the net income of DRT, ATC, and SBA demonstrated significant impacts only after a lagged period ranging from 0.25 to 1 year, indicating a similar influence by tenant behavior, as described for rental revenues. However, the analysis of EQN's data revealed that the REIT's net income was not significantly impacted by interest rates. This lack of significance can be explained by neglecting the use of a proper current measurement of the REITs' operating performance. Currently, (Adjusted) Funds From Operations ((A)FFO) serves as the appropriate measure for assessing performance as depreciation expenses do not provide meaningful information to investors. Thus, the market considers these expenses as not value-relevant for REITs (Gore & Scott, 1998). However, this paper did not implement (A)FFO as the appropriate performance measure due to the absence of this financial indicator in the REITs' financial statements pre-GFC (EDGAR Entity Landing Page, n.d.).

In regard to the cash ratio, significant impacts by interest rates were found for several REITs. Nevertheless, this paper will not delve further into the results of this financial metric as none of the four REITs exhibited a good fit to the model. The highest fit achieved explained only 21% of the ratio. Consequently, this lack of explanatory power fails to provide a reliable regression model, making a proper discussion of the impact on the cash ratio impossible.

In general, the observed distinction in the impact of the 3-month and 10-year Treasury rates, as reported in the results, is noteworthy across nearly all observations. These findings align with existing literature on the influence of interest rates on the performance of REITs, where the divergence in impact is attributed to the difference in the credit duration and the characteristics of the 10-year Treasury rate as an indicator of economic stability while the 3-month Treasury rate reflects immediate market conditions (Akimov et al., 2020; He et al., 2003; Stevenson et al., 2007; Wong & Reddy, 2018).

Similar outcomes have been documented for different sub-sector REITs in the US, although specialized REITs did not exhibit a significant difference in the impact of the 3-month and 10-year Treasury rates on their financial performance (Lin et al., 2021). Moreover, the contrasting characteristics and reflection of economic expectations between the two interest rates could account for their significant impacts after lagged periods on various financial metrics and indicators. Namely, the impacts of the 10-year Treasury rate were found to lag by an equal or longer duration compared to the 3-month Treasury rate. However, previous literature investigating the effect of lagged periods on the financial performance of REITs have reported findings indicating a lagged response of approximately six months (Mueller & Pauley, 1995; Reddy & Wong, 2017). In contrast, the analysis conducted in this paper revealed that several financial metrics and indicators experienced a lagged impact of more than a year. It is likely that this disparity can be attributed to the difference in measurement of the impact on REIT prices in existing literature compared to the measurement of various financial metrics and indicators employed in this paper. Notably, the effects on these metrics and indicators tend to be impacted after a longer period when interest rates were observed to increase in relation to the more volatile stock market.

Another notable finding arises from the analysis of the most prominently impacted REITs in relation to various financial metrics and indicators. This analysis reveals that ATC is most significantly affected by the D/E ratio, D/A ratio, ICR, and net income (based on the 3-month Treasury rate). In contrast, EQN is most dominantly impacted by the DICR and rental revenues (based on the 10-year Treasury rate), while DRT is most dominantly impacted by rental revenues (based on the 3-month Treasury rate) and net income (based on the 10-year Treasury rate). Lastly, SBA demonstrates the most significant impact only on the current ratio. The cash ratio was not analyzed due to regression models that failed to exhibit a good fit, and the FDR was excluded as it relies more on preferences and specific REIT characteristics. From the analysis, it can be concluded that while ATC exhibits the most prominent impacts on financial metrics and indicators, it is not possible to distinctly characterize a weak financial performance among the REITs in relation to rising interest rates. Furthermore, a clear differentiation between global operating data and communication infrastructure REITs cannot be made, except for the cautious observation that rental revenues of global data center REITs are more negatively impacted by rising interest rates compared to global telecom tower REITs. Additionally, the divergent impacts on financial metrics and indicators for ATC and SBA may result from the substantial gap in market capitalization between the two REITs, as presented in *Tables 1* and *2*. This suggests that global operating communication infrastructure REITs are more prone to negative impacts on their financial performance resulting from rising interest rates, as their value increases.

Considering that this paper solely analyzed two global-scale data and communication infrastructure REITs, the conclusions drawn from the results are based on a limited representation of these specialized sub-sector REITs, where sensitivity to individual factors could be significant. While this paper provided a detailed analysis of the individual financial performances, an accurate reflection of sector-wide financial performances is thus unrealistic. Given that the findings from the individual performances of global operating REITs differ significantly from the evidence found for the financial performance of specialized REITs as a whole, it is important to extend research on the impact of rising interest rates on the financial performance of global operating REITs. Additionally, further investigation into data and communication infrastructure REITs, which have not been properly studied within the specialized REIT sector, is recommended.

Based on the empirical findings, it can be concluded that the financial performance of all four data and communication infrastructure REITs is significantly and negatively impacted by the upward movement of both the 3-month and 10-year Treasury rates. However, an exception can be observed in the case of the D/E ratios and the D/A ratios, as these increases provide the REITs with greater financial stability and flexibility. This finding diverges from existing literature, which suggests that the financial performance of the specialized REIT sector in the US remains unaffected by fluctuations in short- and long-term interest rates.

Thus, it is crucial to emphasize the vulnerability of foreign investment risk and the distinctive characteristics and market dynamics of data and communication infrastructure REITs, which differentiate them from the broader specialized REIT sector. Moreover, distinct differentiations between data center real estate and telecom tower real estate within the data and communication infrastructure REITs were not evident, except for the observation that rental revenues from data center real estate are more negatively affected by increases in both the 3-month and 10-year Treasury rates compared to rental revenues from telecom tower real estate. Additionally, evidence suggests that global operating communication infrastructure REITs experience a more prominent impact on their financial performance due to rising interest rates, as their value increases. However, given the limited representation of the REITs in the dataset, these comparative results should be interpreted cautiously, as they may not accurately reflect the broader landscape.

Considering the projected increase in US interest rates in the coming years and the current diminishing of contractionary monetary policies, it becomes critical to intensely study the consequences of rising interest rates on global operating REITs, particularly those investing in data center and telecom tower real estate. The vulnerability of their financial performance, if not adequately addressed, could lead to disruptions in modern infrastructure, thereby employing critical implications on society as a whole.

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Appendices

Appendix 1 Descriptive statistics of the financial metrics and indicators

Table 1: *Descriptive statistics of the data infrastructure REITs: June 2002/September 2004-March 2023*

	Equinix Inc.					**Digital Realty Trust**				
Variable	*Obs*	*Mean*	*Std Dev*	*Min*	*Max*	*Obs*	*Mean*	*Std Dev*	*Min*	*Max*
Debt to Equity	84	1.1446	0.3454	0.3956	2.3174	75	1.2437	0.4479	0.7057	2.9994
Debt to Assets	84	0.4366	0.0929	0.2565	0.9550	75	0.4734	0.0581	0.3652	0.6656
Interest Coverage ratio	84	1.1477	1.9499	-6.2513	4.2189	75	2.4745	0.9085	1.0590	6.6165
Cash ratio	84	1.0714	0.7235	0.0743	4.8264	75	0.0688	0.1164	0.0002	0.9622
Current ratio	84	1.9826	0.9163	0.2337	5.4643	75	1.8977	1.0968	0.6886	6.0294
Debt Service Coverage ratio	84	0.0080	0.0450	-0.1454	0.0481	75	0.0185	0.0061	0.0061	0.0309
Fixed Debt ratio	84	0.8236	0.0656	0.6821	0.9921	75	0.8412	0.1035	0.1940	1.0000
Rental Revenue	84	660520	599914	18040	1998209	75	417173	373444	24666	1329968
Net Income	84	45032	65377	-44088	258786	75	55826	65037	-37370	372406
Market cap (US$)	72.670.000.000					32.600.000.000				

Table 2: *Descriptive statistics of the communication infrastructure REITs: June 2002-March 2023*

	American Tower Corporation					**SBA Communications Corporation**				
Variable	*Obs*	*Mean*	*Std Dev*	*Min*	*Max*	*Obs*	*Mean*	*Std Dev*	*Min*	*Max*
Debt to Equity	84	2.6005	1.3678	0.7955	6.7590	84	8.3726	78.656	-305.37	530.11
Debt to Assets	84	0.5810	0.0748	0.4112	0.7141	84	0.9867	0.1793	0.7256	1.3493
Interest Coverage ratio	84	2.0445	1.7278	-5.8191	4.8404	84	0.3938	1.1764	-2.7073	3.7814
Cash ratio	84	0.4384	0.5524	0.0910	4.9073	84	0.7294	0.9002	0.0532	4.6128
Current ratio	84	0.9896	0.6996	0.3918	5.7596	84	1.4107	1.1718	0.1184	5.3068
Debt Service Coverage ratio	84	0.0235	0.0128	-0.0100	0.0453	84	0.0076	0.0080	-0.0259	0.0196
Fixed Debt ratio	84	0.7670	0.1046	0.4382	0.9513	84	0.7722	0.0955	0.5191	0.9256
Rental Revenue	84	1011886	784503	135484	2714500	84	258589	187197	26866	617268
Net Income	84	169587	251147	-683800	898200	84	-5944	53478	-155946	188623
Market cap (US$)	89.820.000.000					24.880.000.000				

Appendix 2 Summarized multiple linear regression results

Table 3: *Multiple linear regression results: Debt to Equity ratio: June 2002/September 2004-March 2023*

	3-month Treasury rate			**10-year Treasury rate**		
Company	*Coefficient*	*R-squared*	*Lag*	*Coefficient*	*R-squared*	*Lag*
Equinix Inc.	*-0.0399** *(0.0215)*	0.3780	-	*-0.110**** *(0.0350)*	0.4130	-
Digital Realty Trust	*0.0863**** *(0.0257)*	0.4540	-	*0.128**** *(0.0396)*	0.4220	-
American Tower Corporation	*-0.233**** *(0.0480)*	0.6270	-	*-0.493**** *(0.1140)*	0.6590	-
SBA Communications Corporation	*-3.165* *(-5.447)*	0.0160	-	*-0.3230* *(16.13)*	0.0130	-

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 4: *Multiple linear regression results: Debt to Assets ratio: June 2002/September 2004-March 2023*

	3-month Treasury rate			**10-year Treasury rate**		
Company	*Coefficient*	*R-squared*	*Lag*	*Coefficient*	*R-squared*	*Lag*
Equinix Inc.	*-0.000241* *(0.00542)*	0.2500	-	*0.0244** *(0.0135)*	0.2930	3 Periods
Digital Realty Trust	*-0.0142**** *(0.00328)*	0.5940	5 Periods	*-0.0175**** *(0.00625)*	0.5080	6 Periods
American Tower Corporation	*-0.0293**** *(0.00472)*	0.3220	3 Periods	*-0.0622**** *(0.0085)*	0.3230	5 Periods
SBA Communications Corporation	*0.00503* *(0.00798)*	0.6720	-	*-0.0342* *(0.022)*	0.6610	8 Periods

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 5: *Multiple linear regression results: Interest Coverage ratio: June 2002/September 2004-March 2023*

	3-month Treasury rate			**10-year Treasury rate**		
Company	*Coefficient*	*R-squared*	*Lag*	*Coefficient*	*R-squared*	*Lag*
Equinix Inc.	*-0.0973* *(0.0796)*	0.6560	-	*-0.379**** *(0.127)*	0.6760	-
Digital Realty Trust	*-0.0741* *(0.0648)*	0.2960	1 Period	*-0.344*** (*0.162)*	0.3300	2 Periods
American Tower Corporation	*-0.220**** *(0.0544)*	0.6050	-	*-0.717**** *(0.155)*	0.6600	1 Period
SBA Communications Corporation	*-0.127** *(0.0716)*	0.6700	-	*-0.388**** *(0.106)*	0.7410	-

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 6: *Multiple linear regression results: Cash ratio: June 2002/September 2004-March 2023*

	3-month Treasury rate			10-year Treasury rate		
Company	*Coefficient*	*R-squared*	*Lag*	*Coefficient*	*R-squared*	*Lag*
Equinix Inc.	*0.128** (0.0585)*	0.0690	-	*0.412*** (0.104)*	0.1570	-
Digital Realty Trust	*-0.0185** (0.00842)*	0.1440	-	*-0.0101 (0.0108)*	0.1010	-
American Tower Corporation	*-0.0662** (0.0295)*	0.1520	2 Periods	*-0.266 (0.203)*	0.2060	4 Periods
SBA Communications Corporation	*0.170* (0.0987)*	0.2100	4 Periods	*0.339* (0.193)*	0.1920	4 Periods

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 7: *Multiple linear regression results: Current ratio: June 2002/September 2004-March 2023*

	3-month Treasury rate			10-year Treasury rate		
Company	*Coefficient*	*R-squared*	*Lag*	*Coefficient*	*R-squared*	*Lag*
Equinix Inc.	*-0.158*** (0.0561)*	0.2850	5 Periods	*-0.295*** (0.0753)*	0.3670	6 Periods
Digital Realty Trust	*-0.0991 (0.0675)*	0.4100	-	*-0.154 (0.137)*	0.5490	1 Period
American Tower Corporation	*-0.147*** (0.0445)*	0.2560	1 Period	*-0.333* (0.191)*	0.2760	4 Periods
SBA Communications Corporation	*0.362*** (0.0791)*	0.5740	4 Periods	*0.677*** (0.170)*	0.5260	4 Periods

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 8: *Multiple linear regression results: Debt Service Coverage ratio: June 2002/September 2004-March 2023*

	3-month Treasury rate			10-year Treasury rate		
Company	*Coefficient*	*R-squared*	*Lag*	*Coefficient*	*R-squared*	*Lag*
Equinix Inc.	*-0.00732*** (0.00252)*	0.3040	-	*-0.0303*** (0.00524)*	0.4980	-
Digital Realty Trust	*-0.000823*** (0.000263)*	0.6560	-	*-0.000766** (0.000359)*	0.6310	-
American Tower Corporation	*6.33e-05 (0.000703)*	0.4530	-	*-0.00199 (0.00137)*	0.4630	-
SBA Communications Corporation	*-0.000520* (0.000279)*	0.6910	-	*-0.00223*** (0.000709)*	0.7290	-

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 9: *Multiple linear regression results: Fixed Debt ratio: June 2002/September 2004-March 2023*

	3-month Treasury rate			10-year Treasury rate		
Company	*Coefficient*	*R-squared*	*Lag*	*Coefficient*	*R-squared*	*Lag*
Equinix Inc.	*-0.00181 (0.00476)*	0.0860	1 Period	*0.000647 (0.00797)*	0.0840	-
Digital Realty Trust	*-0.0128*** (0.00458)*	0.3730	1 Period	*-0.0138* (0.00724)*	0.3330	1 Period
American Tower Corporation	*-0.0243*** (0.00853)*	0.4140	2 Periods	*-0.0334** (0.0162)*	0.3510	2 Periods
SBA Communications Corporation	*-0.0336*** (0.00647)*	0.3930	-	*-0.0614*** (0.0114)*	0.3540	-

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 10: *Multiple linear regression results: Rental Revenues: June 2002/September 2004-March 2023*

	3-month Treasury rate			10-year Treasury rate		
Company	*Coefficient*	*R-squared*	*Lag*	*Coefficient*	*R-squared*	*Lag*
Equinix Inc.	*-104,759*** (28,496)*	0.2970	4 Periods	*-423,803*** (30,785)*	0.7030	6 Periods
Digital Realty Trust	*-85,260*** (11,958)*	0.6140	2 Periods	*-169,568*** (22,574)*	0.7210	2 Periods
American Tower Corporation	*-100,493*** (23,684)*	0.7550	-	*-309,872*** (37,656)*	0.8560	-
SBA Communications Corporation	*-18,967*** (3,414)*	0.9280	2 Periods	*-51,646*** (7,218)*	0.9420	4 Periods

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 11: *Multiple linear regression results: Net Income: June 2002/September 2004-March 2023*

	3-month Treasury rate			10-year Treasury rate		
Company	*Coefficient*	*R-squared*	*Lag*	*Coefficient*	*R-squared*	*Lag*
Equinix Inc.	*-1,028 (1,518)*	0.7550	4 Periods	*-4,766 (4,475)*	0.7510	6 Periods
Digital Realty Trust	*-7,587** (3,416)*	0.3890	2 Periods	*-24,336*** (8,153)*	0.4240	2 Periods
American Tower Corporation	*-28,887** (13,523)*	0.6380	-	*-47,806* (25,286)*	0.6290	1 Period
SBA Communications Corporation	*6,904** (2,964)*	0.3740	-	*-20,075** (8,788)*	0.3800	4 Periods

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Appendix 3 Weights and impacts concerning rental revenue and net income

Table 12: *Weights of financial indicators proportionally to the REITs with the use of the "inverse ratio" formula: June 2002/September 2004-March 2023*

Variable	Equinix Inc.	Digital Realty Trust	American Tower Corporation	SBA Communications
Rental Revenue	0,1514	0,2397	0,0988	0,3867
Net income	0,2221	0,1791	0,0589	-1,6824

Table 13: *Proportional impacts of the short- and long-term interest rate on the rental revenue of the REITs: June 2002/September 2004-March 2023*

	3-month Treasury rate			**10-year Treasury rate**		
Company	*Coefficient*	*R-squared*	*Lag*	*Coefficient*	*R-squared*	*Lag*
Equinix Inc.	*-15,8605*	0.2970	4 Periods	*-64,1638*	0.7030	6 Periods
Digital Realty Trust	*-20,4368*	0.6140	2 Periods	*-40,6454*	0.7210	2 Periods
American Tower Corporation	*-9,9287*	0.7550	-	*-30,6154*	0.8560	-
SBA Communications Corporation	*-7,3345*	0.9280	2 Periods	*-19,9715*	0.9420	4 Periods

Table 14: *Proportional impacts of the short- and long-term interest rate on the net income of the REITs: June 2002/September 2004-March 2023*

	3-month Treasury rate			**10-year Treasury rate**		
Company	*Coefficient*	*R-squared*	*Lag*	*Coefficient*	*R-squared*	*Lag*
Equinix Inc.	*-0,2283*	0.7550	4 Periods	*-1,0585*	0.7510	6 Periods
Digital Realty Trust	*-1,3588*	0.3890	2 Periods	*-4,3586*	0.4240	2 Periods
American Tower Corporation	*-1,7014*	0.6380	-	*-2,8158*	0.6290	1 Period
SBA Communications Corporation	*-11,6153*	0.3740	-	*33,7742*	0.3800	4 Periods

Appendix 4 Detailed multiple linear regression results

4.1 Equinix Inc.

VARIABLES	(10Y) Debttoequityratio	(3M) Debttoequityratio
US10YTreasuryRate	*-0.110***	
	(0.0350)	
Totalcurrentassets	4.68e-08	6.40e-08
	(4.04e-08)	(4.51e-08)
NetIncomeLoss	1.38e-06**	1.10e-06
	(6.87e-07)	(6.93e-07)
Commonsharesoutstanding	1.12e-05***	1.16e-05***
	(1.81e-06)	(2.47e-06)
Shareprice	-0.00163***	-0.00137***
	(0.000272)	(0.000271)
US3MTreasuryRate		*-0.0399**
		(0.0215)
Constant	1.110***	0.741***
	(158)	(112)
Observations	84	84
R-squared	413	378

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Debttoassetsratio	(3M) Debttoassetsratio
L3.US10YTreasuryRate	*0.0244**	
	(0.0135)	
Commonsharesoutstanding	5.53e-06***	3.01e-06***
	(1.26e-06)	(5.92e-07)
Shareprice	-0.000323***	-0.000235***
	(6.20e-05)	(5.20e-05)
NetIncomeLoss	-2.99e-07	4.21e-08
	(2.53e-07)	(1.76e-07)
Currentratio	-0.00611	-0.00395
	(0.00908)	(0.0101)
US3MTreasuryRate		*-0.000241*
		(0.00542)
Constant	0.166*	0.331***
	(0.0903)	(0.0330)
Observations	81	84
R-squared	293	250

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Interestcoverageratio	(3M) Interestcoverageratio
US10YTreasuryRate	*-0.379**** *(127)*	
Totalcurrentassets	-1.98e-07 (1.19e-07)	-3.20e-08 (8.82e-08)
NetIncomeLoss	1.87e-05*** (2.21e-06)	1.91e-05*** (2.35e-06)
Debttoequityratio	2.048*** (657)	2.207*** (683)
US3MTreasuryRate		*-0.0973* *(0.0796)*
Constant	-628 (1.021)	-2.069** (861)
Observations	84	84
R-squared	676	656

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Cashratio	(3M) Cashratio
US10YTreasuryRate	*0.412**** *(104)*	
Totalassets	1.80e-08 (4.77e-08)	5.36e-09 (4.70e-08)
NetIncomeLoss	-5.60e-06 (3.95e-06)	-2.82e-06 (3.63e-06)
Shareprice	0.00132 (0.00116)	0.000251 (0.00118)
Debtservicecoverageratio	4.587* (2.389)	1.238 (2.115)
US3MTreasuryRate		*0.128*** *(0.0585)*
Constant	-438 (369)	0.908*** (135)
Observations	84	84
R-squared	157	69

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Currentratio	(3M) Currentratio
L6.US10YTreasuryRate	*-0.295**** *(0.0753)*	
Interestexpense	-6.60e-06* (3.62e-06)	-9.26e-06** (3.59e-06)
NetIncomeLoss	1.70e-07 (2.61e-06)	-7.70e-07 (2.76e-06)
Totalassets	-1.72e-08 (1.53e-08)	1.25e-08 (1.72e-08)
Debtservicecoverageratio	-17.30*** (4.804)	-9.315 (6.100)
L5.US3MTreasuryRate		*-0.158**** *(0.0561)*
Constant	3.826*** (316)	2.845*** (190)
Observations	78	79
R-squared	367	285

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Debtservicecoverageratio	(3M) Debtservicecoverageratio
US10YTreasuryRate	*-0.0303**** *(0.00524)*	
Totalcurrentassets	-1.37e-09 (5.14e-09)	8.96e-09 (5.74e-09)
NetIncomeLoss	5.23e-07*** (1.09e-07)	4.12e-07*** (1.22e-07)
Currentratio	0.0113* (0.00656)	0.00310 (0.00744)
Shareprice	-0.000126*** (3.26e-05)	-6.90e-05** (3.18e-05)
US3MTreasuryRate		*-0.00732**** *(0.00252)*
Constant	0.0848*** (0.0122)	-0.00323 (0.0180)
Observations	84	84
R-squared	498	304

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Fixedratedebtratio	(3M) Fixedratedebtratio
US10YTreasuryRate	*0.000647*	
	(0.00797)	
NetIncomeLoss	-2.59e-07	-2.42e-07
	(1.83e-07)	(1.75e-07)
Shareprice	0.000109*	0.000101*
	(6.16e-05)	(5.16e-05)
Debttoequityratio	0.0355	0.0332
	(0.0284)	(0.0263)
L.US3MTreasuryRate		*-0.00181*
		(0.00476)
Constant	0.767***	0.775***
	(0.0497)	(0.0283)
Observations	84	83
R-squared	84	86

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Rentalrevenues	(3M) Rentalrevenues
L6.US10YTreasuryRate	*-423,803****	
	(30,785)	
Debtservicecoverageratio	-2.823e+06**	5.313e+06***
	(1,181E+09)	(969,506)
Currentratio	-146,944***	-159,795***
	(48,097)	(59,508)
L4.US3MTreasuryRate		*-104,759****
		(28,496)
Constant	2.331e+06***	1.063e+06***
	(157,696)	(144,508)
Observations	78	80
R-squared	703	297

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) NetIncomeLoss	(3M) NetIncomeLoss
L6.US10YTreasuryRate	*-4,766*	
	(4,475)	
Shareprice	204.2***	217.4***
	(31.61)	(25.40)
Currentratio	2,323	1,230
	(5,300)	(3,978)
Debtservicecoverageratio	262,973**	240,441***
	(107,836)	(59,844)
L4.US3MTreasuryRate		*-1,028*
		(1,518)
Constant	2,478	-10,997
	(26,251)	(11,429)
Observations	78	80
R-squared	751	755

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

4.2 Digital Realty Trust

VARIABLES	(10Y) Debttoequityratio	(3M) Debttoequityratio
US10YTreasuryRate	*0.128***	
	(0.0396)	
Totalcurrentassets	-1.66e-08	-2.45e-08
	(1.84e-08)	(2.08e-08)
NetIncomeLoss	2.25e-07	2.72e-07
	(2.97e-07)	(2.71e-07)
Shareprice	-0.00249	-0.00317
	(0.00314)	(0.00320)
US3MTreasuryRate		*0.0863***
		(0.0257)
Constant	1.092***	1.415***
	(222)	(167)
Observations	75	75
R-squared	422	454

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Debttoassetsratio	(3M) Debttoassetsratio
L6.US10YTreasuryRate	*-0.0175***	
	(0.00625)	
NetIncomeLoss	-5.76e-08	-5.15e-08
	(7.34e-08)	(6.34e-08)
Currentratio	-0.0157**	-0.0129**
	(0.00649)	(0.00637)
Shareprice	-0.000816***	-0.000691***
	(0.000214)	(0.000181)
L5.US3MTreasuryRate		*-0.0142***
		(0.00328)
Constant	0.604***	0.558***
	(0.0226)	(0.00714)
Observations	69	70
R-squared	508	594

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	Interestcoverageratio	Interestcoverageratio
L2.US10YTreasuryRate	*-0.344***	
	(162)	
Totalcurrentassets	-4.33e-09	-4.42e-09
	(3.81e-08)	(4.13e-08)
NetoperatingIncomeLoss	4.32e-06	9.16e-06**
	(4.65e-06)	(3.71e-06)
Debttoequityratio	226	162
	(158)	(120)
L.US3MTreasuryRate		*-0.0741*
		(0.0648)
Constant	2.803***	1.554***
	(825)	(361)
Observations	73	74
R-squared	330	296

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Cashratio	(3M) Cashratio
US10YTreasuryRate	*-0.0101*	
	(0.0108)	
Totalassets	-1.98e-10	1.68e-09
	(2.50e-09)	(1.64e-09)
NetIncomeLoss	-1.03e-07	-1.20e-07
	(2.42e-07)	(2.39e-07)
NetoperatingIncomeLoss	-6.91e-07*	-1.08e-06***
	(4.11e-07)	(2.60e-07)
Currentratio	0.0237	0.0211
	(0.0213)	(0.0193)
US3MTreasuryRate		*-0.0185***
		(0.00842)
Constant	0.124**	0.135***
	(0.0572)	(0.0262)
Observations	75	75
R-squared	101	144

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Currentratio	(3M) Currentratio
L.US10YTreasuryRate	*-154*	
	(137)	
Interestexpense	2.80e-05***	2.72e-05***
	(8.00e-06)	(8.30e-06)
NetoperatingIncomeLoss	-1.80e-05***	-2.11e-05***
	(5.32e-06)	(6.28e-06)
Totalassets	5.72e-08***	7.23e-08***
	(1.38e-08)	(1.91e-08)
US3MTreasuryRate		*-0.0991*
		(0.0675)
Constant	1.806***	1.675***
	(677)	(455)
Observations	74	75
R-squared	549	410

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	Debtservicecoverageratio	Debtservicecoverageratio
US10YTreasuryRate	*-0.000766***	
	(0.000359)	
Totalcurrentassets	-8.40e-10***	-6.83e-10***
	(1.27e-10)	(1.38e-10)
NetoperatingIncomeLoss	2.92e-08*	2.09e-08
	(1.68e-08)	(1.73e-08)
Currentratio	-0.00210***	-0.00223***
	(0.000465)	(0.000480)
US3MTreasuryRate		*-0.000823****
		(0.000263)
Constant	0.0256***	0.0248***
	(0.00238)	(0.00186)
Observations	75	75
R-squared	631	656

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Fixedratedebtratio	(3M) Fixedratedebtratio
L.US10YTreasuryRate	*-0.0138**	
	(0.00724)	
NetoperatingIncomeLoss	-5.51e-07**	-6.25e-07***
	(2.20e-07)	(2.23e-07)
Totalstockholdersequity	2.38e-09	4.13e-09**
	(1.69e-09)	(1.67e-09)
Debttoequityratio	-0.0915***	-0.0852***
	(0.0226)	(0.0205)
L.US3MTreasuryRate		*-0.0128****
		(0.00458)
Constant	1.037***	1.003***
	(0.0455)	(0.0393)
Observations	74	74
R-squared	333	373

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Rentalrevenues	(3M) Rentalrevenues
L2.US10YTreasuryRate	*-169,568****	
	(22,574)	
Debtservicecoverageratio	-3.502e+07***	-4.736e+07***
	(5,967E+09)	(6,462E+09)
L2.US3MTreasuryRate		*-85,260****
		(11,958)
Constant	1.562e+06***	1.423e+06***
	(101,443)	(146,500)
Observations	73	73
R-squared	721	614

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	NetIncomeLoss	NetIncomeLoss
L2.US10YTreasuryRate	*-24,336****	
	(8,153)	
Shareprice	453.9	941.2***
	(280.5)	(279.3)
Debtservicecoverageratio	-1,709E+09	-1,54E+09
	(1,296E+09)	(1,631E+09)
Currentratio	-11,743	-16,821**
	(8,742)	(8,051)
L2.US3MTreasuryRate		*-7,587***
		(3,416)
Constant	150,758***	67,358
	(52,306)	(52,500)
Observations	73	73
R-squared	424	389

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

4.3 American Tower Corporation

VARIABLES	(10Y) Debttoequityratio	(3M) Debttoequityratio
US10YTreasuryRate	*-0.493****	
	(114)	
Totalassets	3.35e-08***	4.54e-08***
	(4.39e-09)	(4.77e-09)
NetIncomeLoss	3.04e-07	6.98e-07
	(4.32e-07)	(4.59e-07)
US3MTreasuryRate		*-0.233****
		(0.0480)
Constant	3.259***	1.757***
	(440)	(147)
Observations	84	84
R-squared	659	627

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

	(10Y)	(3M)

VARIABLES	Debttoassetsratio	Debttoassetsratio
L5.US10YTreasuryRate	*-0.0622***	
	(0.00850)	
NetIncomeLoss	4.51e-09	-5.00e-08**
	(1.41e-08)	(2.44e-08)
USGDP	-1.11e-08***	2.94e-09
	(2.90e-09)	(2.35e-09)
Currentratio	-0.00104	-0.00823
	(0.0103)	(0.0193)
L.US3MTreasuryRate		*-0.0293****
		(0.00472)
Constant	0.960***	0.583***
	(0.0779)	(0.0560)
Observations	79	83
R-squared	323	322

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Interestcoverageratio	(3M) Interestcoverageratio
L.US10YTreasuryRate	*-0.717****	
	(155)	
Totalcurrentassets	-6.78e-08	9.83e-08
	(1.25e-07)	(1.79e-07)
NetIncomeLoss	4.93e-06***	5.63e-06***
	(7.79e-07)	(1.15e-06)
Debttoequityratio	-0.512***	-0.346***
	(128)	(124)
US3MTreasuryRate		*-0.220****
		(0.0544)
Constant	4.787***	2.138***
	(620)	(280)
Observations	83	84
R-squared	660	605

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Cashratio	(3M) Cashratio
L4.US10YTreasuryRate	*-266*	
	(203)	
L.Totalassets	-2.42e-08**	-2.36e-08
	(1.18e-08)	(1.46e-08)
L4.NetIncomeLoss	2.50e-06	2.11e-06*
	(1.53e-06)	(1.26e-06)
L4.NetoperatingIncomeLoss	-1.64e-06	-4.56e-07
	(1.30e-06)	(3.62e-07)
L2.US3MTreasuryRate		*-0.0662***
		(0.0295)
Constant	1.886*	0.868***
	(1.035)	(229)
Observations	80	80
R-squared	206	152

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	Currentratio	Currentratio
L4.US10YTreasuryRate	*-0.333**	
	(191)	
Interestexpense	-6.44e-06***	-3.86e-06**
	(2.42e-06)	(1.53e-06)
NetIncomeLoss	4.94e-08	-2.38e-08
	(2.57e-07)	(2.68e-07)
Shareprice	-0.00188	-0.000513
	(0.00155)	(0.00142)
L.US3MTreasuryRate		*-0.147***
		(0.0445)
Constant	2.978***	1.717***
	(945)	(200)
Observations	80	83
R-squared	276	256

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Debtservicecoverageratio	(3M) Debtservicecoverageratio
US10YTreasuryRate	*-0.00199*	
	(0.00137)	
Totalcurrentassets	-9.91e-09***	-1.06e-08***
	(2.21e-09)	(2.27e-09)
NetoperatingIncomeLoss	5.56e-08***	6.61e-08***
	(1.37e-08)	(1.25e-08)
Currentratio	0.00892***	0.00971***
	(0.00207)	(0.00222)
US3MTreasuryRate		*6.33e-05*
		(0.000703)
Constant	0.0166**	0.00746
	(0.00742)	(0.00472)
Observations	84	84
R-squared	463	453

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Fixedratedebtratio	(3M) Fixedratedebtratio
L2.US10YTreasuryRate	*-0.0334**	
	(0.0162)	
NetoperatingIncomeLoss	1.86e-07	2.54e-07**
	(1.41e-07)	(1.23e-07)
Totalassets	-2.82e-10	-1.40e-10
	(1.98e-09)	(2.01e-09)
Totalstockholdersequity	-1.93e-08***	-1.93e-08***
	(6.97e-09)	(6.61e-09)
L2.US3MTreasuryRate		*-0.0243***
		(0.00853)
Constant	0.908***	0.814***
	(0.0695)	(0.0264)
Observations	82	82
R-squared	351	414

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	Rentalrevenues	Rentalrevenues
US10YTreasuryRate	*-309,872***	
	(37,656)	
Debtservicecoverageratio	-8.200e+06***	-809,422
	(1,598E+09)	(2,121E+09)
Totalstockholdersequity	0.213***	0.268***
	(0.0120)	(0.0110)
US3MTreasuryRate		*-100,493***
		(23,684)
Constant	1.124e+06***	-101,341
	(181,691)	(66,305)
Observations	84	84
R-squared	856	755

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) NetIncomeLoss	(3M) NetIncomeLoss
L.US10YTreasuryRate	*-47,806**	
	(25,286)	
Totalstockholdersequity	-0.00718	-0.00304
	(0.0225)	(0.0207)
Shareprice	2,175***	2,501***
	(258.3)	(275.1)
US3MTreasuryRate		*-28,887***
		(13,523)
Constant	159,094	5,689
	(163,888)	(84,241)
Observations	83	84
R-squared	629	638

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

4.4 SBA Communications Corporation

VARIABLES	(10Y) Debttoequityratio	(3M) Debttoequityratio
US10YTreasuryRate	*-323*	
	(16.13)	
Totalcurrentassets	6.98e-06	1.57e-06
	(4.17e-05)	(3.18e-05)
NetIncomeLoss	-3.74e-05	-1.02e-05
	(9.90e-05)	(4.16e-05)
Shareprice	-0.0810	-0.0877
	(153)	(0.0539)
US3MTreasuryRate		*-3.165*
		(5.447)
Constant	15.35	21.03
	(82.44)	(28.73)
Observations	84	84
R-squared	13	16

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Debttoassetsratio	(3M) Debttoassetsratio
L8.US10YTreasuryRate	*-0.0342*	
	(0.0220)	
NetIncomeLoss	-7.06e-08	-1.50e-07
	(2.50e-07)	(2.56e-07)
USGDP	2.87e-08***	3.49e-08***
	(6.75e-09)	(4.01e-09)
Currentratio	-0.00773	-0.0210**
	(0.0104)	(0.00819)
US3MTreasuryRate		*0.00503*
		(0.00798)
Constant	0.604***	0.407***
	(175)	(0.0775)
Observations	76	84
R-squared	661	672

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

	(10Y)	(3M)

VARIABLES	Interestcoverageratio	Interestcoverageratio
US10YTreasuryRate	*-0.388***	
	(106)	
Totalcurrentassets	6.11e-07	1.47e-06**
	(5.36e-07)	(7.38e-07)
NetIncomeLoss	1.42e-05***	1.52e-05***
	(1.72e-06)	(1.81e-06)
Debttoequityratio	-0.00105	-0.00136
	(0.00114)	(0.00135)
US3MTreasuryRate		*-0.127**
		(0.0716)
Constant	1.452***	203
	(373)	(257)
Observations	84	84
R-squared	741	670

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Cashratio	(3M) Cashratio
L4.US10YTreasuryRate	*0.339**	
	(193)	
Totalassets	-5.52e-09	-7.04e-08**
	(5.22e-08)	(2.93e-08)
NetIncomeLoss	2.01e-07	-9.18e-07
	(1.36e-06)	(1.22e-06)
L4.US3MTreasuryRate		*0.170**
		(0.0987)
Constant	-225	0.928***
	(795)	(272)
Observations	80	80
R-squared	192	210

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Currentratio	(3M) Currentratio
L4.US10YTreasuryRate	*0.677***	
	(170)	
Interestexpense	-1.11e-05**	-1.45e-05***
	(5.41e-06)	(4.58e-06)
NetoperatingIncomeLoss	1.28e-06	-3.36e-06**
	(2.06e-06)	(1.51e-06)
Totalcurrentassets	2.36e-06**	2.18e-06**
	(1.01e-06)	(9.50e-07)
L4.US3MTreasuryRate		*0.362***
		(0.0791)
Constant	-796	1.367***
	(732)	(236)
Observations	80	80
R-squared	526	574

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

	(10Y)	(3M)

VARIABLES	Debtservicecoverageratio	Debtservicecoverageratio
US10YTreasuryRate	*-0.00223***	
	(0.000709)	
Totalcurrentassets	-7.39e-10	2.61e-09
	(1.84e-09)	(1.71e-09)
NetoperatingIncomeLoss	7.93e-08***	9.29e-08***
	(7.48e-09)	(1.09e-08)
Currentratio	0.00152***	0.00125**
	(0.000531)	(0.000483)
US3MTreasuryRate		*-0.000520**
		(0.000279)
Constant	0.00684***	-0.000725
	(0.00193)	(0.00171)
Observations	84	84
R-squared	729	691

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Fixedratedebtratio	(3M) Fixedratedebtratio
US10YTreasuryRate	*-0.0614****	
	(0.0114)	
Totalassets	-8.74e-09	-2.23e-09
	(6.70e-09)	(6.92e-09)
Shareprice	0.000199	0.000361
	(0.000206)	(0.000250)
Debttoassetsratio	-0.0581	-0.0349
	(0.0670)	(0.0647)
US3MTreasuryRate		*-0.0336****
		(0.00647)
Constant	1.038***	0.825***
	(0.0671)	(0.0577)
Observations	84	84
R-squared	354	393

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

VARIABLES	(10Y) Rentalrevenues	(3M) Rentalrevenues
L4.US10YTreasuryRate	*-51,646****	
	(7,218)	
Debtservicecoverageratio	7.822e+06***	1.157e+07***
	(2,382E+09)	(1,897E+09)
Totalstockholdersequity	-0.0424***	-0.0512***
	(0.00440)	(0.00494)
L2.US3MTreasuryRate		*-18,967****
		(3,414)
Constant	302,022***	129,185***
	(37,486)	(16,317)
Observations	80	82
R-squared	942	928

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

	(10Y)	(3M)

VARIABLES	NetIncomeLoss	NetIncomeLoss
L4.US10YTreasuryRate	*-20,075***	
	(8,788)	
Totalstockholdersequity	-0.0171***	-0.0124**
	(0.00387)	(0.00484)
Totalassets	-0.00747**	0.00249
	(0.00363)	(0.00200)
US3MTreasuryRate		*6,904***
		(2,964)
Constant	74,675*	-42,800***
	(42,692)	(8,958)
Observations	80	84
R-squared	380	374

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*