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Quantile Spillovers and Connectedness Between Real Estate Investment Trust, the Housing Market, and Investor Sentiment

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Abstract: This paper examines the quantile connectedness between Real Estate Investment Trusts (REITs), housing market sentiment, and stock market sentiment in the U.S. over the period between January 2014 and June 2022 using the quantile vector autoregression (QVAR) model. We find modest spillover effects at the median quantile (8.51%), which become more pronounced at the extreme tails (between 50.51% and 59.73%). The COVID-19 pandemic amplifies these interconnections. REITs are net receivers at the median but net transmitters at extreme quantiles, while stock market sentiment mainly transmits during normal conditions and receives in highly bullish markets. Home purchase sentiment shifts from fluctuating roles before the pandemic to being a net transmitter post-2021. Overall, negative shocks have a greater impact than positive ones, and REITs exhibit stock-like behavior. These findings underscore the importance for fund managers and investors to consider sentiment volatility in both stock and real estate markets, especially during extreme market conditions.

Keywords: quantile connectedness; REITs; investor sentiment; housing market; stock market

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1. Introduction

Sentiment plays a pivotal role in shaping the dynamics of the real estate landscape, influencing housing prices and returns (Beracha et al. 2019; Clayton et al. 2009; Das et al. 2015; Hausler et al. 2018). Increased uncertainty, often reflected by sentiment, is linked to rising housing investment and reduced house price inflation (Ngene et al. 2017; Christidou and Fountas 2018). Notably, real estate markets are strongly influenced by economic factors and consumer behaviors (Beracha et al. 2019; Clayton et al. 2009; Das et al. 2015; Hausler et al. 2018), and local housing price shocks have contagion effects on other domestic markets (De Bandt et al. 2010; Anastasiou et al. 2021), highlighting the behavioral effects in real estate markets.

However, direct investment in real estate often demands significant capital (Gau and Wang 1990), posing challenges for retail-sized investors due to capital constraints. Instead, small investors can opt for Real Estate Investment Trusts (REITs), which are firms that pool resources to collectively invest in a diversified portfolio of income-generating real estate assets. Traded on major stock exchanges like stocks, REITs offer liquidity, enabling smaller investors to access the real estate market without direct ownership challenges (S. L. Chiang and Tsai 2023). Notably, REIT securities have become attractive financial instruments, providing opportunities for direct real estate investing, sharing rental profits, and mitigating the entry barriers and liquidity issues associated with property ownership (Mensi et al. 2023; Tong et al. 2024). Remarkably, REITs have witnessed significant growth, attracting capital from both institutional and retail investors (Marfatia et al. 2021). As of December 2022, global listed REITs had an equity market capitalization exceeding USD 1.9 trillion, as per the National Association of Real Estate Investment Trusts (NAREIT).[1]

While REITs serve as a robust proxy for the real estate market (Marfatia et al. 2017; Akinsomi et al. 2017) and provide a unique investment platform for retail-sized investors (Marfatia et al. 2017; Marfatia et al. 2022), there exists a research gap regarding the connection between sentiment and REITs. Despite sentiment's well-documented impact on housing markets, the specific effects on REIT performance remain inadequately explored. A few studies, however, show empirical evidence of investor sentiment influencing REIT returns (Lin et al. 2009; Huerta et al. 2015; Huerta et al. 2016; S. L. Chiang and Tsai 2023; Mensi et al. 2023), suggesting a correlation with stock prices (S. L. Chiang and Tsai 2023; Fei et al. 2010; Yung and Nafar 2017). Given that investor sentiment can influence investment decisions (S. L. Chiang and Tsai 2023; Baker and Wurgler 2007; Barber and Odean 2008), we contend that changes in sentiment extend beyond the traditional effects on housing prices to influence REIT asset prices and their adjustment behavior. Notably, REITs behave like small stocks and are characterized by information opaqueness (Danielsen and Harrison 2000; Devos et al. 2007; Lin et al. 2009; Yung and Nafar 2017), making them particularly attractive to retail investors, who are inherently more susceptible to sentiment (Baker and Wurgler 2007, 2006; Barber and Odean 2008).

While the impact of sentiment on financial markets, especially due to the global COVID-19 pandemic, is increasingly evident (Mensi et al. 2023; Yousaf et al. 2022), the specific effect of the COVID-19 on REITs remains relatively unexplored (Mensi et al. 2023). The lack of attention is surprising considering the rapid growth and popularity of equity REITs in recent years (Mensi et al. 2023). Despite a few studies offering empirical evidence on the impact of COVID-19 on REIT returns (Anglin et al. 2021; Bossman et al. 2022; Liow 2022), the majority of these studies are confined to a narrow sample period characterized by prolonged low interest rates. Nonetheless, the period following the COVID-19 pandemic is marked by a global increase in interest rates aimed at combating inflation, revealing a notable shortcoming in existing studies. Considering the sensitivity of housing prices to interest rate changes and their consequential impact on housing demand in general (C. Lee and Park 2022; Simo-Kengne et al. 2016) and specifically on REITs (Çelik and Arslanli 2022), there is a growing necessity to explore the nuanced relationship between sentiment and REITs amid rising interest rates. This research gap highlights the need for a more comprehensive understanding of how REITs navigate the evolving financial landscape in the post-pandemic era.

This study investigates the dynamic connectedness of Real Estate Investment Trusts (REITs), housing market sentiment, and stock market sentiment in the U.S., examining their inter-relationships during normal market phases, systemic crises, and rising interest rates. Despite REITs' attractive risk-return profiles and diversification benefits, their effectiveness may wane during severe systemic events such as the recent pandemic (Bossman et al. 2022). Our analysis focuses on network connectedness in terms of portfolio asset allocation, investment strategies, and risk management. Emphasizing the diversifying attributes of REIT exposure, the study spans from January 2014 to June 2022, encompassing significant events such as Brexit, the U.S.–China 2018–2019 Trade Wars, the ongoing COVID-19 pandemic, the Russia–Ukraine war, and the subsequent surge in inflation and rise in interest rates post-pandemic.

Our study contributes to the existing literature in several key aspects. Firstly, it is the first exploration exclusively centered on the dynamism of connectedness between REITs, housing market sentiment, and stock market sentiment, evaluating the impacts of COVID-19 and rising interest rates on spillover size and direction. These markets are pivotal for institutional and conventional investors due to their crucial roles in developed economies (Mensi et al. 2023). To the best of our knowledge, this is the first study specifically focusing on major REIT markets during the rising inflation and interest rates post-pandemic. Our examination of the pandemic's effects and post-pandemic rising inflation on real estate segments offers valuable insights for market participants and regulators, underscoring the necessity for tailored policy solutions to ensure the smooth functioning of major REIT markets, especially during global crises. Secondly, we adopt the network spillover frame-

work by Diebold and Yilmaz (2012) in the quantile regression approach by Ando et al. (2022). The time-varying quantile connectedness analyses allow for the examination of differing spillover and/or co-movement dynamics at the extrema (tails) of the distributions (Shafiullah et al. 2022). Given that financial uncertainty is a documented main transmitter of shocks driving real estate markets (Gabauer and Gupta 2020), and that sentiment plays a significant role in real estate and housing markets (Beracha et al. 2019; Clayton et al. 2009; Das et al. 2015; Hausler et al. 2018), our framework assures robust analysis, providing a comprehensive understanding of the evolution of risks and interdependencies across REITs, housing market sentiment, and stock market sentiment in response to sharp market movements.

Our findings support the presence of asymmetry in spillover among REITs, housing market sentiment, and stock market sentiment. While there is a relatively modest spillover effect in the median quantiles, it becomes significantly more pronounced at the extremely lower and extremely higher tails. We find that the advent of the COVID-19 pandemic exacerbates interconnectivity across quantiles. Both static and dynamic spillover analyses reveal that in the median quantile, REITs function as net receivers but shift to being net transmitters in the extreme quantiles. Conversely, under normal market conditions, stock market sentiment predominantly transmits, but in highly bullish markets, it reverses to becoming a net receiver. Home purchase sentiment fluctuates between transmitting and receiving roles before the pandemic, but notably transitions to being a consistent transmitter post-2021. These findings underscore the intricate interplay between sentiment, market conditions, and economic trends, offering valuable insights for investors, policymakers, and market analysts alike.

The rest of this paper is organized as follows: Section 2 presents the related literature, Section 3 introduces the data and methods, Section 4 discusses the empirical results, and Section 5 concludes the study.

2. Literature Review

2.1. Housing Markets, Macroeconomic Conditions, and Sentiment

Previous research has predominantly associated housing prices with traditional economic indicators, including GDP, income levels, population, and interest rates (Case et al. 2012; Gupta et al. 2011; Bjørnland and Jacobsen 2010). Macro-level shocks, such as alterations in monetary policy or shifts in interest rates, have been identified as significant drivers of housing prices (Plakandaras et al. 2020; Simo-Kengne et al. 2016). For instance, a contractionary monetary policy triggers an increase in mortgage rates, leading to higher housing costs, reduced demand for houses, and exerting downward pressure on house prices (Demary 2010; Rahal 2016; De Santis and Surico 2013; Everett et al. 2021). Additionally, the inflation channel suggests a nuanced impact; while inflation may stimulate residential investment due to real estate's role as an inflation hedge, it could also lead to higher interest rates, potentially suppressing real estate demand and adversely affecting house prices (Demary 2010). Furthermore, a positive output shock, resulting in increased disposable income, may channel funds towards enhanced consumption or real estate investment, contributing to an upswing in real estate prices (Demary 2010; Beltratti and Morana 2010).

Despite the importance of these economic fundamentals, they often fall short in fully explaining the observed high volatility in housing prices (Alkay et al. 2018; Vasileiou et al. 2024b). Scholars are increasingly turning to consumer psychology and irrational behavior to account for the substantial price fluctuations in the housing market (Granziera and Kozicki 2015). Residential property's dual role as both a consumer good and an investment good (Marfatia et al. 2022) necessitates the consideration of sentiment's influence on housing prices, particularly during periods of economic uncertainty. Understanding the impact of consumer sentiment on housing prices is crucial given its role in driving demand for durable goods and shaping investors' risk perception towards financial assets (Mishkin et al. 1978; Van Raaij and Gianotten 1990; Fuhrer 1993; Throop 1992).

In this regard, Shiller (2008) emphasizes the impact of optimistic outlooks on future home prices and shifts in public perceptions on housing supply responses. Changes in sentiment and housing price expectations, detached from economic fundamentals, have been identified as potential triggers for "bubble-bursting" events that can influence housing prices (Abraham and Hendershott 1996; Muellbauer and Murphy 2008). Optimistic sentiment, marked by increased expectations of future housing returns, tends to draw a surge of homebuyers into the property market (Dong et al. 2021). This influx, combined with positive sentiment, triggers a rapid escalation in transaction volumes (Fischer and Stamos 2013), fostering substantial upward momentum in housing prices (Tsai and Peng 2011; Asal 2019; Hong et al. 2022).

More recent studies highlight that sentimental shocks drive fluctuations in house prices, even in the absence of changes in aggregate fundamentals (Anastasiou et al. 2021; Ling et al. 2015; Abildgren et al. 2018; Vasileiou et al. 2024a). Notably, Caraiani et al. (2022) contribute valuable insights, revealing that under contractionary monetary policy, the impact on real house prices is more pronounced in optimistic market conditions, especially with unconventional policy decisions. Cheung and Lee (2020) and Vasileiou et al. (2024b) further highlight the asymmetric effects of investor sentiment on real estate, persisting even after controlling for macroeconomic conditions. This tendency to over-react to price changes during periods of elevated sentiment underscores the necessity of exploring behavioral factors beyond conventional economic and housing market fundamentals (Marfatia et al. 2022). Billio et al. (2012) also demonstrate that systemic events can emerge when risks are highly correlated across seemingly unrelated areas, such as the residential housing market and broader financial markets.

2.2. Financial Uncertainty, Monetary Policy, and REITs

The literature extensively covers the transmission of U.S. monetary policy shocks to international financial markets, particularly as global financial and economic linkages have strengthened (T. C. Chiang 2020). Numerous studies have highlighted the co-movement induced by U.S. monetary policy shocks in international financial market asset prices (Miranda-Agrippino and Rey 2020). The transmission of unconventional monetary policy shocks to various financial markets, including REITs, is facilitated through signaling and portfolio rebalancing channels. Specifically, the portfolio rebalancing channel involves central banks purchasing long-term securities, reducing the bond supply, boosting bond prices, and lowering yields (Marfatia et al. 2021). As a result, investors respond by adjusting their portfolios, favoring alternative assets like equities and REITs for higher returns (Gagnon et al. 2011; Bauer and Neely 2014).

Recent studies concentrate on the predictability of REIT returns, considering them a robust proxy for real estate markets (Akinsomi et al. 2016; Marfatia et al. 2017, 2021). Studies reveal the impact of monetary policy surprises on REITs, showing consistent co-movements in international asset prices (Bredin et al. 2007; Chou and Chen 2014). Monetary policy surprises affecting the rental incomes of real estate companies also exert influence on REIT prices (Chan et al. 2005; Chou and Chen 2014). For example, shifts in macroeconomic conditions, such as quantitative easing announcements, markedly affect returns for emerging markets' REITs (Gupta and Hardik 2018). The influence of U.S. monetary policy on global REITs proves variable over time and between countries, illustrating the dynamic nature of REITs within the financial landscape (Marfatia et al. 2017). Notably, REIT returns exhibit a negative correlation with the unexpected component of inflation, challenging the notion that mortgage REIT investments provide a safe haven during inflationary periods (Adrangi et al. 2004). Furthermore, monetary shocks exert about twice as much influence on REITs as they do on the S&P 500 Index during high-variance regimes (Anderson et al. 2012), underscoring the distinct market dynamics of REITs.

However, as REITs are traded similarly to stocks, they are sensitive to financial uncertainty beyond macroeconomic factors. Damianov and Elsayed (2018) document varied return spillovers across housing, mortgages, equity REITs, and the stock market. During

downturns, the housing market transmits spillovers, while in high-uncertainty periods, it receives spillovers from REITs and stock markets. Liow and Huang (2018) note crisis-sensitive volatility connectedness in REITs, and Liow (2022) emphasizes the impact of local stock markets on REITs' volatility. Recent studies confirm increased market interdependence during the uncertainty of the COVID-19 pandemic (Lesame et al. 2021; Mensi et al. 2023; Bossman et al. 2022) and the Russia–Ukraine war (Alam et al. 2023). These findings stress the significance of economic policy uncertainty, implied volatility, interest rates, world stock market return, and local stock market behavior in determining interconnectedness in REITs (Liow and Huang 2018).

2.3. Sentiment, Stock Markets, and REITs

Extensive literature highlights the behavioral impact on stock markets, emphasizing that investors' psychological patterns, including shifts in sentiment like overconfidence, optimism, and wishful thinking, influence decision-making processes (Kyle 1985; Black 1986; De Long et al. 1990; Shleifer and Summers 1990; Brown and Cliff 2004). This positive association positions investors as noise traders (Barber and Odean 2008; Foucault et al. 2011; Kaniel et al. 2008; Kumar and Lee 2006), impacting stock markets through their behavioral patterns.

An immense body of literature provides empirical evidence of investor sentiment's impact on stock returns. Notably, studies consistently show an inverse relationship between investor sentiment levels and future stock returns (Baker and Stein 2004; Baker and Wurgler 2006, 2007; Kumar and Lee 2006). Moreover, previous research explores the impact of sentiment on stock return volatility (Verma and Verma 2007; Hadad and Kedar-Levy 2024; Foucault et al. 2011; Yu and Yuan 2011; W. Y. Lee et al. 2002), revealing that shifts in sentiment correspond to revisions in stock return volatility. Foucault et al. (2011) assert that the presence of retail trading activity positively affects both stock returns and volatility, suggesting a more pronounced effect when retail investors, who are less informed and more susceptible to psychological biases and sentiment (Barber and Odean 2008; Kaniel et al. 2008; Kumar and Lee 2006), are more active in the market.

Considering REITs, the financial literature provides little evidence of the impact of investor sentiment on their returns. Similar to stocks, optimistic (pessimistic) sentiment corresponds to higher (lower) REIT returns (Lin et al. 2009; Hao et al. 2016). Huerta-Sanchez and Escobari (2018) observe an asymmetric impact of bearish and bullish institutional investor sentiments on REIT returns. Akinsomi et al. (2016) empirically demonstrate that economy-wide indicators, monetary policy instruments, and sentiment indicators are potent predictors of REIT returns. Interestingly, institutional sentiment plays a dominant role, with corrections in institutional expectations having a larger impact on REIT returns and volatility than changes in individual expectations (Huerta et al. 2016; Huerta et al. 2015). However, these findings are based on historical data, when equity REITs were smaller and primarily traded by institutional investors (Huerta et al. 2016).

More recently, NAREIT reports a significant increase in trading volume in the equity REITs market, surging from USD 4.8 billion in 2013 to over USD 10.0 billion in 2023.[2] This rise is attributed to increased activity from retail-size investors, potentially impacting investment decisions and influencing asset price adjustments. In this regard, Yung and Nafar (2017) find that REITs attracting high retail investor attention tend to earn higher returns. Rochdi and Dietzel (2015) also document a significant relationship between investor sentiment, proxies by online search volume, and the performance of the U.S. REIT market. Additionally, Mensi et al. (2023) observe that sentiment, gauged by the News Sentiment Index, significantly influences the spillover magnitude of REIT returns. Similarly, S. L. Chiang and Tsai (2023) document a strong integration of the REIT market with stock returns, being heavily influenced by investor sentiment. However, these studies typically assess the spillover size and direction based on mean impact levels, whereas in practice, systematic shocks exhibit more complex and variable impact modes, particularly extreme shocks, which can have a much larger impact than the mean shock (J. Wang et al. 2023).

While the existing literature has made significant strides in exploring how sentiment influences real estate and broader financial markets, it largely centers on average or mean impacts without fully addressing tail behaviors that reveal critical asymmetries. While several studies have established that investor sentiment can drive stock market returns and real estate investment decisions (e.g., Baker and Wurgler 2007; Brown and Cliff 2004), Hao et al. (2016) and Huerta-Sanchez and Escobari (2018) have also confirmed that sentiment impacts REITs, identifying positive and negative sentiment general effects on returns. However, these studies tend to overlook how these effects differ in magnitude and direction during periods of extreme market stress or exuberance.

Surprisingly, the financial literature provides limited research on asymmetric impacts on REIT returns. Birz et al. (2021) document the asymmetric effects of real estate news on REIT returns, with positive news significantly influencing REIT market returns more than negative sentiment and the impact being particularly stronger in REITs with high institutional ownership. This is in contrast with the substantial impact of negative sentiment on stock markets (Verma and Verma 2007; Hadad and Kedar-Levy 2024; Baker and Wurgler 2007). Zhang et al. (2023) and S. L. Chiang and Tsai (2023) also identify consistent positive influences on REIT returns from momentum and reveal asymmetric effects in price adjustment behaviors under varying investor sentiments. Moreover, while works like that of Birz et al. (2021) document the asymmetric effects of news on REITs, they are limited to news-specific reactions and do not comprehensively address broader investor sentiment dynamics during crisis periods. This limitation is further highlighted by studies that of such as Mensi et al. (2023), which, while acknowledging the role of sentiment in REIT performance, focus primarily on mean impact levels and lack insights into the behavior during extreme positive or negative market shifts. This approach fails to capture the non-linear spillover behaviors that often characterize periods of economic disruption and geopolitical risk.

The gaps in the literature are particularly evident in understanding how REITs interact with other market sentiment indices during systemic shocks, such as those seen in the COVID-19 pandemic or geopolitical events like the Russia–Ukraine war. Research that addresses these complex, tail-end dynamics is sparse despite evidence from financial theory and practice that such events can magnify the effects of sentiment asymmetrically (e.g., J. Wang et al. 2023). This gap is critical, as understanding tail behaviors can provide deeper insights into risk management and policy implications for REITs, especially during times of heightened uncertainty.

Given this research gap, we aim to investigate the asymmetric impact and spillover among housing sentiment, stock market sentiment, and REIT returns. We acknowledge that systematic shocks may exhibit intricate and variable trajectories, especially during extreme events. Therefore, studying spillover effects during such periods is crucial. With substantial trading volumes in global REITs and their integration with the U.S. market, as noted by Mensi et al. (2023), it is essential to explore the driving factors influencing the U.S. REIT markets. This exploration not only affects specific REIT markets but also extends to various interconnected markets, contributing to a deeper understanding of market dynamics.

3. Data and Preliminary Analysis

This study investigates how housing sentiment and stock market sentiment influence U.S. equity REITs. To assess sentiment's impact on U.S. equity REITs, we follow Damianov and Elsayed's (2018) methodology, gathering monthly data on the U.S. equity REIT index from the NAREIT's website, which reflects U.S. REIT price movements. To gauge housing market sentiment, we rely on the Fannie Mae Home Purchase Sentiment Index (HPI) sourced from the National Housing Survey's (NHS) website. The HPI provides valuable insights into consumers' housing-related attitudes and financial conditions, and it evidently has good predictive power for U.S. housing prices (Wilcox 2015). Additionally, we incorporate Baker and Wurgler's (2006) Investor Sentiment Index, which is available on Wurgler's website, to assess stock market sentiment.[3] This index, derived from various

market sentiment proxies, is widely used in the literature and correlates strongly with business cycle variables (Sibley et al. 2016). Our data sample spans from January 2014 to June 2022, aligning with the last publication date of the market sentiment indicator. Lastly, we calculate the monthly returns of all three variables by computing the difference in the logarithmic values between consecutive data points.

Figure 1 depicts the monthly returns of our variables for the entire sample. Despite a generally stable trend in all variables, notable spikes and troughs are observed for both REITs and the HPI in early 2016. These fluctuations can be attributed to historically low interest rates and investor expectations regarding the real estate market. Conversely, during the same period, the stock market experienced a positive impact from the Federal Reserve's interest rate cuts, as reflected in the significant surge of investor sentiment. In 2021, U.S. stocks and the housing price index (HPI) began to diverge as each responded differently to Federal Reserve policies. While the housing market initially remained strong due to low inventory and high demand, rising mortgage rates gradually reduced affordability, leading to a slowdown in price growth by late 2022. This price reduction improved buyer sentiment, making homes more accessible despite earlier rate hikes (Ringo 2022; Dong et al. 2021). Regarding stock market sentiment, investor sentiment initially surged in late 2021, being boosted by government fiscal and monetary support measures like stimulus payments, extended unemployment benefits, and other COVID-19 relief efforts. However, by 2022, the Federal Reserve's shift toward inflation control—marked by aggressive rate hikes—began to diminish this optimism, leading to a notable drop in investor sentiment as markets adjusted to a tighter monetary environment (B. Z. Wang et al. 2020).

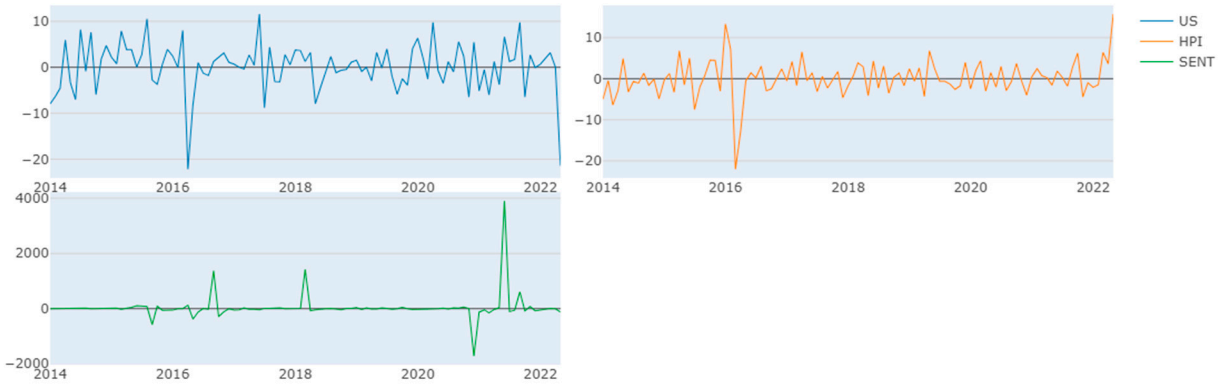


Figure 1. Time-series plot of the variables under examination.

Table 1 presents the descriptive statistics of the variables under consideration. The summary statistics of the monthly returns show that except for stock market sentiment (SENT), the mean returns of the REIT market and housing market (HPI) are close to zero, thus indicating little change in the returns of these two markets. On the other hand, the positive mean value of SENT is indicative of rising investor sentiment over the sampled period. Next, the stock market sentiment index, however, exhibits the largest fluctuations, as indicated by the highest variance figure, implying substantial swings of investor moods in the stock market. Additionally, there is a degree of variability in the skewness values among the three variables. Positive skewness is shown for SENT, whereas negative skewness is found for REITs and the HPI. This might imply that both net return transmission and reception often occur for the three markets under examination, both, thus, motivating us to investigate the extremely positive and negative spillovers as well as identify any disparity in these spillovers. Next, all variables exhibit high kurtosis (representing leptokurtic behavior), therefore rejecting the null hypothesis of normality assumption of the return distribution. Indeed, the results of the Jarque–Bera test strongly refute the null hypothesis that all variables are normally distributed. The results of the Q(10) and Q^2(10) tests demonstrates the presence of serial correlation and ARCH/GARCH

patterns in the residual series, thus making it legitimate for our choice of a time-varying parameter model. Finally, the unit root test strongly rejects the null hypothesis of a unit root; hence, the time-series returns are stationary.

Table 1. Summary statistics.

	REITs	HPI	SENT
Mean	0.148	0.104	35.942
Variance	28.392	20.356	231,570.5
Skewness	−1.201 ***	−0.649 ***	5.178 ***
Ex. kurtosis	4.144 ***	6.305 ***	42.369 ***
JB	96.540 ***	174.365 ***	8005.814 ***
ERS	−0.797	−0.5	−3.828 ***
Q(10)	2.001	4.691	6.135
Q2(10)	2.552	12.946 **	1.646

Notes: Skewness: D'agostino (1970) test; Kurtosis: Anscombe and Glynn (1983) test; JB: Jarque and Bera (1980) normality test; ERS: Elliott et al. (1996) unit root test; Q(10) and $Q^2(10)$: Fisher and Gallagher (2012) weighted portmanteau test. Significance: *** 1%; ** 5%.

4. Methodology

The aim of this study is to explore the dynamics of spillovers between REITs, the HPI and investor sentiment. Specifically, we are interested in answering the following questions: Are there any differences in the intensity and direction of return spillovers within mortgages, housing, and the stock market amid economic upswings and downturns? Do the return spillovers across these markets change between housing market booms and declines? Furthermore, how do they react to economic disruptions and geopolitical events? The answers to these inquiries have important implications for several stakeholders, such as homeowners, prospective homebuyers, investors, and policymakers.

In this paper, to address these issues, we adopt the quantile connectedness approach introduced by Ando et al. (2022) and Chatziantoniou et al. (2021). Within the framework of Diebold and Yilmaz (2012), the quantile connectedness approach computes the spillover indices from various quantiles (τ) based on quantile variance decomposition. While previous studies have largely relied on traditional mean-based methods such as vector autoregression (VAR) models and Granger causality tests, which capture average spillover effects but may overlook nuanced changes under extreme market conditions (e.g., Bredin et al. 2007; Chou and Chen 2014), the use of quantile connectedness in our study provides a more comprehensive view by capturing the heterogeneity of spillover effects across different market regimes, particularly during periods of economic disruption or geopolitical uncertainty. This approach is critical for understanding complex and asymmetric relationships in the market that traditional methods may not fully address (Mensi et al. 2023; Ozcelebi and Kang 2024). Another key benefit of this methodology is its ability to measure the degree to which the forecast error variance of the return of each market can be traced back to different shocks within the generalized VAR system regardless of variable ordering. In addition, there is no need to apply theoretical restrictions on the parameters or the identification of the shocks (Diebold and Yilmaz 2012; Chatziantoniou et al. 2021).

Specifically, we employ quantile vector autoregression, QVAR(p), of the following form:

$$y_t = \mu(\tau) + \sum_{j=1}^{p} \Phi_j(\tau) y_{t-j} + u_t(\tau) \quad (1)$$

where y_t and y_{t-j} are $k \times 1$ dimensional endogenous variable vectors consisting of REITs, the HPI, and investor sentiment, τ represents the quantile between [0, 1], p is the lag length of the QVAR model, $\mu(\tau)$ is a $k \times 1$ dimensional conditional mean vector, $\Phi_j(\tau)$ is a $k \times k$ dimensional QVAR coefficient matrix, and $u_t(\tau)$ is the $k \times 1$ dimensional error vector that

has a $k \times k$ dimensional variance–covariance matrix, $\Sigma(\tau)$. Next, we need to transform the QVAR(p) to its QVMA(∞) representation, such that:

$$y_t = \mu(\tau) + \sum_{j=q}^{p} \Phi_j(\tau) y_{t-j} + u_t(\tau) = \mu(\tau) + \sum_{i=0}^{\infty} \Psi_i(\tau) u_{t-i} \tag{2}$$

We can then compute the H-step Generalized Forecast Error Variance Decomposition (GFEVD) (Koop et al. 1996; Pesaran and Shin 1998), which shows the impacts of a shock in variable j on variable i:

$$\Psi_{ij}^{g}(H) = \frac{\sum(\tau)_{ii}^{-1} \sum_{h=0}^{H-1} \left(e'_i \Psi_h(\tau) \sum(\tau) e_j\right)^2}{\sum_{h=0}^{H-1} \left(\left(e'_i \Psi_h(\tau) \sum(\tau) \Psi_h(\tau)' e_i\right)\right.} \tilde{\Psi}_{ij}^{g}(H) = \frac{\Psi_{ij}^{g}(H)}{\sum_{j=1}^{k} \Phi_{ij}^{g}(H)} \tag{3}$$

where e_i represents a zero vector with unity at the i-th position. This normalization leads to the following: $\sum_{j=1}^{k} \tilde{\psi}_{ij}^{g}(H) = 1$ and $\sum_{i,j=1}^{k} \tilde{\psi}_{ij}^{g}(H) = k$.

The overall impact variable i has on all other variables j, the total directional connectedness TO others, is calculated as:

$$C_{i \to j}^{g}(H) = \sum_{j=1, i \neq j}^{k} \tilde{\psi}_{ji}^{g}(H) \tag{4}$$

The impact of all other variables j on variable i, also known as the total directional connectedness FROM others, is given by:

$$C_{i \leftarrow j}^{g}(H) = \sum_{j=1, i \neq j}^{k} \tilde{\psi}_{ij}^{g}(H) \tag{5}$$

Finally, the NET total directional connectedness, which represents the net influence variable i has on the analyzed network, is the difference between the total directional connectedness TO others and the total directional connectedness FROM others:

$$C_{i}^{g}(H) = C_{i \to j}^{g}(H) - C_{i \leftarrow j}^{g}(H) \tag{6}$$

A positive (negative) value of $C_i^g(H)$ indicates a net transmitter (net recipient) from the other variables.

The adjusted total connectedness index (cTCI) (Chatziantoniou and Gabauer 2021) is then computed as

$$C^{g}(H) = TCI = \frac{\sum_{i,j=1, i \neq j}^{k} \tilde{\psi}_{ij}^{g}(H)}{k - 1} \tag{7}$$

We utilize empirical connectedness measures with a lag order of 2 and a forecast horizon of 10 months ahead.[4] Following Damianov and Elsayed (2018), we implement a 60-month rolling window approach to estimate the time-varying connectedness at the quantile level. The initial window encompasses observations from period 1 to 60, with subsequent windows progressing sequentially up to from period (T − 60 + 1) to T, resulting in N = T − 60 + 1 subsamples for the rolling regression estimate of the QVAR model.

5. Empirical Results

5.1. Connectedness in the Median Quantile

Table 2 illustrates that the average connectedness among REITs, the HPI, and stock market sentiment in the median quantile is relatively weak at the 8.51% level. Generally speaking, sentiment indices serve as net transmitters, while REITs play the net-receiving role. To uncover the influences of events on the total connectedness over time, Figure 2

depicts the time-varying total connectedness among the three variables. Although the spillover is moderate, it tends to increase over the sample period. Notably, the total connectedness experienced a significant surge from 2021 onwards, which is consistent with the findings of Bossman et al. (2022) and Lesame et al. (2021), who similarly report an increase in market interdependence during the COVID-19 pandemic. This phenomenon can be attributed to the momentum effects of government interest rate measures to support businesses and individuals during the pandemic.

Table 2. Average dynamic connectedness table in the median quantile VAR ($\tau = 0.5$).

	REIT	HPI	SENT	FROM
REIT	91.4	6.42	2.18	8.6
HPI	4.26	93.84	1.89	6.16
SENT	0.84	1.42	97.74	2.26
TO	5.1	7.84	4.07	17.02
Inc. own	96.5	101.68	101.82	cTCI = 8.51
NET	−3.5	1.68	1.82	

Notes: The results are based on a quantile VAR model with a lag length of order 2 (BIC) and a 10-step-ahead forecast.

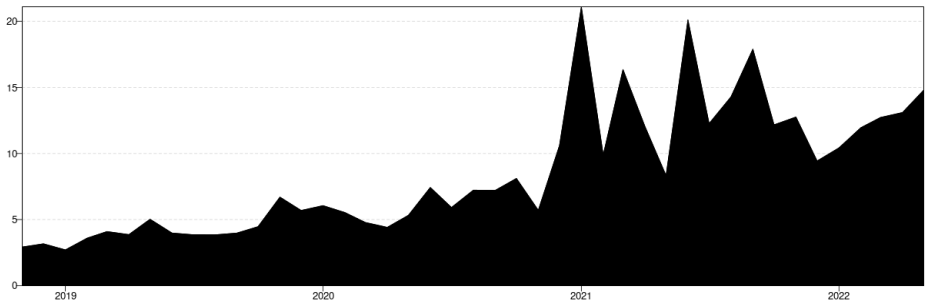


Figure 2. Total spillover in the median quantile VAR ($\tau = 0.5$). Note: The results are based on a rolling window of 60 months and 10-step-ahead forecast horizons.

Figure 3 reveals that REITs consistently serve as the enduring recipient of shocks throughout the entire period under examination[5]. This characteristic is attributed to the public trading nature of REITs, making them subject to market dynamics and sentiment similar to other equities (Hao et al. 2016; Lin et al. 2009). This view is also supported by Damianov and Elsayed (2018), who highlight the impacts of financial uncertainty on REITs owing to the similar characteristics of REITs and stocks. Positive sentiment, driven by favorable economic indicators or corporate earnings reports, can bolster the demand for REITs and other risk assets (Koelbl 2020; Carstens and Freybote 2019), while negative sentiment stemming from geopolitical tensions or economic uncertainties may trigger risk aversion among investors, resulting in capital outflows from REITs and other risky assets (Demiralay and Kilincarslan 2022).

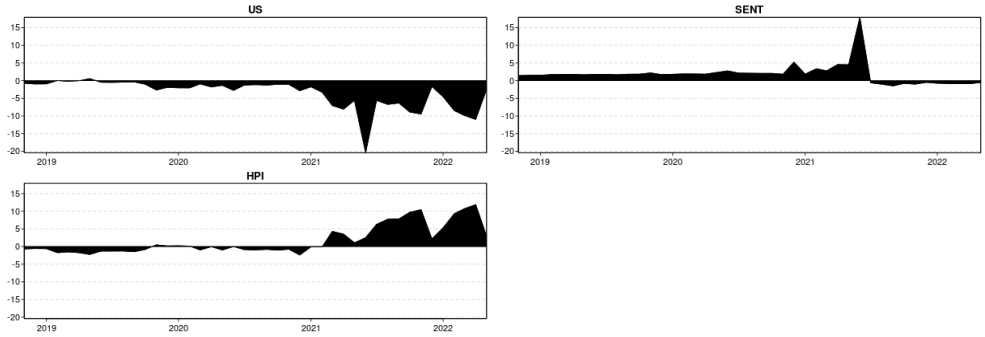


Figure 3. Net directional connectedness in the median quantile VAR ($\tau = 0.5$). Note: The results are based on a rolling window of 60 months and 10-step-ahead forecast horizons.

Furthermore, Figure 3 illustrates that the two sentiment indices predominantly serve as net transmitters, which is consistent with findings of Akinsomi et al. (2016), who emphasize the influence of sentiment indicators on REITs. This result is also consistent with the results of Wu and Wang (2024), who document that changes in the stock market can predict REIT returns but not vice versa. However, their respective roles have exhibited alternations over the sample period. Regarding stock market sentiment, it notably assumed the role of a net transmitter of shocks until mid-2021 before a role reversal and turning to be a net recipient of shocks. Following the initial impact of the COVID-19 pandemic, the global financial markets experienced significant volatility and uncertainty. During this period, stock market sentiment likely served as a key transmitter of shocks due to heightened sensitivity to economic indicators and pandemic-related news (Bai et al. 2023; Papadamou et al. 2023; Zehri 2021; Cevik et al. 2022). Investors closely monitored developments in the stock market as a barometer of overall market sentiment and economic recovery prospects. Consequently, shocks originating from changes in stock market sentiment had a substantial influence on other sectors, including REITs and housing markets (S. L. Chiang and Tsai 2023; Caraiani et al. 2022). As the global economy gradually recovered, shifts in market dynamics, such as changes in housing market sentiment, gained prominence as indicators of economic health and recovery (Agarwal and Varshneya 2022). This transition likely contributed to the changing role of stock market sentiment from a net transmitter to a net recipient of shocks, reflecting evolving market conditions and investor behaviors influenced by central bank interventions, fiscal stimulus measures, and vaccination campaigns during the pandemic recovery period (Yousaf et al. 2023). The initial phase of market recovery, characterized by expansive monetary policies and fiscal stimulus packages, may have bolstered investor confidence and contributed to positive stock market sentiment. However, as policy responses evolved and market participants adjusted their expectations, the influence of stock market sentiment on other sectors may have diminished, leading to its transition from a net transmitter to a net recipient of shocks.

Conversely, sentiment related to home purchases reveals a noticeable shift in its role as a shock transmitter, particularly in 2021, following a period of serving as a net receiver. Until mid-2021, amid the aftermath of the COVID-19 pandemic, housing market sentiment likely reflected uncertainties surrounding economic recovery, job stability, and the overall housing market outlook (Nguyen and Le 2023). As a result, housing market sentiment predominantly responded to shocks originating from external factors, such as changes in stock market sentiment, economic indicators, and policy measures (Marfatia et al. 2022; Caraiani et al. 2022). Economic uncertainties and market volatilities may have made housing market sentiment more reactive to external shocks, leading to its role as a net recipient. Additionally, the lagged effects of policy interventions could partly explain the net-receiving role of housing market sentiment. While the fiscal and monetary stimulus measures from governments and central banks to support economic recovery and stabilize financial markets primarily aimed to alleviate immediate pressures on households and businesses, their full effects on the housing market may have taken time to materialize. As such, until mid-2021, housing market sentiment may have remained sensitive to broader economic conditions and policy developments (Caraiani et al. 2022), making it a net recipient of shocks. Around mid-2021, as vaccination campaigns progressed, economies began to reopen, and consumer confidence improved. These positive developments likely contributed to a shift in market dynamics, with housing market sentiment becoming more proactive and influential in shaping overall market sentiment (Nguyen and Le 2023). Improving economic conditions, coupled with pent-up demand for housing, may have bolstered confidence among homebuyers and investors, leading to a more assertive role for housing market sentiment as a net transmitter of shocks.

5.2. Connectedness in the Extreme Quantile

Table 3 presents the average dynamic connectedness table focusing on the significantly lower and higher quantile VARs ($\tau = 0.05$; $\tau = 0.95$) of REITs, the HPI, and stock market

sentiment. It is noteworthy that contagion exhibits a notably heightened strength in the extreme quantiles compared to the median quantile, with values ranging from 50.51% to 59.73%. This implies tail risk within the interplay of REITs, the HPI, and stock market sentiment during exceptional events and that the examined markets are largely related to each other under extreme events. Therefore, extreme negative/positive shocks have a considerable impact on the system of connectedness, suggesting diversification benefits for investors in these markets. The contributions to others (TO) and contributions from others (FROM) in both the lower and upper tails are stronger than those for the median. In particular, the contributions from others in the left tail are stronger than those for the right tail, thus suggesting asymmetric impact on REIT returns, which is in line with Mensi et al. (2023) and Tong et al.'s (2024) observation.

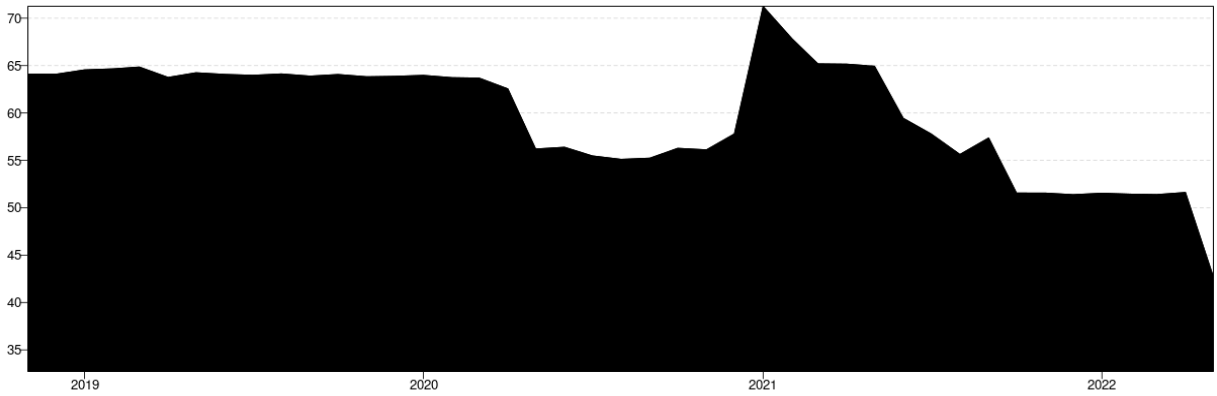
Table 3. Average dynamic connectedness table in the extreme quantile VAR.

	The Extreme Lower Quantile VAR (τ = 0.05)				**The Extreme Higher Quantile VAR (τ = 0.95)**			
	REIT	**HPI**	**SENT**	**FROM**	**REIT**	**HPI**	**SENT**	**FROM**
REIT	54.77	31.43	13.79	45.23	62.78	31.73	5.49	37.22
HPI	29.92	56.42	13.67	43.58	34	60.03	5.96	39.97
SENT	16.37	14.29	69.34	30.66	11.16	12.67	76.17	23.83
TO	46.28	45.72	27.46	119.47	45.16	44.4	11.45	101.01
Inc. own	101.06	102.14	96.8	cTCI	107.95	104.43	87.62	cTCI
NET	1.06	2.14	−3.2	59.73	7.95	4.43	−12.38	50.51

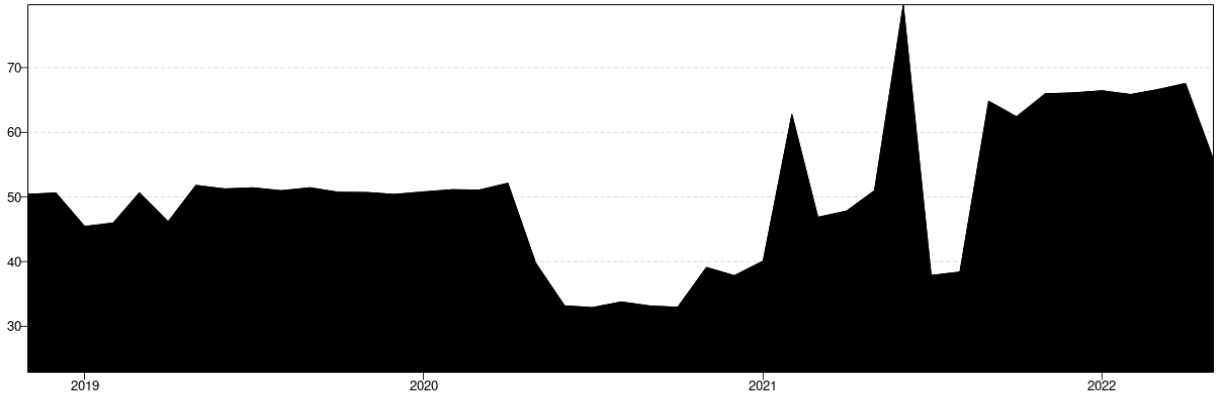
Notes: The results are based on a quantile VAR model with a lag length of order 2 (BIC) and a 10-step-ahead forecast.

To discern specific episodes influencing connectedness across our variables over time, we employed the time-varying total connectedness within the extreme quantile VAR models ($\tau = 0.05$; $\tau = 0.95$). Across quantiles, Figure 4 provides evidence of a high total connectedness index in both the lower and upper tails (reaching 72% at the 5th and 80% at the 95th percentile), indicating that extreme negative and positive shocks induce an increase in the intensity of return connectedness. This result is in line with the findings on the spillover of extreme events (Yousaf et al. 2022).

As depicted in Figure 4, the degree of connectedness remained relatively stable before 2020, hovering around high levels of 64% in the lower quantile and 50% in the higher quantile. This stability can be attributed to investors' increased risk aversion during economic uncertainty or downturns, leading them to seek refuge in assets perceived as safer or more stable, such as real estate (Yang et al. 2012). During this period, interconnectedness was notably higher in the lower quantiles, reflecting bearish markets characterized by negative sentiment. This suggests that REITs, housing markets, and stock markets are more sensitive to extreme negative shocks than to positive ones, especially during turbulent periods. The heightened impact of negative shocks on the stock market aligns with earlier findings (Baker and Wurgler 2006, 2007; Verma and Verma 2007; Hadad and Kedar-Levy 2024), possibly due to psychological factors like fear and uncertainty prompting investors to closely monitor market movements and react strongly to news or events (Bird and Yeung 2012; Huynh et al. 2021; Dash and Maitra 2022), thereby intensifying market interconnectedness. Our finding contrasts with some of the existing literature on REITs, which suggests that positive shocks have a greater impact on REIT returns (Birz et al. 2021; Zhang et al. 2023). The contrasting results can be attributed to methodological differences; employing the QVAR methodology with rolling regression, which captures the interconnectedness more efficiently (Ando et al. 2022), may contribute to these variations.



(**A**) Total spillover in the extreme lower quantile VAR ($\tau = 0.05$)



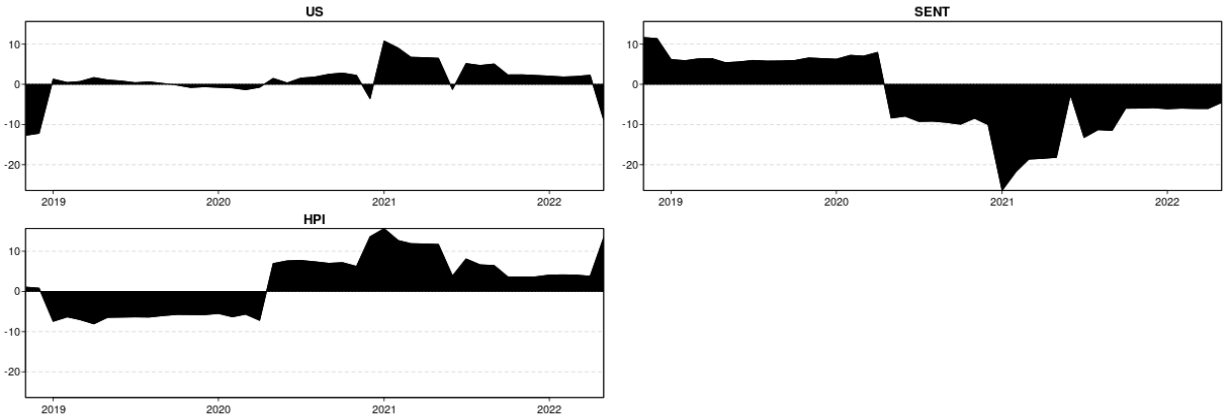
(**B**) Total spillover in the extreme higher quantile VAR ($\tau = 0.95$)

Figure 4. Total connectedness in the extreme quantile VAR. Note: The results are based on a rolling window of 60 months and 10-step-ahead forecast horizons.

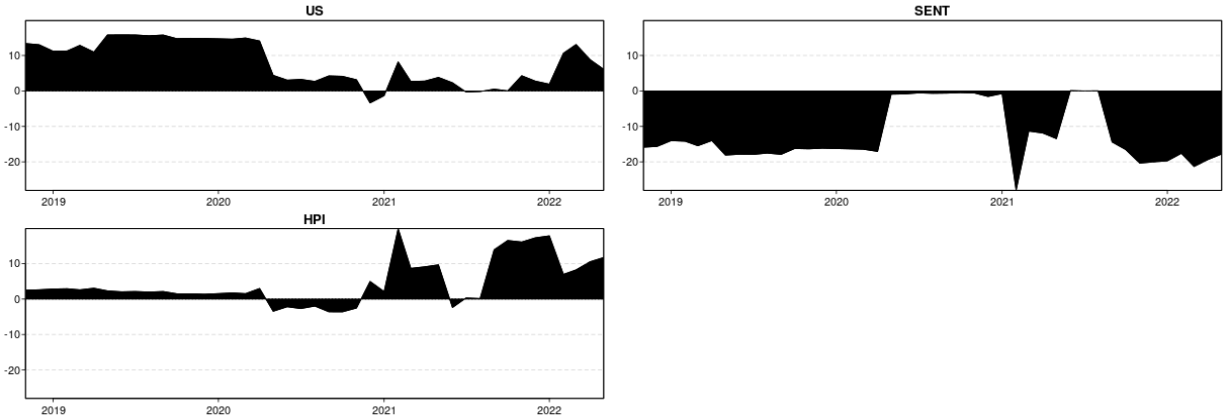
Subsequently, a notable decline in spillover was observed at the onset of 2020, coinciding with the emergence of the COVID-19 pandemic in the United States. At the end of 2020, the connectedness in the lower quantile underwent a resurgence, reaching a peak of over 70% before gradually diminishing to approximately 45% by 2023. In contrast, connectedness in the higher quantile, i.e., bullish markets, exhibits substantial fluctuations and increases to the level of around 60% during the same period. In 2021, central banks and governments around the world responded to the COVID-19 crisis by implementing unprecedented monetary and fiscal stimulus measures, including cutting interest rates to historically low levels and injecting liquidity into financial markets (Grasselli 2022). These measures have not only supported stock market performance but have also contributed to lower mortgage rates and increased affordability in the housing market, stimulating demand for real estate assets (B. Wang 2022). As a consequence, the interconnectedness between these markets may increase as investors react to common drivers such as interest rate movements and policy announcements. These results are in line with those of Caraiani et al. (2022), who document that contractionary monetary policy reduces the growth rate of real house prices more strongly when the market is characterized by optimism rather than pessimism, with this effect being more pronounced under unconventional monetary policy decisions. Furthermore, positive sentiment and market momentum have been observed to drive investor behaviors, leading to herding effects and increased trading activities across different markets (Chiang and Lin 2019; Hudson et al. 2020).

Figure 5 illustrates the estimated spillovers at both the lower and upper tails, revealing REITs' persistent role as a transmitter of shocks, distinct from their position in the median quantile. REITs consistently transmit shocks to both housing market sentiment and stock market sentiment across bearish and bullish market conditions due to their unique leverage

and real estate exposure (Ooi et al. 2010; Yang et al. 2012). During bearish market conditions, REITs reflect declining property values, impacting investor confidence, while in upturns, rising property values bolster sentiment. Additionally, REITs act as key indicators of the real estate market even without direct property ownership (Marfatia et al. 2017; Akinsomi et al. 2017; S. L. Chiang and Tsai 2023). This intermediary role allows them to serve as conduits through which real estate market shocks permeate into housing and stock market sentiments, amplifying their impact across the financial ecosystem.



(**A**) Net directional connectedness in the extreme lower quantile VAR ($\tau = 0.05$)



(**B**) Net directional connectedness in the extreme higher quantile VAR ($\tau = 0.95$)

Figure 5. Net directional connectedness in the extreme quantile VAR. Note: The results are based on a rolling window of 60 days and 10-step-ahead forecast horizons.

Moreover, the post-pandemic period brings an intensified focus on REITs' transmitting role. As shown in Figure 5, REITs' connectedness becomes more pronounced in both the extreme lower and upper quantiles, reflecting heightened market volatility and uncertainty. The COVID-19 pandemic has led to rapid fluctuations in economic conditions, where REITs, as publicly traded entities, are particularly responsive to investor behavior and sentiment shifts. This period of unpredictability underscores the importance of REITs as significant transmitters of shocks, with market participants reacting quickly to changes in economic outlook and stability (Bui et al. 2022; Bouri et al. 2021). In other words, as publicly traded entities, REITs are particularly sensitive to market dynamics and investor behaviors, making them significant transmitters of shocks during varying market conditions (Lin et al. 2009; Huerta et al. 2015; Huerta et al. 2016; S. L. Chiang and Tsai 2023; Mensi et al. 2023). During both bearish and bullish market conditions, REITs can serve as a key transmitter of shocks as market participants react to changing economic conditions and uncertainty.

By contrast, the figure illustrates a notable contrast in the behavior of REITs during normal market conditions. Prior to 2020, REITs tended to serve as shock receivers,

indicating their sensitivity to external factors like interest rates and geopolitical events. This sensitivity contributed to heightened volatility and fluctuations in housing market sentiment (Karanasos and Yfanti 2021; Demiralay and Kilincarslan 2022; Mensi et al. 2023). Additionally, investor portfolio adjustments influenced REIT demand and performance, further reinforcing their role as shock receivers.

Yet, the roles of sentiment indices differ between the two quantile cases. In the extremely lower quantile preceding early 2020, stock market sentiment functioned as the net transmitter, while housing sentiment acted as the net receiver. Yet, their roles reversed after early 2020. In the extreme higher quantile, stock market sentiment consistently played the role of the net receiver throughout the entire sample period. Housing sentiment demonstrated its transmitting role for most of the study period, except during mid-2020. This result indicates that stock market sentiment has a stronger ability to spill over to other markets at the downside of return distribution, which is the opposite of the results obtained with housing market sentiment. Our findings therefore contrast the findings reported by Damianov and Elsayed (2018) and Mohammed et al. (2023). We conjecture that the transmitting role of stock market sentiment during market downturns could be explained by the heightened risk aversion of investors, which, on the one hand, can trigger emotional responses and irrational behavior among investors, and, on the other hand, could translate negative sentiment in the stock market quickly into broader market pessimism, leading to widespread selling across various asset classes and resulting in a stronger spillover effect from the stock market to other markets, including commodities, currencies, and real estate.

In short, the spillover intensity is notably higher than in median conditions, with connectedness values ranging from 50.51% to 59.73%, reflecting stronger interdependencies during extreme market shifts in both extreme quantiles. In bearish conditions (lower quantile), REITs primarily act as net transmitters, channeling negative shocks to the housing and stock markets, aligning with investor risk aversion that heightens interconnectedness. This is because as publicly traded assets, REITs are susceptible to investor sentiment shifts; when sentiment turns negative, REITs become channels through which negative shocks spread to related sectors, such as housing and stock markets. In bullish conditions (upper quantile), REITs also transmit positive shocks, but to a lesser extent, showcasing an asymmetric response to market optimism versus pessimism. Furthermore, the lower quantile shows a stronger reception of spillovers, particularly impacting REITs, which are more susceptible to extreme downside risks. Housing sentiment, on the other hand, usually functions as a net receiver during downturns but shifts to a consistent transmitter post-2021, coinciding with economic recovery. This asymmetry highlights how REITs, typically shock receivers in normal conditions, transition to significant shock transmitters in extreme quantiles, amplifying systemic risk and interconnectedness in both bearish and bullish extremes.

6. Conclusions

Acknowledging the limited research on the asymmetric impacts on REIT returns despite the recognized significance of sentiment on housing prices and REITs, this paper, thus, aims to investigate the asymmetric impacts and spillover among housing sentiment, stock market sentiment, and REIT returns, particularly during extreme events. Notably, this is the first attempt to understand the role of REITs in networks with sentiment indices, especially at the extreme upper and lower tails, as it can reveal any difference in the intensity and direction of return spillovers during bearish and bullish market conditions.

Specifically, we examine extreme lower return spillovers and extreme upper return spillovers by employing the quantile connectedness approach by Ando et al. (2022). The results show that the lower quantile spillovers are higher than both the medium and upper quantile spillovers. Furthermore, the contributions to/from others in the lower tails (bearish market) are stronger than those in the upper tails (bullish market). Generally speaking, REITs act as net receivers in the median quantile but turn to be net transmitters in the extreme quantiles. Conversely, stock market sentiment primarily serves as a net transmitter

under normal market conditions, yet it assumes the net-receiving role in highly bullish markets. In very bearish markets, the market's sentiment changes depending on whether it is pre- or post-pandemic. As for home purchase sentiment, its role oscillates between being a net transmitter and a net receiver before the onset of the COVID-19 pandemic but unequivocally emerges as a net transmitter after 2021.

Overall, our findings suggest that negative shocks exert higher impacts than positive shocks, which is in line with the literature on equities (Baker and Wurgler 2007; Hadad and Kedar-Levy 2024; Verma and Verma 2007) but contradicts the findings of a few studies on REITs (Birz et al. 2021; Zhang et al. 2023). Our findings, therefore, imply that REITs behave like stocks and, hence, are influenced by sentiment to/from the stock market. On another note, we also find that REITs are influenced by sentiment to/from the real estate market, in the same direction.

The recent financial literature has delved into understanding the interplay between investor sentiment and REIT returns (see, e.g., Birz et al. 2021; S. L. Chiang and Tsai 2023; Mensi et al. 2023; Zhang et al. 2023), reflecting the growing appeal of REIT securities to retail-size investors. Our study sheds light on the intricate relationship between sentiment and REIT returns, offering valuable insights into market dynamics and the potential influence of sentiment on spillover effect. By adopting a tail connectedness approach, we enhance our understanding of how investor sentiment influences REITs, particularly during extreme shocks. Our findings extend the existing literature by addressing the gaps in research on asymmetric impacts and spillover effects in the context of REITs, contributing to a deeper understanding of market behavior and informing investment decision-making processes.

The implications of our research underscore the importance for fund managers and investors considering REITs in their portfolios to recognize the significant volatility influenced by sentiments from both stock and real estate markets. This volatility is especially pronounced during periods of market stress, such as economic disruptions or geopolitical events, which can alter typical investment patterns. REITs, due to their dual nature as stock-like assets and real estate investments, exhibit distinct behavior when sentiment shifts dramatically. For instance, during severe market downturns or crises, REITs may transition from being net receivers to net transmitters of sentiment-driven impacts, a shift that can result in amplified volatility and unexpected portfolio risks. Conversely, in highly bullish conditions, stock market sentiment can shift from a dominant transmitter to a net receiver, demonstrating the intricate interplay between these sentiment indices and market conditions. Notably, this pattern is consistent with the trends observed across broader financial markets, where geopolitical events and economic disruptions drive similar sentiment-driven dynamics (Costola and Lorusso 2022; Mensi et al. 2021; Umar et al. 2022; Hadad et al. 2024).

Since sentiments can substantially affect overall market dynamics and investor behaviors, especially during periods of elevated pessimism or optimism, understanding these patterns is vital for policymakers, investors, and market participants. The ability to predict and respond to how sentiment impacts REITs and broader financial assets can improve risk management strategies and investment decision making, ensuring that participants are not blindsided by shifts in market sentiment during crises or following significant geopolitical events.

Our findings also carry significant implications for regulators, who must be aware of how REITs and sentiment indices respond differently under various economic stressors. For example, during crises such as the COVID-19 pandemic or periods of inflation, targeted regulations can help ensure liquidity and robust risk management in REIT markets. Policymakers should adopt comprehensive monitoring systems that capture real-time changes in investor sentiment, enabling the proactive management of sentiment-driven volatility. Given REITs' and the housing market's sensitivity to post-pandemic interest rate adjustments, monetary policy must strike a balance between necessary rate hikes and their potential repercussions on real estate markets. This awareness can prevent unintended market shocks that may exacerbate volatility and disrupt financial stability.

Future research could delve into the cross-country and regional variations in how investor sentiment influences REIT returns, considering diverse market structures, regulations, and investor behaviors. Also, examining the roles of institutional and retail-size investors in shaping sentiment-driven movements in REITs would offer valuable insights for real estate finance practitioners and investors.

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Data Availability Statement: REITs data presented in this study are available at NAREIT at https://www.reit.com/data-research. HPI index data is available at National Housing Survey's (NHS) website available at https://www.fanniemae.com/research-and-insights/surveys-indices/national-housing-survey. Sent index derived from Jeffery Wurgler's website available at https://pages.stern.nyu.edu/~jwurgler/. These data were derived from the following resources available in the public domains above.

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

Notes

1 https://www.reit.com/investing/global-real-estate-investment (accessed on 30 March 2024).

2 https://www.reit.com/data-research/reit-market-data/reit-industry-financial-snapshot (accessed on 30 March 2024).

3 The Baker and Wurgler (2006) index is derived from the first principal component of five sentiment proxies. For robustness, we also utilized an updated version of the indicator, where each sentiment proxy was orthogonalized with respect to six macroeconomic indicators. Despite this refinement, our findings remained consistent with the original results.

4 For robustness, we conducted tests on the generalized variance decomposition matrix using varying numbers of lags. We present the results based on 2 lags, selected for their minimal Akaike (AIC), Schwartz (SIC), and Hannan–Quinn (HQ) information criteria.

5 We also perform the Granger causality test and find strong evidence that housing market sentiment Granger-causes the return of REITs, whereas REIT returns do not Granger-cause housing market sentiment. We do not find any other significant Granger causality regarding any pair of the remaining variables. These results are available upon further request.

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