The effect of quantitative easing and quantitative tightening on U.S. equity REIT returns

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Abstract:

The Federal Reserve (the Fed) has implemented several quantitative easing (QE) programmes to stimulate the U.S. economy and increase the inflation rate after the great financial crisis (GFC) and the COVID-19 crisis. However, when the inflation rate started to increase steeply in 2021, the Fed instead begun to implement quantitative tapering (QT) to cool down the U.S. economy and bring back inflation to its target rate. This study seeks to estimate the effect of the QE and QT programmes on the U.S. equity Real Estate Investment Trusts (REITs) index returns, while controlling for several other important macro-financial factors. The estimations show that the QE programmes significantly contributed to a long period of positive REIT returns, while the recent 2022 QT efforts has contributed significantly to the recent period of negative REIT returns. We also find that the increases in the key macro-financial factors Baa Corporate Bond Yield ad the CBOE volatility index of the U.S. stock market (VIX) result in lower REIT returns, while increases in total bank equity capital of FDIC-Insured Commercial Banks and Savings Institutions contribute to positive REIT returns. We also find that the negative initial REIT return reaction to the COVID-19 outbreak was likely outperformed by the positive impacts of the large combined monetary (QE) and fiscal stimulus packages implemented after the outbreak of the COVID-19 crisis. The findings of this study show that REIT returns are highly sensitive to profound QE and QT programmes through important monetary transmission mechanisms channels such as the interest rate, asset price and risk-taking channels. This research supports REIT investors to understand how the Fed's monetary policy actions, particularly QE and QT programmes, impact the returns of the REIT index, and to adjust their investment strategies accordingly based on their expectations of future monetary policy actions and macro-financial conditions.

Keywords: REITs, Quantitative Easing, Quantitative Tightening, Real Estate, Inflation

JEL-codes: E31, E44, E49, G19
1. Introduction

Central banks implement various conventional and unconventional monetary policies to maintain price stability (normally defined as 2 percent annual inflation rate) by affecting aggregate demand. According to the theory of transmission mechanisms of monetary policy, central banks intend to affect aggregate demand and inflation through several mechanisms and channels. When central banks raise or lower their policy rates, and/or increase or decrease their balance sheets, they might affect aggregated demand and prices levels through a complex interplay between different monetary policy transmission channels, such as the interest-rate channel, the asset price channel, the exchange rate channel, the bank lending channel, and the balance sheet channel. For instance, according to the asset price channel, the evolution of actual and expected policy rates affect aggregate demand and inflation through changes in the prices of assets such as stocks, bonds and real estate. Indeed, how conventional, and unconventional monetary policy interventions affect asset prices is a field that is analyzed and debated by many market participants and academicians (e.g., Bouis et al., 2013; Kashyap and Stein, 2023; Miranda-Agrippino and Nenova, 2022).

REITs are companies that own or finance income-producing real estate across a range of property sectors (Nareit, 2023), and can be divided into equity REITs or mortgage REITs. Equity REITs typically own and operate properties, while mortgage REITs focus on investing in mortgage-backed securities or other mortgage-related assets. They are subject to specific regulations and tax regimes that are designed to incentivize investment in the real estate sector. In this paper, we focus on the returns generated by publicly traded equity Real Estate Investment Trusts (REITs). Equity REITs are the majority among REITs, and there are numerous publicly traded U.S. equity REITs that are held by financial institutions and retail investors.

Both the direct residential and commercial real estate markets, and the securitized real estate markets (which publicly traded REITs belong to), are exposed to similar risk factors, especially in the long run (see e.g., Hoesli and Oikarinen, 2012) such as the overall level of economic activities, and the conditions in the financial markets such as the interest rate and bond markets. In the short run, REIT returns might be more correlated with the overall stock market returns. Since changes in conventional and unconventional monetary policies of the Federal Reserve might affect the returns on stock markets and the direct residential and commercial real estate markets, REIT returns might also be affected by various monetary policy activities through various complex and interrelated transmission mechanism channels.

This study seeks to explain the relationship between the performance of U.S. equity REIT returns and the Federal Reserve’s monetary policy interventions during the great financial crisis, the COVID-19 crisis, and the recent high inflation crisis. By controlling for important macro-financial factors and utilizing quarterly dummy variables, we offer a comprehensive analysis of the impact of QE and QT programs on REIT returns, contributing to a deeper understanding of the dynamics within the real estate investment landscape.
2. Background

**REITs as an asset class**

Real estate as an investment class has grown in popularity among institutional investors, such as pension funds and sovereign wealth funds (Cvijanović et al., 2020; Van Loon and Aalbers, 2017). For investors who want to seek exposure to real estate equity investments, they can choose between two broad categories: private (direct) real estate and public (listed, securitized) real estate (Farrelly and Moss, 2021; Shilling and Wurtzebach, 2019). Publicly traded REITs belong to the latter category.

Since their introduction in the U.S. in 1960, REITs have gained global popularity and have been adopted in various forms in countries such as Canada, Australia, and several countries in Europe and Asia. The popularity can be attributed to their ability to attract capital to the real estate industry and provide investors with a convenient and efficient way to invest in real estate assets.

While investing in a traditional real estate stock may offer exposure to the real estate sector, investing in a REIT provides a more direct way to invest in real estate assets, as well as certain tax advantages. In many countries, REITs are subject to specific regulations and tax regimes that are designed to incentivize investment in the real estate sector. For example, in the U.S., REITs must have the bulk of its assets and income connected to real estate investment and must pay at least 90% of its taxable income to shareholders annually in the form of dividends, which helps to reduce the tax burden on the REIT and ensures a steady stream of income for investors (U.S. Securities and Exchange Commission, 2011). In addition, a qualified REIT is allowed to deduct from its corporate taxable income all of the dividends that it pays out to its shareholders.  

U.S. REITs own approximately $4.5 trillion in gross real estate, making it a huge asset class (Nareit, 2023). More than $3 trillion of that is from public listed and non-listed REITs and the remainder from privately held REITs. Approximately 150 million of Americans own REITs through their retirement savings and other investment funds. Hence, the economic and investment reach makes the asset class very interesting to study.

The macro-dependency of REITs is closely intertwined with two key aspects of monetary policy: QE and the federal funds rate. The implementation of QE measures and adjustments to the federal funds rate by central banks can have significant implications for REITs, influencing their financing costs, investor sentiment, and overall performance within the real estate market. As a result, it is crucial for investors to monitor and understand these macroeconomic policies and their potential effects on REITs.

**Federal funds rate and asset prices/REITs**

The federal funds rate, determined by central banks, directly influences interest rates throughout the economy. Changes in the federal funds rate can affect borrowing costs for REITs and impact their profitability. In theory, the traditional view of interest-rate channels is supposed to function in the following way: an easing in monetary policy leads to a lowering in the real interest rate, which in turn lowers the real cost of borrowing, leading to a rise in investment spending, thus causing an increase in aggregate demand (Mishkin, 2016). When demand exceeds supply, upward price pressure is likely to occur.

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1 See U.S. Securities and Exchange Commission (2011) for all requirements in detail that must be met to qualify as a REIT.
Regarding REITs and their relation to interest rates, prior empirical research generally suggest that interest rates do impact REIT returns. Giliberto & Shulman (2017) found that the degree of interest rate sensitivity for equity REITs varies over time, and has switched direction, and that any “pure” effect is often subsumed in equity REITs beta against stocks, using daily data between 1995-2016. Despite recent high sensitivity, the authors conclude that there is no long-run predictive rule that applies to how equity REIT returns respond to movements in interest rates. Shulman (2015) found a high degree of interest rate sensitivity for equity REITs in 2013 and 2014, using daily data. Swanson et al. (2002) observed that REITs were more sensitive to the term structure of interest rates than to the level of interest rates, using daily data. He et al. (2003) found that REIT returns were more sensitive to changes in Baa yields than to changes in yields on U.S. Treasuries, using monthly data from 1972 through 1998.

Apart from traditional interest rate effects, transmission mechanisms of monetary policy via changes in the federal funds rate can be divided into two simple categories, according to Mishkin (2016): those operating through asymmetric information effects on credit markets, and those operating through asset prices. In theory, higher interest rates lower other securities prices such as REITs, through asset prices, ceteris paribus (especially inflation expectations) (Monetary Policy Committee, 1999). This is because expected future returns are discounted by a larger factor, leading to a lower present value of any given future income stream. Since major central banks in advanced economies (AEs) follow an explicit target for the inflation rate at or near 2%, they all have respectively worked with extremely expansionary monetary policies. This has led to a boom in the development of asset prices globally, REITs included. Furthermore, regarding the influence on stock prices in theory, higher real interest rates on bonds imply that the expected return increases on this alternative to stocks (Mishkin, 2016). Thus, stocks become a less attractive asset in relation to bonds, leading to a decreased demand for stocks, which lowers their prices.

In practice, the monetary policy transmission has not functioned in the theoretical ways described above since below-target inflation has been the result for several years in many AEs. Even though central banks in AEs over time have added unconventional instruments to achieve said inflation, the real results have, before COVID-19, not aligned with theory (see e.g., Bouis et al., 2013; Pain et al., 2014; Borio and Gambacorta, 2017). Thus, once inflation catches up in today’s environment, it is not certain whether it is central banks that mainly contribute to it.

QE and asset prices/REITs

The effect of unconventional expansionary monetary policies in the form of QE programs is a popular research topic. Indeed, to stimulate economies that undergo financial and/or economic crises, central banks have launched QE programs where large-scale asset purchases (typically various types of bonds) by money creation to lower especially longer-term bond yields and interest rates (Tawadros and Moosa, 2022). The lower interest rate environments are supposed to give households and firms incentives to consume and invest more than they otherwise would (Al-Jassar & Moosa 2019; Morais et al. 2019), and therefore supporting the real economy and to boost consumer price inflation through various monetary transmission mechanism channels. Neely and Fawley (2013) describes in detail the circumstances of and motivations for the quantitative easing programs of the Federal Reserve, Bank of England, European Central Bank, and Bank of Japan.

The Fed launched large QE programs to stimulate the US economy in connection to the GFC 2007-08 (Gulati and Smith 2022; Morais et al. 2019; Smith and Valcarcel 2023). In November 2008, the FED announced QE1, and in May 2009 the FED announced the expansion of QE1. In
December 2008, the federal funds rate was reduced to effectively zero, indicating a very expansionary monetary policy regime in the aftermath of the GFC.

Two other prominent examples of large QE programs are the European Central Bank’s large-scale asset purchasing program launched in 2015 in connection to the Eurozone debt crisis (Morais et al. 2019), and the Bank of Japan’s (BOJ) QE program embarked in 2013 as a part of several other government intervention policies to boost Japan’s economy (the package of policies is called “Abenomics”) (Lam 2015).

There is a common view among market practitioners and financial news media that QE generated increases in money supplies, central banks’ balance sheets and lower interest rates, have resulted in strong rises in common financial asset prices and real estate prices (Dib 2021; Forbes 2023). Several academicians also share this view (Bhattarai and Neely 2022; Ivanova 2018). Georgiadis and Gräb, (2016) find that ECB asset purchase programme (ECB QE) has boosted financial asset prices. Due to the asset price inflation caused by QE programme, expansionary QE leads to wealth inequality (De Luigi et al. 2023; Colciago et al. 2019). This is a common theme in the housing affordability debate in many countries.

A wide range of literature has investigated the transmission channels of such unconventional monetary policies, both for the Fed and the ECB (e.g., Kashyap and Stein, 2023; Miranda-Agrippino and Nenova, 2022). Furthermore, international evidence show that such central bank balance sheet expansions have had a discernible and significant impact on the economy and financial markets (Haldane et al., 2016). According to evidence for the US, the effectiveness of QE may vary over time, depending on the liquidity of the financial system and state of the economy, where a weaker economy and a more disturbed state of financial markets implies a bigger impact of QE. Evidence also shows that QE, mainly operating through financial channels, can have large spill-over effects cross-border. Moreover, there is high uncertainty and little prior experience of the speed with which AEs return to normalcy following financial crises that were met by large liquidity injections along with unusually low interest rates.

One important channel through which unconventional monetary policies can impact the economy is the “risk-taking channel”, first introduced in Bernanke and Kuttner (2005). This channel works by linking monetary policy to investors’ perception and pricing of risk, as well as the degree of risk tolerance. When central banks implement monetary policies that affect asset prices, it eases the leverage constraints of investors and may influence their willingness to take on more risk. This, in turn, can feed back into asset prices and the movement of capital across borders (Adrian and Shin, 2010, 2014; Borio and Zhu, 2012). The risk-taking channel has become more important in recent years, possibly due to the prolonged period of low interest rates and unconventional monetary policies implemented by major central banks. These policies have incentivized investors to search for yield in assets such as high-yield bonds, emerging market debt, equities and REITs. This quest for higher returns has pushed up the prices of these assets, potentially creating asset price bubbles in some markets.

More concretely, Borio and Zhu (2012) describe several ways through which ultra-low interest rates, resulting from both low central bank policy rates and asset purchases (QE) by major central banks can lead to behavioural effects with regards to risk-taking for economic agents. There are at least three ways, that are intended to operate jointly, in which a risk-taking channel may operate. Firstly, one set of effects operates through the impact on incomes, valuations, cash flows and the resulting measured risk, where asset values typically gain a boost from lower interest rates and large-scale asset purchase programmes. In turn, private investors may re-evaluate estimated probabilities of defaults and losses-given-defaults because of the increase in the value of corporate
equities relative to corporate debts. Typically, lower asset price volatilities are a result from a reduced risk perception.

Secondly, there is a set of “search for yield” effects that operates through the relationship between target rates of return and market rates (BIS, 2004; Rajan, 2006). Expansionary monetary policies may increase incentives for asset managers to take on more risk for several reasons. These reasons may express themselves psychologically or behaviourally, or alternatively reflect institutional or regulatory constraints. One example of the former are difficulties in adjusting expectations following periods of exuberance in financial markets. One example of the latter are life insurance companies and pension funds that are constrained by a minimum guaranteed nominal rate of return, and as a result need to manage their assets in order to deal with expected liabilities.

Thirdly, effects may also operate through communication policies of a central bank and the characteristics of policymakers’ reaction functions. Investors and banks can for instance take on more risk if future policy decisions are more predictable, thus reducing market uncertainty. This could lead to a moral hazard problem since economic agents expect the central bank to use a more expansionary approach in events of bad economic outcomes, hence creating an “insurance effect” because of a decreased probability of downside risk. This risk-taking channel is more likely to come into play in cases with non-standard measures such as those implemented by the Fed lately, where a large volume of liquidity is injected into the system, which may have had a big impact on investors’ behaviour and on volatility developments in financial markets.

*Latest 2022 QT and asset prices/REITs*

In response to a steep increase in consumer price inflation and elevated risk of sustained high inflation risks, the Federal Reserve started in March 2022 to raise their target range for the federal funds rate. Furthermore, in May 2022, the Federal reserve released its QT plans for reducing the size of the Federal Reserve’s Balance Sheet (Sengupta and Smith 2022; Wei 2022). The central banks of many other countries and economic regions, including the Euro zone, also started to increase their policy rates and started QT programs to fight the too high inflation rates. Several market practitioners and financial markets news media discuss the potential impact of QT on many key economic variables such as GDP, unemployment, house prices, activities in real estate construction section, and financial asset prices. However because the QT started only very recently, academic research on the effect of the recent ongoing QT on key economic variables academic research is rare compared to the large volume of published research on the effect of QE. Still, examples of recent research of the effect of QT Karahan and Soykök 2023; Warnock and Wurster 2023). Indeed, this paper is an early attempt to empirically analyze the effects of the QT that started in March 2022.

3. Method

In our regression model, we employ a Newey-West estimator to account for the presence of heteroscedasticity and autocorrelation. This is an extension of the OLS estimator, where Newey-West can be viewed as a more robust approach that considers the dynamic nature of time series data. Thus, we achieve more reliable and efficient coefficient estimates compared to traditional OLS estimation. Regarding endogeneity, addressing it in time series analysis poses a considerable challenge, even when utilizing sophisticated econometric models. Dynamic endogeneity arises when the current value of an independent variable is affected by past values of the dependent variable, violating the
assumption of strict exogeneity in fixed effects estimators (Arellano & Bond, 1991; Nickell, 1981). The dynamic nature of the relationship between the error term and the independent variables further complicates the adjustment process. One key obstacle lies in the time-varying nature of omitted variable bias, making it difficult to adequately address endogeneity concerns in time series data. As this bias varies over time, it becomes increasingly difficult to effectively address and mitigate endogeneity-related concerns in this particular analytical framework. Furthermore, Li et al. (2021) analyzed 80 quantitative articles using regression analysis that the Journal of International Business Studies published between 2015 and 2017, and found that dynamic endogeneity problems are common, especially in some research domains. Thus, even the most advanced quantitative articles have problems with endogeneity.

Despite the significant methodological difficulties in addressing endogeneity in a time series context, we made efforts to employ time lags as a strategy to tackle this issue. By incorporating time lags of the independent variables in our analysis, we aimed to account for the potential influence of past values on the current values, thereby mitigating endogeneity concerns. This approach allows us to capture the temporal dynamics and potential feedback effects within the data, providing a means to address endogeneity and enhance the validity of our findings in the time series analysis.

We consider QE and QT as strong high-impact events created by the Fed, as well as the outburst of the great financial crises of 2007-2009 (GFC) and COVID19, also as high-impact events which makes it possible to use an event study methodology as described by Binder (1998), where binary explanatory variables are the key component. The goal in an event study is to see whether a particular event influences some outcome (Wooldridge, 2015). Inspired by previous event studies, we apply time-dummies (event time dummy variables) for black swan events and other economic events which have a huge impact on the where QE and QT have been used. Thus, we make use of statistical analysis of abnormal returns represented by the size of estimated regression coefficients. In the context of analyzing time series data, binary or dummy independent variables can be used to represent whether a particular event occurred during each time period. Such variables are useful because the unit of observation is time itself. Therefore, a binary or dummy variable allows us to indicate, for each time period, whether a certain event of interest occurred or not. We make use of this method while controlling for several other important macro-financial factors. This is an alternative method of analyzing abnormal returns, wherein the conventional approach of modeling abnormal returns as prediction errors from the market model equation is avoided. Instead, this method advocates for the extension of the sample period to encompass the event period. In the case of a single event, a binary variable, $D_t$, can be incorporated into the return equation, serving as an indicator for the occurrence or non-occurrence of the event:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \gamma_i D_t + u_{it}$$

The coefficient $\gamma_i$ represents the abnormal return for security $i$ during period $t$, and is estimated directly in the regression model. In other words, this method involves incorporating the abnormal return as a parameter in the market model regression equation. The origins of this method can be traced back to Izan (1978), who examined a portfolio of firms that had all experienced regulatory announcements during the same calendar periods. She used the equally weighted portfolio return as the dependent variable in the equation:

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2 Black swans are highly significant yet unpredictable events. See Taleb (2007) for more.
\[ R_{pt} = \alpha_p + \beta_p R_{mt} + \sum_{a=1}^{A} \gamma_{pa} D_{at} + u_{pt} \]  

Equation 2 contains a dummy variable \( D_{at} \) for each announcement period \( a \). When an equally weighted portfolio return is used as the dependent variable, \( \hat{\gamma}_{pa} \) is the estimator of the average abnormal return across the stocks in the portfolio. Hypotheses about \( \gamma_{pa} \) are tested using the standard t-test.

A more recent study that makes use of this method is for instance Duca and Ling (2020) who used time dummy variables in order to estimate the risk premium on commercial property. More specifically, they used a regulatory capital variable as a time-dummy for Basel bank regulations. Moreover, they used another time dummy to control for the October 2013 shutdown of the federal government that narrowed risk premia by creating uncertainty about whether Treasury debt payments would be maintained.

Sometimes, as in our study, multiple dummy variables are used to capture the effects of an event that extends over a period of time. These dummy variables typically represent several weeks or months and allow for the modeling of the event’s impact on the dependent variable over time. By using a set of dummy variables that represent the time periods before and after the event, the regression can account for changes in the dependent variable that may occur during those time periods. Moreover, QE dummies have been used in previous research in relation to equity markets. For instance, Hudepohl et al. (2021) uses eight different QE dummies for different time periods to examine effects of QE by the ECB on stock markets. Shogbuyi and Steeley (2017) similarly model the effects of US and UK QE on equity markets with multiple dummy variables.

Inspired by this, we try to capture the significant changes associated with QE and QT programs, as we incorporated multiple quarterly dummy variables in our regression model (see Table 2b). These dummy variables allowed us to account for any distinct shifts in REIT returns that may have occurred during the periods influenced by QE and QT initiatives. In addition to the QE and QT event dummy variables, we control for other important macro-financial factors as independent variables in our analysis. By controlling for these variables, we aimed to isolate and examine the specific impact of QE and QT programs on REIT returns.

4. Data and descriptive statistics

Table 1 below presents the data used to estimate our model. The data cover a time span from January 1990 to July 2022 and consist of quarterly data with 131 observations. The data used in this study come from Federal Reserve Economic Data (FRED). FRED has data on REIT prices and returns. More specifically, we use the Wilshire US Real Estate Investment Trust Total Market Index. FRED also provides data on the balance sheet of the Federal Reserve System. Specifically, we make use of the not seasonally adjusted data on total bank equity capital, percent change from year ago. We also use their data on Moody’s seasoned Baa corporate bond yield (DBAA) and the CBOE Volatility Index (VIX). The VIX reflects market volatility in the U.S. stock market, and the DBAA captures the prevailing interest rates in the corporate bond market, serving as a proxy for the overall cost of borrowing and lending in the economy.
Table 1. Variable descriptions of continuous variables, quarterly data.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Data source</th>
</tr>
</thead>
<tbody>
<tr>
<td>REIT_Index</td>
<td>Wilshire US Real Estate Investment Trust Total Market Index</td>
<td>FRED</td>
</tr>
<tr>
<td>REIT_R</td>
<td>REIT_Index quarterly log return</td>
<td>Own comp.</td>
</tr>
<tr>
<td>VIX</td>
<td>CBOE Volatility Index</td>
<td>FRED</td>
</tr>
<tr>
<td>VIX_D1</td>
<td>VIX first difference</td>
<td>Own comp.</td>
</tr>
<tr>
<td>TBEC</td>
<td>Total bank equity capital, mUSD</td>
<td>FRED</td>
</tr>
<tr>
<td>TBEC_R</td>
<td>Total bank equity capital, % change from Year ago</td>
<td>FRED</td>
</tr>
<tr>
<td>DBAA</td>
<td>Moody’s Seasoned Baa Corporate Bond Yield</td>
<td>FRED</td>
</tr>
<tr>
<td>DBAA_D1</td>
<td>DBAA first difference</td>
<td>Own comp.</td>
</tr>
</tbody>
</table>

Table 2a below presents basic descriptive statistics of the key continuous variables. The smallest value of REIT_R (REIT total index quarterly return computed as logarithmic return) is minus 51%, which occurred in 2008Q3 during the midst of the Great Financial Crises (GFC). Actually, the second smallest value of REIT_R is minus 41.43% which also occurred during the end of GFC, namely in 2009Q1. The third lowest return of minus 29.61% occurred in 2020Q1, when stock markets in general declined sharply due to the COVID-19 outbreak. In 2009Q2 and 2009Q3, the REIT_R showed the two largest positive quarterly returns: 27.51% and 30.32%, respectively. Indeed, after the long downward period of very strong negative returns during the GFC, the REIT index series recovered strongly, resulting in the high positive return values of REIT_R. The VIX exhibited the maximum value of 53.54 in 2020Q1 (COVID19 stock market crash). The VIX was also very high during the GFC, for instance it reached value of 39.69 in 2008Q3 and 44.14 in 2009Q1, reflecting the large implied volatility of the SP500 index.

Table 2a. Descriptive statistics of data from 1990Q2 to 2022Q2.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent variable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REIT_R (log return)</td>
<td>2.15%</td>
<td>10.59%</td>
<td>-51.00%</td>
<td>30.32%</td>
</tr>
<tr>
<td><strong>Explanatory variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VIX</td>
<td>19.81</td>
<td>7.83</td>
<td>9.51</td>
<td>53.54</td>
</tr>
<tr>
<td>VIX_D1</td>
<td>0.09</td>
<td>7.66</td>
<td>-23.11</td>
<td>39.76</td>
</tr>
<tr>
<td>TBEC_R</td>
<td>6.73%</td>
<td>4.48%</td>
<td>-7.54%</td>
<td>25.12%</td>
</tr>
<tr>
<td>DBAA</td>
<td>6.57%</td>
<td>1.76%</td>
<td>3.11%</td>
<td>10.76%</td>
</tr>
<tr>
<td>DBAA_D1</td>
<td>-0.03%</td>
<td>0.40%</td>
<td>-1.28%</td>
<td>1.04%</td>
</tr>
</tbody>
</table>

Note: Excluding event time dummy variables.

As explained above, event time dummy variables are used to represent important economic events that can contribute to explaining and understanding the variation in REIT_R. Table 2b below presents the event time dummy variables used as explanatory variables of REIT_R: GFC073 (value of 1 time period 2007Q3), GFC_QE_083 (value of 1 in time period 2008Q3), COVID (value of 1 in time period 2020Q2), and finally Tapering_2022Q2 (value of in time period 2022Q2).

Since events that occur in one time period (in this paper, one specific quarter a specific year) can have a long-lasting effect on the REIT_R. Therefore, one or more time-lags may be included in the econometric models that are estimated (see results section below). Indeed, as Yu (2016) explains, there is a significant uncertainty about the size of the effects of QE and the various
monetary transmission mechanism channels through which QE did operate. For instance, the size of the Fed’s total assets increased from about USD900 billion in early September year 2008 to about USD2.2 trillion by the end of year 2008 (see Figure 5). This large increase in the Fed’s balance sheet happened when the financial markets faced turmoil due to the Lehman collapse in September 2008. Thus, there might be a complex mix of both financial market turmoil due to the Lehman collapse in the beginning of 2008Q3, and a positive effect of the QE program that also began in 2008Q3. When studying the REIT quarterly returns, the third quarter of 2008 show a positive return of about 5 percent. However, the REIT index fell sharply during 2008Q4 and 2009Q1. Thereafter, from 2009Q2 and onwards, the REIT index started to increase strongly. One likely explanation is that the negative effect of the Lehman collapse was stronger throughout 2008Q4 and 2009Q1, while the positive effects of the QE programme started in 2009Q2.

Similar way of reasoning can be presented for the COVID_QE event dummy variable. After the initial financial negative shocks due to the outburst of Covid-19, the REIT index fell sharply in 2020Q1. However due the very large combined monetary and fiscal stimulus packages offered by not only the US central bank and government, but also by financial and monetary authorities of other large economies including the euro area, the REIT index not only recovered from the large drop, but also surpassed the top level before Covid-19 outburst. For instance, the Fed’s balance sheet almost doubled in size during 2020Q1 and 2020Q2 and continued to increase until 2022Q1. We thus hypothesize that the QE programmes after the outbreak of GFC and Covid-19, respectively, resulted in large increase of REIT index through various monetary transmission mechanisms, such as the interest rate channel, the signalling effect channel, the asset price channel, the risk channel. See e.g., Mishkin (2016) for a presentation of various monetary transmission mechanism channels, see also Yu (2016). When the inflation started to increase strongly, the Fed started their tapering programme (QT, represented by the Tapering_2022Q2 event dummy variable) in 2022Q2, resulting in a decline in the size of the Fed’s balance sheet (see Figure 5). Thus, we hypothesize that the decline in the Fed’s balance sheet (QT) resulted in a decrease in REIT index. Table 2b shows the main event dummy variables.

### Table 2b. The event time dummy variables 2007 to 2022Q2.

<table>
<thead>
<tr>
<th>Event Dummy Variable</th>
<th>Value of 1 in quarter</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>GFC_073</td>
<td>2007Q3</td>
<td>Event dummy variable representing when the GFC was triggered.</td>
</tr>
<tr>
<td>GFC_QE_083</td>
<td>2008Q3</td>
<td>Event dummy variable representing the drop in capital availability after Lehman Brothers failed (Sep 15 2008). This GFC083 variable also represents the first QE programme when the Fed’s balance sheet more than doubled in size from end of 2008Q3 throughout 2008Q4.</td>
</tr>
<tr>
<td>COVID_QE</td>
<td>2020Q2</td>
<td>Event dummy variable representing the stock market crash and the start of the recovery due to the COVID19 outbreak.</td>
</tr>
<tr>
<td>Tapering_2022Q2</td>
<td>2022Q2</td>
<td>Event dummy variable representing the start of the FED diminishing their balance sheet through Quantitative Tapering (QT).</td>
</tr>
</tbody>
</table>
Figure 1 below presents the REITs total return index from January 1990 to July 2022. The figure shows three periods in time where there have been large shocks in the time series, related to the events described in Table 2b:

Figure 2, Figure 3 and Figure 4 further zooms in on these subsets of the time series. Figure 2 and Figure 3 shows how the index has recovered from the GFC and COVID-19 shocks after strong initial fall in REIT index figures. However, since the index still to date has not recovered from the high inflation in 2022, Figure 4 only shows the downturn caused by the inflation and central bank contractionary monetary tightening shocks.

![REITs Total Return Index](image)

**Figure 1.** REITs Total Return Index, Quarterly, Jan-1990 to Jul-2022.
Figure 2. REITs Total Return Index GFC, Quarterly, Oct-2007 to Oct-2009.

Figure 3. REITs Total Return Index COVID-19, Quarterly, Jul-2019 to Oct-2020.

Figure 4. REITs Total Return Index High Inflation, Quarterly, Oct-2020 to Jul-2022.
5. Empirical results

The incorporation of quarterly dummy variables for QE and QT in our regression analysis serves as a robust method to capture significant changes in the U.S. equity REIT market. Our results reveal that the quarterly dummy variables incorporated in the regression model exhibit a high level of statistical significance. They capture substantial variations in REIT returns over different time periods, from the GFCQ073 (start of the GFC), to the GFC_QE_083 (the Lehman collapse and when QE programme started), to COVID_QE (stock market fell due to Covid and start of Covid QE stimulus) and to the recent high inflation crisis represented by the Tapering_2022Q2 event dummy variable. We present two regression models: for regression results without QT starting in 2022 Q2, see model 1 in Table 3. For regression results with tapering 2022 Q2, see model 2 in Table 3.

In both models, the large changes in returns are captured by quarterly dummies. The estimations show that the QE programmes significantly contributed to positive REIT returns after while the recent 2022 QT efforts has contributed significantly to the recent period of negative REIT returns. More specifically, all quarterly dummies including every time-lag, is significant at the 1% level. Thus, the lagged effects from QE and QT that starts in a certain period can have long-lasting effects in subsequent quarters. It is worth noting that these effects may even manifest before the actual event occurs if the market anticipates and prices in the forthcoming changes.

Moreover, the coefficients on the size and the statistically significant quarterly event dummy variables imply that each QE and QT program has had a substantial impact on REIT returns, which is not surprising. Especially the quarterly dummies and their time-lags, when analyzed in relation to the GFC, exhibit substantial coefficients. As a result of time-lags, the strong coefficients sometimes exhibit a switch in sign. The switch in sign observed in the coefficients when considering time-lags, highlights the dynamic nature of the crises’ effects. This switch implies that the impact of QE may vary over time, with positive coefficients indicating a positive association between the respective quarter and QE, while negative coefficients indicate a negative association. This result emphasizes the importance of considering time-lags when analyzing the effects of QE and QT.

Regarding the key macro-financial factors in our model, we observe that the Baa Corporate Bond Yield variable exhibits a strong coefficient, indicating a significant negative relationship with...
REIT returns. This finding suggests that increases in Baa Corporate Bond Yields are associated with lower REIT returns. Additionally, the VIX variable demonstrated a moderately strong coefficient, albeit weaker than the Baa variable, indicating a significant negative relationship with REIT returns. This suggests that higher levels of market volatility, as reflected by the VIX, are also associated with decreased REIT returns. On the other hand, the variable representing the total bank equity capital of FDIC-Insured Commercial Banks and Savings Institutions displayed a relatively weaker coefficient. Although this coefficient was weaker compared to the Baa and VIX variables, it still exhibited statistical significance. This indicates that increases in total bank equity capital contribute to positive REIT returns, albeit to a lesser extent than the other variables.

The constant term did not demonstrate statistical significance. However, all independent variables, including the Baa Corporate Bond Yield, VIX, and total bank equity capital, demonstrated statistical significance in relation to REIT returns. The Baa and VIX variables exhibited significance at the 1% level, indicating a high level of confidence in the observed relationships. Notably, the Baa variable also displayed statistical significance at the 5% level in model 2 with tapering and at the 1% level in model 1 without tapering, indicating its varying but still significant impact. Conversely, the variable representing total bank equity capital remained statistically significant at the 5% level for both models, albeit with a relatively weaker coefficient. We also find that the negative initial REIT return reaction to the COVID-19 outbreak (see coefficient of COVID_QE event variable in Table 3) was likely outperformed by the positive impacts of the very combined monetary (QE) and fiscal stimulus packages implemented after the outbreak of the COVID-19 crisis (see the coefficients of the COVID_QE_lag variables in Table 3).

Table 3. Econometric results of model 1 (without QT) and model 2 (with QT of year 2022)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>VIX_D1</td>
<td>-0.572206*** (7.6383)</td>
<td>-0.564096*** (7.2670)</td>
</tr>
<tr>
<td>DBAA_D1</td>
<td>-6.081661*** (-3.6125)</td>
<td>-5.485132** (3.2888)</td>
</tr>
<tr>
<td>TBEC_R</td>
<td>0.275944** (2.8262)</td>
<td>0.242456** (2.7390)</td>
</tr>
<tr>
<td>GFC_QE_083</td>
<td>18.229348*** (10.9409)</td>
<td>17.237741*** (11.1478)</td>
</tr>
<tr>
<td>GFC_QE_083_L1</td>
<td>-48.846348*** (-44.1773)</td>
<td>-49.447123*** (-53.1606)</td>
</tr>
<tr>
<td>GFC_QE_083_L2</td>
<td>-37.315814*** (-39.3513)</td>
<td>-37.914808*** (-46.5589)</td>
</tr>
<tr>
<td>GFC_QE_083_L3</td>
<td>8.294848*** (3.4526)</td>
<td>8.946632*** (3.6821)</td>
</tr>
<tr>
<td>COVID_QE</td>
<td>-10.783829*** (-4.6941)</td>
<td>--10.228319*** (-4.3624)</td>
</tr>
<tr>
<td>COVID_QE_L1</td>
<td>-3.696131*** (-4.6941)</td>
<td>-3.774236*** (-5.2390)</td>
</tr>
<tr>
<td>COVID_QE_L2</td>
<td>3.939961*** (4.8395)</td>
<td>4.010374*** (4.9197)</td>
</tr>
<tr>
<td>COVID_QE_L3</td>
<td>8.185824*** (5.8708)</td>
<td>7.697231*** (5.6103)</td>
</tr>
<tr>
<td>COVID_QE_L4</td>
<td>4.674532*** (5.1760)</td>
<td>4.883596*** (5.4013)</td>
</tr>
<tr>
<td>COVID_QE_L5</td>
<td>3.545855*** (3.360515)</td>
<td></td>
</tr>
</tbody>
</table>
6. Discussion

Based on our empirical results, we draw the conclusion that the Fed’s QE and QT programs have exerted a significant impact on REIT returns during previous major black swan events encompassing the GFC, the COVID-19 pandemic, and the recent high inflation crisis. These events, characterized by their unforeseen and profound disruptions to the global financial landscape, have demonstrated a strong association with the dynamics of QE and QT programs. Our findings underscore the crucial role played by the Fed’s transmission mechanism in influencing REIT returns during times of heightened market volatility and economic uncertainty.

The presence of sign switches in the quarterly dummies suggest that market participants may anticipate and incorporate information about future policy actions, leading to changes in economic variables, including REIT returns, even before the actual implementation of such policies. Our analysis enables researchers to differentiate between the immediate and lagged effects of the crisis, as well as to assess the persistence of these effects over time. Moreover, it highlights the importance of considering market expectations and reactions when evaluating the overall impact of QE and QT on the economy. In the specific case of REITs, the lagged effects of QE and QT demonstrate that market prices may already incorporate expectations and adjustments even before the policy measures take effect. This implies that the market’s reaction to QE and QT may begin well in advance, as prices reflect investors’ capitalization of the anticipated effects of these monetary policy actions on REIT returns.

Furthermore, key macro-financial factors turn out to have significant influence on the development of REIT returns. Our results indicate a strong negative relationship between Baa Corporate Bond Yields and REIT returns, suggesting that higher borrowing costs can dampen the attractiveness of real estate investments and subsequently impact REIT performance. This finding highlights the importance of interest rate dynamics and their influence on the behavior of REIT returns. There is also a statistically significant and moderately negative relationship between the VIX and REIT returns, indicating that increased market volatility is accompanied by lower REIT returns. This finding suggests that during episodes of heightened market volatility and economic uncertainty, investors exhibit a propensity to exhibit risk-averse behavior, thereby demonstrating a reduced inclination towards allocating capital to real estate assets. Consequently, the decreased demand for REITs in such circumstances leads to a downward pressure on their returns, as market sentiment shifts towards a more cautious and conservative investment approach.

Moreover, our findings indicate a positive relationship between total bank equity capital of FDIC-Insured Commercial Banks and Savings Institutions, and REIT returns, suggesting that a well-capitalized banking sector can provide stability and support to the real estate market. Higher bank equity capital reflects greater financial strength and resilience, which can instill confidence in investors and positively impact the performance of REITs. The combined effects of the Fed’s QE and QT programs, alongside the influence of key macro-financial factors such as Baa Corporate Bond Yields, the VIX, and bank equity capital, shed light on the multifaceted nature of REIT performance and the interplay between real estate markets and broader financial conditions.
References


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