What Really Happens During Flight to Safety: Evidence from Real Estate Markets

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Abstract

Flight to safety (FTS) affects the markets for risky assets such as stocks, corporate bonds, and commodities. Yet, little is known about the effects on commercial real estate. We show that REITs offer a partial hedge against FTS, with daily total returns being less sensitive to FTS than many other industries and measures of REIT liquidity actually improving on FTS days. However, a cluster of FTS days signals a decline in economic fundamentals in the long run. We find that the odds of a drop in REIT quarterly revenue increase by 15% after an FTS cluster, ceteris paribus. This effect persists for up to four quarters. We also find that commercial real estate price appreciation is all but wiped out over up to four quarters following an FTS cluster. Our findings benefit investors by providing estimates of the short-term return and liquidity response of REITs to FTS episodes, and by documenting long-term effects on REIT revenues and real asset values.

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1 Introduction

Flight to Safety (FTS) is a typically short period of substantial multi-market distress, defined by significant equity market volatility and the joint occurrence of large negative equity returns and large positive government bond returns. Beber, Brandt, and Kavajecz (2009) show that FTS has two components, flight to quality and flight to liquidity. Treasury securities for instance attract a liquidity premium during FTS periods (Longstaff, 2004). Adrian, Crump, and Vogt (2016) show non-linear relationships between volatility and asset prices as predicted in theoretical models of FTS. More generally, empirical evidence of FTS has been documented in international stock, bond, currency, commodity, and credit markets.[1] By contrast, there is virtually no evidence on the effects of FTS in real estate. We aim to close this gap in the existing literature.

To date, research on FTS appears in two separate parts of the literature. The empirical capital markets literature focuses on FTS-related variation in returns, liquidity, and volatility (Acharya, Amihud, and Bharath, 2013; Baele, Bekaert, Inghelbrecht, and Wei, 2015; Baur and Lucey, 2009). This literature largely studies FTS as a high frequency event, emphasizing short-run responses and market microstructure effects. On the other hand, the asset pricing theory literature describes FTS as a product of investors adjusting to changes in economic conditions, where an increase in precautionary savings leads to lower bond yields and lower equity prices (Bekaert and Engstrom, 2017; Bekaert, Engstrom, and Xing, 2009). In the underlying macro-finance theoretical models, which operate on a low frequency, FTS is an indicator of fundamental changes in the economy that affects asset valuation in the long run. Focusing on real estate allows us to combine both perspectives and shed light on what really happens to this industry during FTS in the short run and in the long run.

[1] See Baele, Bekaert, Inghelbrecht, and Wei (2015); Bernanke, Gertler, and Gilchrist (1996); Lang and Nakamura (1995). The literature has also explored different explanations for FTS. When equity market volatility is high, investment managers fear redemptions and become increasingly risk-averse, leading to a preference for safe, high-quality assets (Vayanos, 2004). When aggregate liquidity is low, Knightian uncertainty leads investors to favor assets with those characteristics (Caballero and Krishnamurthy, 2008). When volatility is high, speculators may stop providing liquidity for high-risk assets, reducing aggregate liquidity (Brunnermeier and Pedersen, 2009). Aggregate liquidity may also decline when asset price shocks reduce the net worth of intermediaries (Adrian and Shin, 2010), or regulation restricts growth in intermediary balance sheets (Adrian, Boyarchenko, and Shachar, 2017; Adrian, Fleming, Shachar, and Vogt, 2017). Caballero and Simsek (2016) show how global capital flows regulate liquidity. FTS may also occur as a result of dynamic adverse selection (Guerrieri and Shimer, 2014).

The real estate industry is well suited to a combined high- and low-frequency analysis of FTS. Real Estate Investment Trusts (REITs) are typically listed companies, enabling a short-run analysis of high-frequency return and market microstructure effects in line with the existing empirical capital markets literature. Fundamentally, REITs generate the vast majority of corporate revenue from operating real properties. Thus, we are able to observe REIT revenues to assess the long-term effects of FTS on future real estate-related cash flows. Further, there is an active secondary market for the underlying real assets owned and operated by firms such as REITs. This allows us to observe commercial real estate prices and cap rates to analyze the impact of FTS on real asset values and risk premia. The joint documentation of high-frequency (return and microstructure) and low-frequency (macro-financial) effects of FTS in a single industry is novel to the literature and constitutes the unique dimension of our study.

There are two channels through which FTS might affect the real estate industry. In the short term, listed real estate equities may be swept up in a general flight from risky equity. In the long run, the long-dated lease contracts that commonly govern cash flows in commercial real estate might imply that a short-term market disturbance such as FTS has little impact on the sector. However, we will show that the effects of some FTS episodes go far beyond the immediate duration of the FTS event itself. As we will describe, FTS can signal an impending decline in macro-economic fundamentals that adversely affects the demand for space and thus reduces future rental income from real properties, depressing asset values.

We begin our empirical analysis by defining FTS days using conventions described, amongst others, in Baele, Bekaert, Inghelbrecht, and Wei (2015). On this basis, we document 93 individual FTS days in the 6,042 trading days during our study period from 1993 to 2016. Thus, FTS appears to be a relatively rare event, with an unconditional daily likelihood of about 1.5%. However, FTS sometimes occur in clusters of two or more days in close succession. In our sample, about 25% of year-quarters experience such a cluster of FTS days. During FTS episodes, a portfolio that is long in Treasury securities and short in equities returns on average 3.6% per day. This result is by construction unique to FTS days, and does not occur outside of FTS episodes.

We then show that REIT industry returns fall 2.49% on average from non-FTS days to FTS days. This represents a significantly smaller drop than in many other industries. Conditioning on common asset pricing factors, we find that the marginal effect of FTS on REIT returns is economically small but actually positive (between 0.25 and 0.28%, depending on model specification). Bansal, Connolly, and Stivers (2014) find that large-cap equities bear the brunt of FTS-related trading. Large-cap firms now dominate the REIT industry, suggesting that REITs might be disproportionately affected by FTS. However, our result might reflect that REITs invest in and derive income from 'hard' real assets.

The empirical capital markets literature suggests that negative return effects of FTS are a product of deteriorating market quality during such episodes. We find evidence of a sell order imbalance and wider realized spreads for REITs, mostly during individual FTS days. However, especially during FTS clusters, REIT price impact of trade and trading volume improve significantly. Our finding suggests that the return effects of FTS on REITs cannot be fully explained by a decline in market quality, especially during clusters of FTS.

As microstructure effects seem unable to fully explain REIT repricing during FTS, we turn to the asset pricing literature that describes the long-run, real-side causes and consequences of FTS. We show that FTS clusters appear to signal a significant deterioration in economic fundamentals, similar to Baele, Bekaert, Inghelbrecht, and Wei (2015). We find that forecasters expect lower real GDP growth in the aftermath of an FTS cluster, suggesting that FTS signals the nature of future economic prospects. We also find that realized GDP growth is 1% to 2.4% lower in quarters following an FTS cluster. Our results thus confirm the basic characteristics of the macro-finance theory models that generate FTS-like behavior.

To the extent that FTS clusters forecast poor economic conditions, there may be an ensuing decline in the demand for space, which reduces the cash flows generated from real estate properties and thus rental revenue for real estate firms. We estimate that the occurrence of an FTS cluster (not an individual FTS day) increases the odds of lower revenue for REITs in the following quarter by 15%, all else equal. To our knowledge, the connection between FTS clusters, real economic activity and corporate cash flows is novel to the literature.

Evidence of long-run effects of FTS on real corporate outcomes raises the question of continued or renewed repricing after the FTS event, when the decline in economic fundamentals actually sets in. We find that REIT industry total return premiums are largely unaffected up to four quarters forward. Consistent with efficient market pricing in REITs, our finding suggests that information signaled by FTS about declining fundamentals is priced quickly and fully, with no further implications for REIT stock returns.

Lower rental revenues suggest a decline in the underlying real estate market fundamentals following FTS clusters. Our estimates show that this decline is economically substantial: we find that the occurrence of an FTS cluster in a quarter almost completely wipes out any appreciation in property prices that would otherwise have followed up to four quarters forward. We estimate that, absent an FTS cluster, commercial property values would increase by 6.28% over four quarters. Following a quarter with an FTS cluster, however, price appreciation over the subsequent four quarters is 6.08% lower, leading to net appreciation of close to zero over that period. Our finding represents novel evidence on the long-term value effects of FTS episodes in the market for real property.

The effect on real asset values may be due to the rental revenue effects we document here but it may also be driven by an adjustment in the risk premium investors require for holding real estate assets. In order to test this conjecture, we examined the relationship between FTS events and future changes in the spread between transaction capitalization rates and the risk-free rate. We find that FTS events are unrelated to future changes in the cap rate spread. We conclude from this analysis that the real asset valuation effects documented here are primarily driven by a downward revision of expected future cash flows, not an adjustment of the risk premium.

Finally, to confirm that we appropriately identify the effects of FTS episodes, we use a set of counter-factual tests around the main individual conditions that indicate an FTS episode, i.e. strongly negative equity returns and strongly positive bond returns. We find that neither an isolated bear market in equities, nor a bond market rally alone, produce any of our main results, suggesting our results are indeed uniquely related to FTS episodes.

Our contributions are as follows. Baele, Bekaert, Inghelbrecht, and Wei (2015) analyze total returns responses to FTS for stocks from a broad cross-section of industries but they exclude real estate. Others focus on the response in stock volatility or liquidity but again exclude the real estate industry (Anand, Irvine, Puckett, and Venkataraman, 2013; Greenwood and Thesmar, 2011; Hameed, Kang, and Viswanathan, 2010). In 2016, real estate has been classified as its own GICS sector and REITs represent the vast majority of firms in the GICS Real Estate sector. We provide a comprehensive analysis of the short-term effects of FTS on total returns and a broad set of microstructure measures in the REIT industry. We believe this to be the first evidence on how real estate markets are affected by FTS episodes.

Some asset pricing models view FTS as an indicator of a decline in economic activity (Bekaert and Engstrom, 2017; Bekaert, Engstrom, and Xing, 2009). Empirically, Baele, Bekaert, Inghelbrecht, and Wei (2015) and Allen, Bali, and Tang (2012) provide some evidence on the relationships between FTS and real economic activity. We expand on the existing evidence by distinguishing between individual FTS events and FTS clusters and by documenting the differences in their impact on expectations and realizations of real economic activity after accounting for the dynamics in those time series. The relationships we document between clusters of FTS and macro-economic fundamentals are, to the best of our knowledge, novel.

As noted, there is some evidence that FTS may signal a decline in future economic activity but the implications for firms and their assets are, to date, unexplored. We demonstrate that FTS clusters adversely affect future cash flows for real estate firms and that these effects are priced into stock returns fully during the actual FTS event. We also show that real asset values decline in the aftermath of FTS clusters. We are, to our knowledge, the first to document long-run implications of FTS for economic fundamentals, corporate cash flows, future stock returns, and asset values in private markets. Our results on the long-term real effects of FTS go beyond the short-term microstructure channel documented to date.

We proceed as follows. Section 2 presents the data. Section 3 outlines our empirical method for identifying FTS episodes. Sections 4 and 5 discuss the short-run and long-run effects of FTS, respectively. Section 6 presents counter-factual tests. Section 7 concludes.

2 Data

We study the period from 1993, the inception of the modern REIT era, through the end of 2016. In order to identify FTS days, we obtain daily stock returns on the S&P500 index and bond returns on the benchmark 10-year Treasury from DataStream.

We then compile the data for the short-run analysis, which focuses on responses to FTS in total returns and market microstucture. For the return analysis, we construct value-weighted industry portfolios from CRSP daily return data using firms with share code 10 or 11 (common stock). We classify firms according to the SIC code-based industry classification scheme of Fama and French.[2] We construct the REIT portfolio from the firms in the FTSE NAREIT universe. The market portfolio is the universe of firms in the industry portfolios. For the microstructure analysis, we obtain firm-level microstructure measures for U.S. REITs from the WRDS Intraday Indicators database. This data covers the period 1993 to 2014.

Next, we compile the data set for the long-run analysis, which emphasizes the relationships between FTS and macro-economic fundamentals, corporate REIT cash flows and real asset values in the commercial property market. For the macro-economic analysis of FTS, we obtain quarterly data on real GDP growth from the Philadelphia Federal Reserve Bank's Real-Time Macroeconomic Database.[3] We obtain estimates of expected future economic activity from the Survey of Professional Forecasters (SPF) at the Federal Reserve Bank of Philadelphia. Specifically, we collect the survey mean expectation of future GDP growth and the survey mean probability of a real GDP decline in the next quarter. For the analysis of firm-level cash flows, we obtain quarterly data on firm characteristics and accounting measures from S&P Global (formerly SNL Financial), with the exception of institutional ownership data. For ownership data, we rely on institutional filings of security holdings (SEC Form 13f). For the analysis of price effects of FTS in the direct U.S. commercial real estate assets, we use the Real Capital Analytics (RCA) Commercial Property Price Index (CPPI). The index is available on a quarterly basis from 2001 to 2017.

[2] For details, see `http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_12_ind_port.html`.

[3] We use the first data report rather than revised estimates as these are sometimes only available with significant delay.

3 Identifying FTS Episodes

We identify FTS episodes broadly following the approach in Baele, Bekaert, Inghelbrecht, and Wei (2015). We thus define FTS as the simultaneous occurrence of unusually high bond and low equity returns. We calculate the indicator for high bond and low equity returns as

$$FTS_t = I\left\{r_t^b > z_b\right\} + I\left\{r_t^s < z_s\right\} \tag{1}$$

where I is the indicator function, r_t^b and r_t^s are bond and stock market returns on day t, and z_i are threshold values defined as

$$z_b = \kappa \cdot \sigma_{b,t} \qquad\qquad z_s = -\kappa \cdot \sigma_{s,t} \tag{2}$$

where $\sigma_{b,t}$ and $\sigma_{s,t}$ are time-varying volatilities for bond and stock returns at time t and z_i is the threshold parameter. This requires equity (bond) returns to be κ standard deviations below (above) zero to identify an FTS day. To avoid look-ahead bias, we use a one-sided kernel to measure return volatility over the past 22 trading days and set $\kappa = 1.5$.[4] We then construct an indicator that takes the value of 1 during FTS days and 0 otherwise.

Table 1 presents descriptive statistics on the time series distribution of FTS days. We count 93 individual FTS days in 6,042 days in our study period. The unconditional likelihood of FTS days was thus 1.5%, consistent with Baele, Bekaert, Inghelbrecht, and Wei (2015). The occurrence of FTS days varies from year to year. The year 2014 saw the highest number of FTS days, with 12 days or a likelihood of FTS of 4.76%. Baele, Bekaert, Inghelbrecht, and Wei (2015) note that FTS days sometimes occur in clusters, which we define as more than one FTS day in a given quarter. We count 23 quarters with an FTS cluster in 96 quarters in our study period. Thus, the quarterly likelihood of a cluster of FTS days is 24%.

[4] Baele, Bekaert, Inghelbrecht, and Wei (2015) define an FTS episode as a day with unusually high (low) bond (equity) returns, with high equity volatility and strong negative high-frequency correlations between bond and equity prices. They also use a two-sided kernel to measure return volatility. We explored different approaches and found that our method of relying on strongly negative (positive) equity (bond) returns generates a distribution of FTS days that is very similar to the one described in Baele, Bekaert, Inghelbrecht, and Wei (2015). We also explored another method where we generate a return volatility using the average of backward-looking volatility and forward-looking VIX volatility. This avoids look-ahead bias, since the VIX value that pertains to the next 22 trading days is observable today. We found little difference using this alternative method.

The occurrence of FTS generally coincides with events that produce uncertainty in equity markets. For instance, 1998, the year of the Russia crisis, saw 4 FTS days. The years 2000 and 2001, marked by the burst of the dot-com bubble, saw 5 and 7 FTS days, respectively. There is also a cluster of large numbers of FTS days that spans the period of the Global Financial Crisis 2007 and the subsequent recovery from the Great Recession.

To illustrate the consequences of FTS for the returns on stocks and bonds, Figure 1 compares the densities of returns on equity, government bonds, and a long-short portfolio (long in bonds and short in equity) during FTS events, as defined by Equations (1) and (2). We find that equity loses substantial value on our FTS days, while the bond index generates a profit. The long-short portfolio returns on average 3.6% on FTS days. These results are not generally repeated for any other days before or after FTS events.

4 Short-Run Effects of FTS

4.1 Daily Total Return Analysis

We begin by describing the aggregate response of REIT returns to FTS and compare it to other industries. We measure the industry-level return response by comparing daily portfolio returns on FTS days with those on non-FTS days. For REITs and other industries, we then test the hypothesis that the mean return on FTS days is equal to that on non-FTS days. Alternatively, we measure the industry-level return response by regressing daily portfolio returns on the FTS indicator and a set of pricing factors as follows

$$R_{i,t} = \gamma_0 + \gamma_1 FTS_t + \gamma_2 \mathbf{X}_t + u_{i,t} \tag{3}$$

where $R_{i,t}$ is the value-weighted return on industry portfolio i on day t, γ_0 is a constant, FTS_t is our FTS indicator, and $\mathbf{X}$ contains other daily pricing factors. We are interested in the value of the estimated coefficient on the FTS indicator, γ_1, for each industry. We estimate γ_1 when controlling for the return on the market portfolio, the Fama and French value and size factors (Fama and French, 1993), the momentum factor (Carhart, 1997), and a liquidity pricing factor constructed from the Amihud (2002) measure.

To test whether the FTS sensitivity of REITs differs from that of other industries, we estimate Equation (3) in a system of regressions for all industry portfolios using SUR (Zellner, 1962). On that basis, we compute the χ^2 statistic and the associated probability that a given industry coefficient, $\gamma_{1,i}$, is equal to the beta coefficient for REITs, $\gamma_{1,REITs}$.

Table 2 presents the return response to FTS days. Panel A shows that raw portfolio total returns on FTS days are significantly negative for all industries. We find that returns on the overall market portfolio are on average 2.69% lower on FTS days than on non-FTS days. We find that REIT returns are also negative on FTS days. However, the difference to non-FTS days at 2.49% is statistically smaller for REITs than for many other industries.

We find significant variation in the estimated FTS response across industries when adding other pricing factors. When controlling for the return on the market, we find that the FTS response of REIT returns is close to zero (Panel B). When controlling for the size and value factors, momentum and liquidity, we find small but significantly positive return responses between 0.25 and 0.28% on FTS days (Panels C through E).

Our analysis suggests two conclusions. First, REIT returns are negatively affected during FTS days but the response to FTS in the REIT industry is statistically smaller than in the majority of other industry portfolios at the 5% level. Second, the FTS effect on total returns is related to firm characteristic-based pricing factors. After adding these pricing factors, we find that REITs have smaller FTS betas than many other industry portfolios. In fact, our results suggest that REITs respond positively to FTS episodes, all else equal.

Bansal, Connolly, and Stivers (2014) find that large-cap stocks are most affected by FTS. Savvy traders might be expected to target large caps with deep, liquid markets and small spreads for the bulk of the de-risking trades. The 32 REITs currently in the S&P 500 Large Cap Index account for 58.7% of the total equity market capitalization of the FTSE Nareit All REITs Index. So, despite the fact that on a value-weighted basis, REITs mimic the large cap index, REITs outperform many other sectors on FTS days. We conjecture that this may reflect the fact that REIT cash flows are derived primarily from longer-term leases on 'hard' assets, but this remains a question for future research.

4.2 Daily Market Microstructure Analysis

FTS-related return dynamics may reflect changes in market quality. The higher equity volatility during FTS episodes may lead market makers to widen spreads (as predicted by standard market-making models) or it may generate reduced market depth as a surge of sell orders is absorbed by the market maker. These issues might be particularly important in the REIT market, since the universe of REITs includes a number of small-cap firms that could be disproportionately affected by a decline in market quality. Our aim in this section is to establish empirically how REIT market quality varies before, during, and after FTS event, and thereby establish whether the REIT return effects just discussed are largely reflecting market microstructure characteristics or are due to other factors.

First, we assess the aggregate response in liquidity to FTS days in REITs versus other industries. We compute an industry portfolio-level version of Amihud's (2002) illiquidity measure as the ratio of the daily absolute industry return to the industry-level (dollar) trading volume on that day as follows

$$ILLIQ_{i,t} = \frac{|R_{i,t}|}{VOL_{i,t}} \tag{4}$$

where $|R_{i,t}|$ is the absolute return of industry portfolio i on day t and $VOL_{i,t}$ is the respective daily trading volume in dollars. This ratio gives the percentage price change per dollar of daily trading volume, or the daily price impact of order flow. Given that the pricing of Amihud's (2002) illiquidity measure is largely driven by the trading volume component (Lou and Shu, 2017), we also compute the inverse of daily dollar trading volume alone. We then employ these liquidity measures to assess differences in the liquidity response to FTS in REITs versus other industries using the same basic method as for the total return analysis.

Table 3 presents the results from measuring daily industry portfolio responses to FTS days in the Amihud price impact of trade measure (Panel A) and in the inverse of dollar trading volume, the denominator of the Amihud measure (Panel B). Each set of columns measures the difference in the outcome variable across FTS and non-FTS days, and reports the t-statistic from a means comparison test.

Panel A of Table 3 shows that the price impact of trade in REITs is reduced by 1.64% per dollar of trading volume on FTS days as compared to non-FTS days. In contrast, the price impact of trade increases the most on FTS days in the Financials portfolio, with an estimate of 2.38%. Our results suggest that REIT liquidity improves somewhat during FTS episodes.

Panel B of Table 3 shows the response to FTS days in the inverse of dollar trading volume. We consider this measure as Lou and Shu (2017) suggest that the Amihud illiquidity measure is priced largely due to the effect of trading volume. We find that the inverse of trading volume in REITs declines during FTS days, suggesting that trading volume itself increases substantially at those times as compared to non-FTS days. According to our estimates, REITs experience the largest increase in trading volume of all industries.

We also analyze FTS-based variations in REIT market quality measures, distinguishing between the effects of individual FTS days and FTS clusters. We focus on order imbalance, price impact of trades (using an alternative to the Amihud measure), depth, and spreads. We further examine daily price efficiency, the volume of quotes in the market, and intraday volatility related to FTS events. Tables 4 and 5 present the results.

We find evidence of a sell order imbalance for individual FTS days and during FTS clusters. However, depth in the market does not appear to be asymmetrically affected: the ratio of bid to offer shares does not appear to deteriorate during FTS. For individual FTS days, the price impact of trades is higher, and this finding holds both for the value-weighted and the share-weighted data. During FTS clusters, the price impact of trades is actually lower. Our data also indicates that the cost of trades rises during FTS but the increase in spreads is nearly four times as large for individual FTS days versus FTS clusters.

In summary, our findings suggest that REIT market quality is affected by FTS but adverse effects seem to be concentrated in individual FTS days. Our results suggest that REIT liquidity (price impact of trades) actually improves during FTS, especially FTS clusters. We conclude from this analysis that adverse return effects of FTS on REITs during individual FTS days may be connected to market microstructure effects. However, these short-run microstructure effects seem unlikely to fully explain REIT repricing during FTS clusters.

5 Long-Run Effects of FTS

5.1 FTS and Macro-Economic Fundamentals

Some asset pricing models describe FTS as a result of investors adjusting to changes in economic conditions: an increase in precautionary savings in bad times leads to lower bond yields and lower equity prices (Bekaert and Engstrom, 2017; Bekaert, Engstrom, and Xing, 2009). In these models, FTS is viewed as an indicator of fundamental changes in the economy that affect asset valuation in general equilibrium. Yet, the empirical evidence on connections between FTS and the macro-economy is less well developed. Baele, Bekaert, Inghelbrecht, and Wei (2015) briefly discuss that a larger concentration of FTS days in a quarter predicts declines in economic fundamentals. Our analysis builds on theirs in several ways.

First, Baele, Bekaert, Inghelbrecht, and Wei (2015) take no specific account of the time series dynamics of the macro variables they study. Instead, their model regresses each macro series on the FTS proportion variable as follows

$$\Delta GDP_t = \alpha_0 + \gamma_1 FTS_{t-j} + \varepsilon_t \tag{5}$$

where ΔGDP_t is the growth rate of GDP at time t, FTS_{t-j} is the FTS measure lagged j periods, and ε captures shocks at time t. In our sample, the GDP growth rate has substantial autocorrelation that their model does not capture. We augment their model to account for those dynamics as follows

$$\Delta GDP_t = \alpha_0 + \beta_1 \Delta GDP_{t-1} + \gamma_1 FTS_{t-j} + \varepsilon_t \tag{6}$$

Second, we modify our model to account for potential differences in single vs. multiple FTS quarters on subsequent GDP growth and on expectations of that growth as follows

$$\Delta GDP_t = \alpha_0 + \beta_1 \Delta GDP_{t-1} + \gamma_1 FTS1_{t-j} + \gamma_2 FTS2 +_{t-j} +\varepsilon_t \tag{7}$$

where $FTS1_{t-j}$ denotes a quarter with a single FTS event and $FTS2_{t-j}$ counts the number of FTS events in a quarter with two or more FTS events.

We employ three different measures of FTS intensity. We use a simple dummy variable to indicate whether there was an FTS day during the quarter. We also use two count variables: one which represents a single FTS event during a quarter and another which gives the count (e.g., 2, 3, etc.) of FTS days in a quarter where there are more than one. Finally, we use the the fraction of FTS days in a quarter as in Baele, Bekaert, Inghelbrecht, and Wei (2015).

We report estimates of FTS effects on actual GDP growth in Table 6 and on expectations of GDP growth in Table 7. Column (1) shows the underlying persistence of GDP growth and thus the importance of accounting for lags.[5] The estimates in Columns (2) to (4) show the effect of our three different FTS measures on future GDP growth, which is negative and statistically significant in each case. From Column (2), future GDP growth falls about 1% when there are three FTS events in a quarter. From Column (3), the estimate indicates that as FTS days in a quarter rise from zero to 10%, future GDP growth declines 2.4%. Finally, the specification in Column (4) shows that the negative impact of FTS on future GDP growth is primarily associated with FTS clusters, not individual FTS days.[6]

Next, we replace the dependent variables in Equations (6) and (7) with different measures of expected future economic activity. Table 7 reports the results. From the estimates in Panel A, Columns (2) to (4), forecasters expect lower future GDP in the aftermath of FTS clusters. The estimates in Panel B indicate that FTS clusters also lead to an elevated estimate of the probability of a GDP decline next quarter. The marginal effects on the chance of a GDP decline range from 17% to 28% for four FTS days in a quarter, or 10% FTS days, respectively.

We conclude from this analysis that FTS events affect the evolution of GDP growth, and also expectations of GDP growth. The bulk of this impact is associated with quarters in which there are two or more FTS events, which is about 25% of the sample. Quarters with individual FTS days appear to have only a very weak, unreliable GDP growth connection. These results constitute some evidence that clusters of FTS have effects beyond the actual event days and that they signal an impending decline in real economic activity.

[5] We explored longer lags for GDP growth and FTS measures, but the models reported in Table 6 dominated in every case.

[6] We also found that FTS has a negative impact on future growth in the GDP deflator; those estimates are available upon request, and largely mimic a similar finding in Baele, Bekaert, Inghelbrecht, and Wei (2015).

5.2 FTS and Future Real Estate Cash Flows

To the extent that FTS clusters forecast poor economic conditions that adversely affect the demand for space, there may be long run changes in future cash flows for real estate companies as rental revenue declines. We now turn to whether FTS has measurable effects on future cash flows at the firm level.

The dependent variable in this analysis is an indicator measuring whether a given REIT experiences a decline in revenue in quarter t, $RevDrop_{i,t}$. The main predictor of interest is the FTS indicator at the end of quarter $t-1$. We estimate the following logistic regression in an unbalanced panel of firm-quarter observations and using maximum likelihood

$$logit(RevDrop_{i,t}) = \gamma_0 + \gamma_1 FTS_{t-1} + \gamma_2 \mathbf{X}_{i,t-1} + u_{i,t} \tag{8}$$

where γ_0 is a constant, FTS_t is the FTS indicator, γ_1 is the impact of FTS on the probability of a REIT-level revenue decline, $\mathbf{X}$ contains other observable firm characteristics at time $t-1$, and u is the residual. We include the following set of control variables. Size is the natural log of the firm's equity market capitalization at the end of the previous quarter. Leverage is total liabilities plus preferred stock divided by market equity plus total liabilities and preferred stock at the end of the previous quarter. Total Institutional Ownership is the percentage of shares held by all institutional owners.[7] Market to Book is the firm's equity market capitalization at the end of the previous quarter divided by the book value of equity. Rated is a dummy variable equal to one if the firm has an investment grade credit rating with S&P or Moodys. Residential, Office, Industrial, Retail, Other, Hotel, Diversified, and Healthcare are property type dummy variables. S&P 500, S&P 400, and S&P 600 are dummy variables equal to one if the firm was a constituent of those indexes during the quarter. Recession is a dummy variable equal to one if the quarter falls during an NBER recession. Appendix Table A1 shows descriptive statistics for the variables used in these regressions. Standard errors are clustered by firm.

[7] Cella, Ellul, and Giannetti (2013) document that stocks with a larger share of short-horizon institutional owners experience a stronger return response to volatility shocks. Greenwood and Thesmar (2011) show that stocks with more concentrated or homogeneous ownership experience larger price drops after a liquidity shock.

Table 8 presents the results from estimating Equation (8), the likelihood of a drop in REIT revenue following a quarter with an individual FTS day (Panel A) versus an FTS cluster (Panel B). Panel A shows that the occurrence of an FTS day by itself has no significant impact on the odds of REIT experiencing a decline in revenue in the subsequent quarter. However, Panel B shows that the likelihood of a drop in revenues for REITs increases significantly after a quarter that experienced a cluster of FTS days. The economic magnitude of the effect is significant. Our estimates suggest that the odds of lower revenues increase by over 15% after a quarter with a cluster of FTS days. We find similar results for two, three, and four quarters into the future. Those results are shown in Appendix Table A2.

The empirical capital markets literature to date largely focuses on short-term impacts surrounding FTS events, ignoring potential long-run effects of FTS. Our results expand on the existing evidence on short-term effects of FTS by documenting the long-run real impact on economic activity and corporate cash flows up to four quarters following an FTS cluster.

5.3 FTS and Future REIT Stock Returns

To the extent that clusters of FTS days signal a decline in future economic fundamentals with ensuing REIT revenue declines, this raises the question, do REIT investors fully price future cash flow changes during the actual FTS event, or is there further repricing that occurs later? If REIT investors price the revenue decline into share prices correctly, we expect that there should be no further repricing related to the preceding FTS event. To find otherwise would suggest a departure from efficient market pricing of REITs.

To address this question, we estimate cumulative total return premiums for the REIT industry over the risk-free rate (proxied by the one-month Treasury Bill) one, two, three, and four quarters into the future following FTS, where FTS is measured as an indicator for the presence of an individual FTS day and, alternatively, as an indicator for an FTS cluster. We estimate the following time series regressions

$$Ret_{t+j} = \gamma_0 + \gamma_1 FTS_t + u_t \tag{9}$$

where Ret_{t+j} is the cumulative return premium $t+j$ quarters into the future with $j = 1, 2, 3$, or 4 quarters after an individual FTS day or FTS cluster. If the information about declining fundamentals signaled by a cluster of FTS days is efficiently priced into the stock market as it becomes available during the FTS episode, then we expect the coefficient γ_1 to be zero.

Table 9 presents the results. We find little evidence that individual FTS days (Panel A) or a clusters of FTS days in a quarter (Panel B) have any predictive power for future REIT industry returns one, two, three or four quarters beyond the actual FTS event. Our finding suggests that any information signaled by FTS clusters relating to an impending economic downturn is priced fully into the stock market during the FTS episode. We find no evidence for a lasting impact or renewed correction in stock returns following FTS.

5.4 FTS and Future Direct Property Prices

The potential for lower REIT revenues also implies there may be an FTS-based deterioration in underlying property prices. That is, FTS episodes may lead to a decline in the underlying real asset market. To assess this potential FTS-related impact, we estimate the effect of FTS clusters on an index of U.S. commercial property prices as

$$CPPI_{t+j} = \gamma_0 + \gamma_1 FTS_t + u_t \tag{10}$$

where $CPPI$ measures the cumulative appreciation in U.S. commercial real estate prices $t+j$ quarters into the future where $j = 1, 2, 3$, or 4 quarters after a quarter with an FTS cluster or individual FTS day. If a cluster of FTS days signals an economic downturn and is followed by declining real estate market fundamentals, then we expect lower price appreciation in the quarters to come, so γ_1 will be significantly negative.

Table 10 shows that commercial property price appreciation in the U.S. is unchanged after the occurrence of an individual FTS day in a quarter (Panel A). However, we find a significantly negative effect on property price appreciation after the occurrence of an FTS cluster in a quarter (Panel B). Our finding is consistent with the evidence on a higher likelihood of revenue reductions for REITs.

REIT revenues are largely comprised of rental revenues from the properties the firms own and operate. If these cash flows decline, then the underlying property assets are less productive, and property values should, as a result, decline. Our finding supports this rationale.

In economic terms, this effect is significant. We find that, absent any FTS-related effects, property price appreciation over four quarters is 6.28% on average. The marginal effect of an FTS cluster occurring prior to the four quarters over which price appreciation is measured is -6.08%. As a result, net price appreciation over the year following a quarter with an FTS cluster is approximately zero. These results represent novel evidence on the long-term effects of FTS outside of trades that occur on the days of an FTS episode.

Property values may change as a result of changes in expected future cash flows or as a result of changes in the risk premium used to discount those future cash flows. We also examined the relationship between FTS events and future changes in the cap rate spread as a proxy for the risk premium. The cap rate spread is measured as the difference between transaction cap rates reported by Real Capital Analytics and the 10-year treasury yield. We examined changes one, two, three, and four quarters ahead. In unreported results, we find that both FTS and FTS bunch events are unrelated to future changes in the cap rate spread. Our finding implies that FTS-related changes in property price appreciation are largely due to the cash flow effects we document here and not to a change in the risk premium.

6 Identification Tests

Our analysis depends on the identification of FTS. A possible criticism is that our findings may simply be a by-product of a bear market in equities or a bond market rally. To address these concerns, we run a set of counter-factual tests. FTS requires two conditions to hold simultaneously, strongly negative equity returns and strongly positive bond returns. We now replicate our main analysis but replace the FTS indicator with counter-factual indicators that take the value of one if a quarter experienced a cluster of strongly negative equity returns alone or strongly positive bond returns alone. This analysis allows us to distinguish between the effects of FTS and those of an isolated bear market in stocks or a bond market rally.

Table 11 presents the results from the logit model of the likelihood of lower REIT revenues following a quarter with a cluster of strongly positive bond returns alone (Panel A) or strongly negative equity returns alone (Panel B). The Table shows that neither a bond market rally alone nor a bear market in equities alone predict revenue declines going forward.

Table 12 presents the results from the regression model of quarterly U.S. CPPI appreciation following a quarter with a cluster of days that experienced strongly positive bond returns alone (Panel A) or strongly negative equity returns alone (Panel B). The Table shows that neither a bond market rally alone nor a bear market in equities alone have any predictive power for future CPPI appreciation.

7 Conclusion

In this study, we explore the effects of FTS episodes in real estate markets. Our work is motivated by the observation that, in contrast to many other asset classes, there is little evidence on how real estate investments behave during FTS.

Empirically, we find that REITs provide at least a partial hedge against FTS in comparison to many other industry stock portfolios. They experience smaller declines in total returns and smaller effects on liquidity measures on FTS days. We also find evidence that clusters of FTS days signal an impending downturn in economic fundamentals with significant implications for REIT revenue growth up to four quarters forward. Lower revenues imply a decline in the productivity of the underlying real estate assets, which results in significant repricing, wiping out capital appreciation up to four quarters into the future, as per our estimates. Counter-factual tests show that these long-term effects are indeed specific to FTS episodes, and not just a by-product of a bond market rally or a bear market in stocks.

The effect of FTS in real estate markets is of interest due to the economic significance of this asset class in the U.S.. Our findings suggest that real estate may be valuable to investors seeking to protect portfolio values from the adverse consequences of FTS. The results of our study may also guide investors and managers in acting on the information content of FTS clusters about future economic fundamentals and property values.

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Figures and Tables

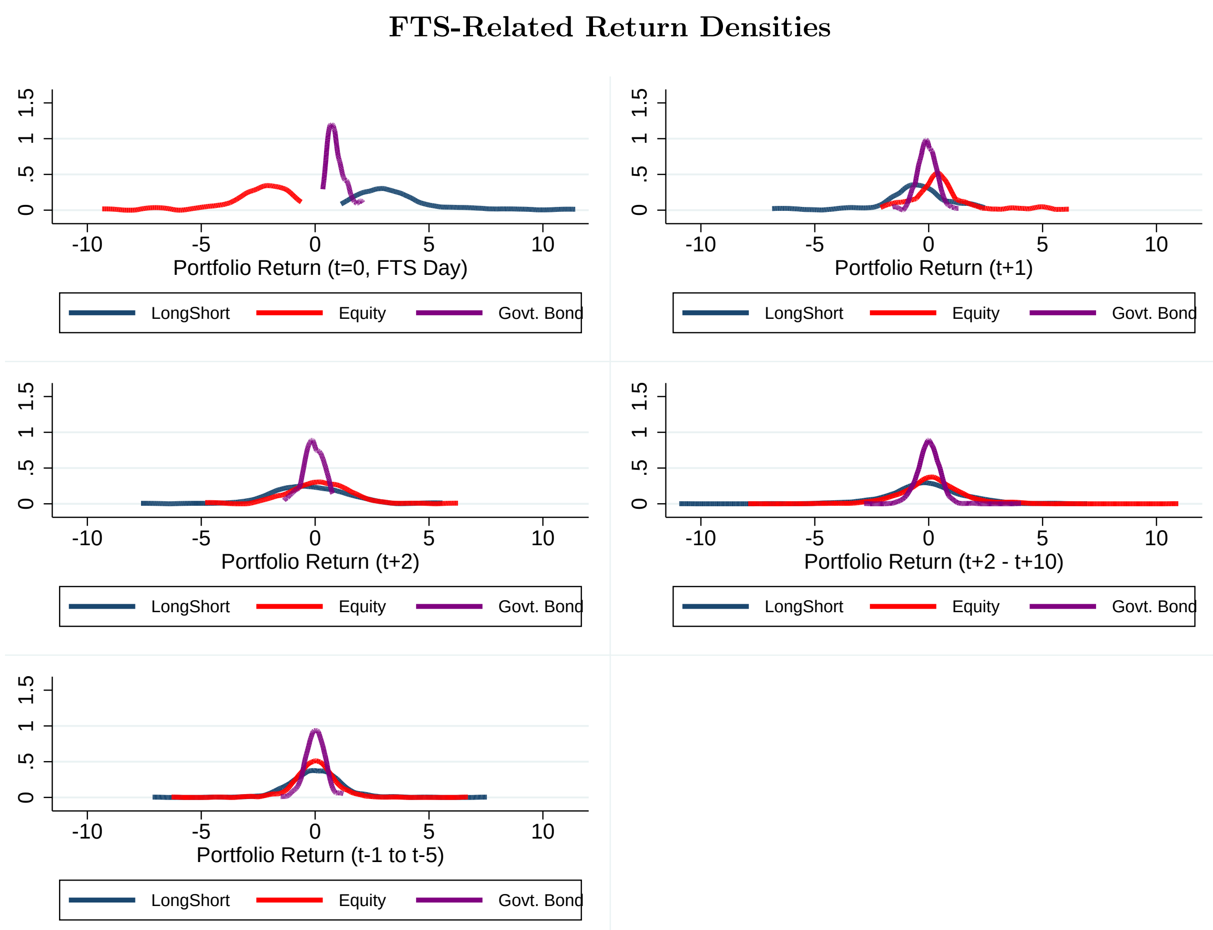

Figure 1: *The Figure shows the equity, bond, and long-short portfolio return densities on FTS days (upper left), the day after an FTS event (upper right), two days after an FTS event (middle left), and for days t+2 through t+10 after an FTS event (middle right) and for the five days before an FTS event, t-1 to t-5 (bottom left). The equity returns are for the S&P500, the bond returns are for the 10-year US Treasury benchmark bond (the data series is from DataStream International, and the long-short portfolio is long in the government bond and short in the S&P500. All returns are daily.*

Distribution of FTS Episodes, 1993–2016

Year	FTS Days	Likelihood	Quarters with FTS Clusters	Likelihood
1993	1.0000	0.0040	0.0000	0.0000
1994	0.0000	0.0000	0.0000	0.0000
1995	0.0000	0.0000	0.0000	0.0000
1996	0.0000	0.0000	0.0000	0.0000
1997	2.0000	0.0079	1.0000	0.2500
1998	4.0000	0.0159	1.0000	0.2500
1999	2.0000	0.0079	0.0000	0.0000
2000	5.0000	0.0198	2.0000	0.5000
2001	7.0000	0.0278	2.0000	0.5000
2002	2.0000	0.0079	0.0000	0.0000
2003	1.0000	0.0040	0.0000	0.0000
2004	2.0000	0.0079	0.0000	0.0000
2005	2.0000	0.0079	0.0000	0.0000
2006	1.0000	0.0040	0.0000	0.0000
2007	8.0000	0.0317	2.0000	0.5000
2008	7.0000	0.0278	2.0000	0.5000
2009	6.0000	0.0238	2.0000	0.5000
2010	9.0000	0.0357	2.0000	0.5000
2011	9.0000	0.0357	3.0000	0.7500
2012	6.0000	0.0238	2.0000	0.5000
2013	1.0000	0.0040	0.0000	0.0000
2014	12.0000	0.0476	3.0000	0.7500
2015	3.0000	0.0119	0.0000	0.0000
2016	3.0000	0.0119	1.0000	0.2500
Total	93.0000		23.0000	
Mean		0.0154		0.2396

Table 1: *FTS Days are defined following Baele, Bekaert, Inghelbrecht, and Wei (2015). We define a quarter as having a cluster of FTS events if it has more than one FTS day during the quarter.*

Industry-Level Total Return Response to FTS Days, 1993–2016

	Panel A: Raw Return			Panel B: CAPM			Panel C: Fama French (FF)			Panel D: FF+Momentum			Panel E: FF+Momentum+Liquidity		
	Beta	t-Statistic	p(χ^2)	Beta	t-Statistic	p(χ^2)	Beta	t-Statistic	p(χ^2)	Beta	t-Statistic	p(χ^2)	Beta	t-Statistic	p(χ^2)
Non-Durables	-0.0178	-19.04	0.0000	-0.0014	-2.23	0.2467	-0.0012	-1.96	0.0002	-0.0010	-1.61	0.0012	-0.0010	-1.62	0.0009
Durables	-0.0325	-20.43	0.0000	-0.0008	-0.93	0.5336	0.0001	0.16	0.0307	-0.0003	-0.36	0.0244	-0.0003	-0.42	0.0189
Manufacturing	-0.0292	-22.78	0.0000	-0.0018	-3.41	0.0962	-0.0009	-1.84	0.0003	-0.0010	-2.05	0.0007	-0.0010	-2.04	0.0005
Energy	-0.0286	-18.09	0.0175	-0.0046	-3.67	0.0047	-0.0034	-2.76	0.0001	-0.0031	-2.55	0.0004	-0.0031	-2.55	0.0003
Chemicals	-0.0228	-20.21	0.0959	-0.0025	-3.31	0.0542	-0.0020	-2.80	0.0000	-0.0019	-2.60	0.0002	-0.0019	-2.60	0.0001
Business Eq.	-0.0301	-17.74	0.0013	0.0037	4.09	0.0225	0.0015	2.01	0.3206	0.0011	1.50	0.2879	0.0012	1.54	0.2797
Telecom	-0.0248	-18.68	0.9403	0.0013	1.68	0.3646	0.0010	1.41	0.1503	0.0009	1.21	0.1922	0.0009	1.21	0.1764
Utilities	-0.0166	-15.07	0.0000	-0.0004	-0.47	0.7452	0.0004	0.46	0.0500	0.0007	0.87	0.1504	0.0008	0.90	0.1439
Retail	-0.0223	-18.90	0.0295	0.0007	1.04	0.5820	0.0007	1.07	0.0637	0.0008	1.12	0.1227	0.0007	1.03	0.0929
Healthcare	-0.0210	-18.07	0.0052	-0.0004	-0.51	0.7751	-0.0012	-1.50	0.0012	-0.0009	-1.17	0.0053	-0.0009	-1.22	0.0039
Financials (ex-REITs)	-0.0328	-21.01	0.0000	-0.0013	-1.65	0.2131	0.0012	2.15	0.1356	0.0009	1.63	0.1371	0.0009	1.64	0.1238
Other	-0.0284	-22.01	0.0011	-0.0005	-1.00	0.6486	-0.0002	-0.42	0.0027	-0.0002	-0.49	0.0066	-0.0002	-0.53	0.0050
REITs	-0.0249	-16.50	n/a	0.0000	0.01	n/a	0.0028	2.97	n/a	0.0025	2.64	n/a	0.0025	2.71	n/a
Market	-0.0269	-23.30	0.0623	0.0000	-2.28	0.9786	0.0000	-2.22	0.0028	0.0000	-2.12	0.0077	0.0000	-2.13	0.0062

Table 2: *The Table reports coefficients from a regression of daily portfolio returns on the FTS indicator variable and pricing factors. Beta is the coefficient on the FTS indicator. Portfolio returns are value-weighted. Industry portfolios are constructed from CRSP data using only firms with share code 10 or 11, and firms are classified by the industry classification scheme of Fama and French. The REITs portfolio is constructed from firms in the FTSE NAREIT universe. Market is the universe of firms in the industry portfolios. Data cover the period 1993 to 2016. Beta is the industry-level sensitivity to FTS. The t-statistic refers to a test for the hypothesis that the estimated Beta is zero.* $p(\chi^2)$ *is the probability that a given industry's Beta is equal to the Beta in the REIT regression, where the system is estimated using SUR. FTS Days are defined following Baele, Bekaert, Inghelbrecht, and Wei (2015).*

Industry-Level Liquidity Response to FTS Days, 1993–2016

	Panel A: Amihud				Panel B: Inverse Dollar Volume			
	Non-FTS	FTS	Difference	t-Statistic	Non-FTS	FTS	Difference	t-Statistic
Non-Durables	0.0296	0.0339	-0.0043	-0.4400	1.2107	1.2037	0.0069	0.0200
Durables	0.0302	0.0501	-0.0199	-0.9100	1.1157	1.1214	-0.0057	-0.0200
Manufacturing	0.0310	0.0225	0.0086	1.2800	1.2497	0.7234	0.5263	5.8700
Energy	0.0235	0.0077	0.0158	9.2000	0.6261	0.2234	0.4027	11.8200
Chemicals	0.0119	0.0077	0.0041	3.2500	0.4743	0.3555	0.1188	1.0600
Business Eq.	0.0405	0.0227	0.0178	4.3000	1.0543	0.6502	0.4041	4.1200
Telecom	0.0256	0.0341	-0.0085	-1.2600	1.1545	1.7490	-0.5945	-1.1700
Utilities	0.0052	0.0026	0.0026	6.0500	0.4146	0.1578	0.2568	11.5000
Retail	0.0412	0.0278	0.0134	3.7700	1.3884	0.9015	0.4870	4.7100
Healthcare	0.0324	0.0149	0.0175	8.6300	0.9818	0.5295	0.4524	4.8500
Financials	0.0631	0.0870	-0.0238	-1.4500	3.1605	3.3736	-0.2130	-0.5400
Other	0.0965	0.0607	0.0358	3.9900	2.9997	2.1351	0.8646	3.2700
REITs	0.0275	0.0111	0.0164	8.3200	1.8932	0.6964	1.1967	9.3500
Market	0.0383	0.0327	0.0055	1.5000	1.4745	1.2147	0.2598	2.7000
Observations	5949	93			5949	93		

Table 3: *The Table reports daily industry-level returns, industry-level Amihud illiquidity measure, and industry-level inverse dollar volume on FTS and non-FTS days. Both the Amihud and inverse dollar volume are multiplied by 1,000,000. Industry portfolios are constructed from CRSP data using only firms with share code 10 or 11, and firms are classified by the industry classification scheme of Fama and French. The REITs portfolio is constructed from firms in the FTSE NAREIT universe. Market is the universe of firms in the industry portfolios. Data cover the period 1993 to 2016. FTS Days are defined following Baele, Bekaert, Inghelbrecht, and Wei (2015).*

REIT Industry Order Imbalance and Market Depth During FTS, 1993–2014

Panel A: (Number of Buy Trades - Number of Sell Trades)/Total Trades

Event Time	FTS Cluster				FTS Day			
	Mean	Median	Std. Dev.	Skewness	Mean	Median	Std. Dev.	Skewness
-20 - -2	-0.006	0.001	0.308	-0.369	0.005	0.023	0.355	-0.548
-1	-0.011	0.000	0.307	-0.448	-0.001	0.017	0.355	-0.665
0	-0.027	-0.009	0.308	-0.394	-0.005	0.015	0.395	-0.398
1	-0.009	0.000	0.296	-0.403	0.021	0.033	0.340	-0.480
2 - 20	-0.004	0.006	0.306	-0.388	0.011	0.028	0.351	-0.384
0*	-0.063	-0.036	0.301	-0.270				

Panel B: (Buy Trade Volume - Sell Trade Volume)/Total Trade Volume

Event Time	FTS Cluster				FTS Day			
	Mean	Median	Std. Dev.	Skewness	Mean	Median	Std. Dev.	Skewness
-20 - -2	-0.007	0.000	1.024	-0.57	-0.001	0.024	0.518	-6.13
-1	-0.027	-0.007	0.444	-5.54	0.001	0.022	0.544	10.9
0	-0.063	-0.021	8.186	-262	-0.013	0.009	4.976	34.7
1	-0.042	-0.009	0.939	-50.9	-0.008	0.020	0.525	-13.6
2 - 20	0.001	0.003	0.934	9.35	0.010	0.025	1.062	2.78
0*	-0.087	-0.071	0.386	1.01				

Panel C: Bid Shares/Offer Shares (Time-Weighted)

Event Time	FTS Cluster				FTS Day			
	Mean	Median	Std. Dev.	Skewness	Mean	Median	Std. Dev.	Skewness
-20 - -2	1.38	1.01	3.04	23.8	1.40	0.96	2.60	16.1
-1	1.35	1.02	2.26	16.1	1.34	0.97	1.94	11.3
0	1.43	1.01	2.84	24.3	1.49	0.98	3.56	41.6
1	1.41	1.03	2.37	14.4	1.34	0.98	2.05	13.5
2 - 20	1.41	1.00	3.24	23.82	1.39	0.96	4.24	34.9
0*	1.45	1.03	2.79	17.7				

Table 4: *The underlying data is from the WRDS Intraday Indicators database, covering 1993 - 2014 and each REIT in our sample. Details on calculation methods are provided there. For each market quality measure used, we compute mean and median from the cross-section defined by individual REITs on a given day relative to FTS events. We aggregate across FTS events in calendar time, distinguishing only events that are FTS singletons vs. an FTS cluster. We report means and medians for the day before, day of, and day after values of the indicated measures. Since the FTS cluster data includes days that are within the FTS cluster window but not FTS days per se, we also present the summary statistics for those specific FTS days within the longer FTS cluster window. We also provide summaries of these variables on event days -20 to -2 and 2 to 20. For the longer pre- and post-FTS periods, we report the average of the daily cross-sectional means, standard deviations and skewness across days 2 through 20 (and -2 through -20), but we report the median of medians for those same periods.*

REIT Industry Price Impact and Cost of Trades During FTS, 1993–2014

Panel A: Percentage Price Impact (Value-Weighted)

Event Time	**FTS Cluster**				**FTS Day**			
	Mean	**Median**	**Std. Dev.**	**Skewness**	**Mean**	**Median**	**Std. Dev.**	**Skewness**
-20 - -2	0.074	0.003	1.227	34.8	0.132	0.004	2.083	28.0
-1	0.099	0.003	2.191	54.0	0.079	0.004	0.793	15.2
0	0.080	0.003	2.154	57.8	0.125	0.005	1.841	56.4
1	0.068	0.004	0.678	18.7	0.080	0.004	1.070	47.1
2 - 20	0.096	0.003	1.576	36.4	0.127	0.004	2.067	30.0
0*	0.085	0.003	4.006	50.2				

Panel B: Percentage Price Impact (Share-Weighted)

	FTS Cluster				**FTS Day**			
Event Time	**Mean**	**Median**	**Std. Dev.**	**Skewness**	**Mean**	**Median**	**Std. Dev.**	**Skewness**
-20 - -2	0.036	0.011	0.118	11.6	0.041	0.018	0.098	8.2
-1	0.039	0.013	0.104	8.1	0.044	0.018	0.129	20.0
0	0.034	0.011	0.118	11.3	0.047	0.021	0.137	260
1	0.044	0.014	0.135	12.4	0.042	0.019	0.132	32.2
2 - 20	0.039	0.013	0.128	13.7	0.040	0.018	0.107	12.5
0*	0.041	0.013	0.133	11.9				

Panel C: Percentage Realized Spread (Value-Weighted)

Event Time	**FTS Cluster**				**FTS Day**			
	Mean	**Median**	**Std. Dev.**	**Skewness**	**Mean**	**Median**	**Std. Dev.**	**Skewness**
-20 - -2	0.400	0.111	1.262	8.3	0.473	0.133	1.878	11.5
-1	0.395	0.117	1.210	7.80	0.438	0.131	1.371	6.64
0	0.439	0.123	2.868	206	0.658	0.196	2.154	65.8
1	0.488	0.129	1.494	8.38	0.440	0.133	1.312	6.81
2 - 20	0.460	0.127	2.396	11.7	0.459	0.130	1.427	7.98
0*	0.450	0.133	1.351	10.1				

Table 5: *The underlying data is from the WRDS Intraday Indicators database, covering 1993 - 2014 and each REIT in our sample. Details on calculation methods are provided there. For each market quality measure used, we compute mean and median from the cross-section defined by individual REITs on a given day relative to FTS events. We aggregate across FTS events in calendar time, distinguishing only events that are FTS singletons vs. an FTS cluster. We report means and medians for the day before, day of, and day after values of the indicated measures. Since the FTS cluster data includes days that are within the FTS cluster window but not FTS days per se, we also present the summary statistics for those specific FTS days within the longer FTS cluster window. We also provide summaries of these variables on event days -20 to -2 and 2 to 20. For the longer pre- and post-FTS periods, we report the average of the daily cross-sectional means, standard deviations and skewness across days 2 through 20 (and -2 through -20), but we report the median of medians for those same periods.*

Future Real GDP Growth and FTS

Variable	Future Real GDP Growth (1)	(2)	(3)	(4)
Real GDP Growth$_{(t-1)}$	0.441***	0.390***	0.383***	0.397***
	(3.13)	(2.74)	(2.76)	(2.81)
FTS Event Count$_{(t-1)}$		-0.324**		
		(-2.26)		
Fraction of FTS Days in Period$_{(t-1)}$			-23.575***	
			(-2.83)	
One FTS Event$_{(t-1)}$				-0.514
				(-1.33)
Multiple FTS Event Count$_{(t-1)}$				-0.321**
				(-2.24)
Observations	97	94	97	94
R^2	0.193	0.237	0.252	0.239

Table 6: *The Table reports estimates of regression coefficients connecting future GDP growth and the occurrence of FTS episodes. These regressions use quarterly data on GDP growth drawn from the Philadelphia Federal Reserve Bank's Real-Time Macroeconomic Database. We use the first data report on GDP in these regressions. The FTS data is of our own construction following methods described in the text. We report t-statistics in parentheses, and statistical significance is indicated as follows: *** p<0.01, ** p<0.05, and * p<0.1.*

Expectations of Real GDP Growth and FTS

	Panel A: Expected Real GDP Growth			
Variable	(1)	(2)	(3)	(4)
Expected GDP Growth$_{(t-1)}$	0.676***	0.637***	0.627***	0.633***
	(3.87)	(3.69)	(3.63)	(3.66)
FTS Event Count$_{(t-1)}$		-0.280**		
		(-2.43)		
Fraction of FTS Days in Period$_{(t-1)}$			-19.258***	
			(-2.67)	
One FTS Event$_{(t-1)}$				-0.202
				(-1.21)
Multiple FTS Event Count$_{(t-1)}$				-0.281**
				(-2.41)
Observations	99	96	99	96
R^2	0.458	0.529	0.543	0.530

	Panel B: Probability of GDP Decline Next Quarter			
Variable	(1)	(2)	(3)	(4)
Probability of GDP Decline$_{(t-1)}$	0.800***	0.744***	0.737***	0.736***
	(5.63)	(5.47)	(5.37)	(5.43)
FTS Event Count$_{(t-1)}$		2.107**		
		(2.27)		
Fraction of FTS Days in Period$_{(t-1)}$			134.934**	
			(2.30)	
One FTS Event$_{(t-1)}$				-1.243
				(-1.05)
Multiple FTS Event Count$_{(t-1)}$				2.144**
				(2.27)
Observations	99	96	99	96
R^2	0.642	0.686	0.690	0.700

Table 7: *The Table reports estimates of regression coefficients connecting future GDP growth and the occurrence of FTS episodes. These regressions use quarterly data on GDP growth drawn from the Philadelphia Federal Reserve Bank's Real-Time Macroeconomic Database. We use the first data report on GDP in these regressions. The FTS data is of our own construction following methods described in the text. We report t-statistics in parentheses, and statistical significance is indicated as follows: *** p<0.01, ** p<0.05, and * p<0.1.*

FTS and Declines in REIT Revenue One Quarter Forward, 1993–2016

Panel A: Individual FTS Days

Variable	Coefficient	z-Statistic	p-Value	% Change Odds (unit change)	% Change Odds (SD change)	SD of X
FTS Days	0.0592	1.2460	0.2130	6.1000		
Rated	0.0092	0.1130	0.9100	0.9000		
S&P 500	0.4599	2.9300	0.0030	58.4000		
S&P 400	0.4324	4.3930	0.0000	54.1000		
S&P 600	0.2836	3.0820	0.0020	32.8000		
Residential	-0.2686	-2.1650	0.0300	-23.6000		
Other	-0.3256	-1.6140	0.1060	-27.8000		
Industrial	-0.0923	-0.7860	0.4320	-8.8000		
Retail	0.0028	0.0250	0.9800	0.3000		
Hotel	-0.1698	-1.1660	0.2440	-15.6000		
Diversified	0.1862	1.1710	0.2420	20.5000		
Healthcare	-0.0204	-0.1110	0.9110	-2.0000		
Recession Dummy	0.4174	5.9090	0.0000	51.8000		
Institutional Ownership	-0.1006	-0.6010	0.5480		-2.6000	0.2610
Market to Book	-0.0574	-2.6700	0.0080		-8.7000	1.5890
Size	0.0436	0.9960	0.3190		7.0000	1.5610
Total Revenue/Total Assets	16.1864	8.4710	0.0000		39.0000	0.0200
Leverage	1.6571	5.4020	0.0000		32.1000	0.1680
Constant	-3.0939	-3.2910	0.0010	N/A	N/A	N/A

Panel B: FTS Clusters

Variable	Coefficient	z-Statistic	p-Value	% Change Odds (unit change)	% Change Odds (SD change)	SD of X
FTS Cluster	0.1418	2.8490	0.0040	15.2000		
Rated	0.0113	0.1390	0.8890	1.1000		
S&P 500	0.4490	2.8360	0.0050	56.7000		
S&P 400	0.4203	4.2620	0.0000	52.2000		
S&P 600	0.2744	2.9730	0.0030	31.6000		
Residential	-0.2692	-2.1780	0.0290	-23.6000		
Other	-0.3278	-1.6280	0.1040	-27.9000		
Industrial	-0.0915	-0.7820	0.4340	-8.7000		
Retail	0.0020	0.0170	0.9860	0.2000		
Hotel	-0.1716	-1.1780	0.2390	-15.8000		
Diversified	0.1840	1.1600	0.2460	20.2000		
Healthcare	-0.0222	-0.1210	0.9040	-2.2000		
Recession	0.3746	5.1130	0.0000	45.4000		
Institutional Ownership	-0.1040	-0.6210	0.5340		-2.7000	0.2610
Market to Book	-0.0562	-2.6310	0.0090		-8.5000	1.5890
Size	0.0446	1.0190	0.3080		7.2000	1.5610
Total Revenue/Total Assets	16.2293	8.4570	0.0000		39.2000	0.0200
Leverage	1.6486	5.3800	0.0000		31.9000	0.1680
Constant	-3.1087	-3.3070	0.0010	N/A	N/A	N/A

Table 8: *The Table reports logit results for an estimation of the lower revenue on FTS day or FTS cluster indicator variables and controls. The sample consists of 9,230 firm-quarter observations and covers the period 1993 to 2016. The dependent variable is an indicator for Lower Revenue 1Q into the future. Variables are defined as in Table A1. P-values are calculated from firm-clustered standard errors. % Change Odds is the percentage change in the odds for the firm having lower revenue for a unit change (in the case of dummy variables) or one standard deviation change (for continuous variables) in the independent variable, respectively. SD of X reports the standard deviation of the continuous independent variable.*

FTS and REIT Industry Return Premiums One to Four Quarters Forward, 1993–2016

Panel A: FTS Day	Constant	SE	t-Statistic	FTS Coefficient	SE	t-Statistic
One Quarter Forward	0.0208	0.0062	3.3616	0.0080	0.0123	0.6463
Two Quarters Forward	0.0434	0.0094	4.6269	0.0185	0.0186	0.9946
Three Quarters Forward	0.0690	0.0118	5.8387	0.0187	0.0235	0.7969
Four Quarters Forward	0.0953	0.0139	6.8653	0.0110	0.0275	0.3997
Panel B: FTS Cluster	**Constant**	**SE**	**t-Statistic**	**FTS Coefficient**	**SE**	**t-Statistic**
One Quarter Forward	0.0229	0.0055	4.1646	-0.0018	0.0236	-0.0755
Two Quarters Forward	0.0478	0.0083	5.7283	0.0051	0.0358	0.1436
Three Quarters Forward	0.0725	0.0105	6.9060	0.0218	0.0450	0.4833
Four Quarters Forward	0.0981	0.0123	7.9597	-0.0018	0.0529	-0.0334

Table 9: *Table reports regression results for a regression of future quarterly REIT industry-level return premiums on FTS day and FTS cluster indicator variables. Panel A reports results for REIT industry-level return premiums after individual FTS Days. Panel B reports results for REIT industry-level return premiums after clusters of FTS Days. The REIT industry portfolio is constructed from firms in the FTSE NAREIT universe. Data cover the period 1993 to 2016. FTS Days are defined following Baele, Bekaert, Inghelbrecht, and Wei (2015).*

FTS and Real Property Price Appreciation One to Four Quarters Forward, 2001–2017

Panel A: FTS Day					Panel B: FTS Cluster				
One quarter forward									
Variable	Coefficient	SE	t-Statistic	p-Value	Variable	Coefficient	SE	t-Statistic	p-Value
Constant	0.0112	0.0044	2.5400	0.0136	Constant	0.0146	0.0030	4.8800	<0.0001
FTS Day	-0.0027	0.0063	-0.4300	0.6657	FTS Cluster	-0.0167	0.0081	-2.0700	0.0423
2 Quarters Forward									
Variable	Coefficient	SE	t-Statistic	p-Value	Variable	Coefficient	SE	t-Statistic	p-Value
Constant	0.0270	0.0084	3.2000	0.0022	Constant	0.0302	0.0058	5.2200	<0.0001
FTS Day	-0.0112	0.0121	-0.9200	0.3607	FTS Cluster	-0.0332	0.0157	-2.1100	0.0386
3 Quarters Forward									
Variable	Coefficient	SE	t-Statistic	p-Value	Variable	Coefficient	SE	t-Statistic	p-Value
Constant	0.0454	0.0122	3.7300	0.0004	Constant	0.0469	0.0086	5.4400	<0.0001
FTS Day	-0.0221	0.0175	-1.2600	0.2120	FTS Cluster	-0.0492	0.0224	-2.2000	0.0317
4 Quarters Forward									
Variable	Coefficient	SE	t-Statistic	p-Value	Variable	Coefficient	SE	t-Statistic	p-Value
Constant	0.0624	0.0162	3.8600	0.0003	Constant	0.0628	0.0117	5.3500	<0.0001
FTS Day	-0.0297	0.0229	-1.2900	0.2010	FTS Cluster	-0.0608	0.0285	-2.1300	0.0368

Table 10: *Table reports results for a regression of returns on the RCA CPPI All Property Index on the FTS or FTS cluster indicator variable one, two, three, and four quarters forward. Data cover the period 2001 to 2017. FTS Days are defined following Baele, Bekaert, Inghelbrecht, and Wei (2015).*

Counter-Factual Events and Declines in REIT Revenue One Quarter Forward, 1993–2016

Panel A: Positive Bond Returns Only

Variable	Coefficient	z-Statistic	p-Value	% Change Odds (unit change)	% Change Odds (SD change)	SD of X
FTS Cluster	-0.1743	-4.0390	0.0000	-16.0000		
Rated	0.0154	0.1900	0.8490	1.6000		
S&P 500	0.4533	2.8990	0.0040	57.3000		
S&P 400	0.4206	4.2860	0.0000	52.3000		
S&P 600	0.2724	2.9750	0.0030	31.3000		
Residential	-0.2670	-2.1570	0.0310	-23.4000		
Other	-0.3290	-1.6350	0.1020	-28.0000		
Industrial	-0.0880	-0.7510	0.4530	-8.4000		
Retail	0.0056	0.0480	0.9610	0.6000		
Hotel	-0.1741	-1.1990	0.2310	-16.0000		
Diversified	0.1821	1.1490	0.2510	20.0000		
Healthcare	-0.0197	-0.1070	0.9140	-2.0000		
Recession	0.3646	5.1660	0.0000	44.0000		
Institutional Ownership	-0.1003	-0.6000	0.5490		-2.6000	0.2610
Market to Book	-0.0580	-2.6630	0.0080		-8.8000	1.5890
Size	0.0400	0.9210	0.3570		6.4000	1.5610
Total Revenue/Total Assets	16.2139	8.5300	0.0000		39.1000	0.0200
Leverage	1.6748	5.4560	0.0000		32.5000	0.1680
Constant	-2.9073	-3.1100	0.0020	N/A	N/A	N/A

Panel B: Negative Equity Returns Only

Variable	Coefficient	z-Statistic	p-Value	% Change Odds (unit change)	% Change Odds (SD change)	SD of X
FTS Cluster	-0.0717	-1.5150	0.1300	-6.9000		
Rated	0.0103	0.1270	0.8990	1.0000		
S&P 500	0.4541	2.8940	0.0040	57.5000		
S&P 400	0.4267	4.3330	0.0000	53.2000		
S&P 600	0.2796	3.0450	0.0020	32.3000		
Residential	-0.2678	-2.1690	0.0300	-23.5000		
Other	-0.3257	-1.6210	0.1050	-27.8000		
Industrial	-0.0915	-0.7830	0.4340	-8.7000		
Retail	0.0032	0.0280	0.9780	0.3000		
Hotel	-0.1707	-1.1710	0.2420	-15.7000		
Diversified	0.1837	1.1570	0.2470	20.2000		
Healthcare	-0.0218	-0.1200	0.9050	-2.2000		
Recession	0.4369	6.1730	0.0000	54.8000		
Institutional Ownership	-0.1128	-0.6700	0.5030		-2.9000	0.2610
Market to Book	-0.0579	-2.6810	0.0070		-8.8000	1.5890
Size	0.0446	1.0210	0.3070		7.2000	1.5610
Total Revenue/Total Assets	16.1852	8.4600	0.0000		39.0000	0.0200
Leverage	1.6593	5.4150	0.0000		32.1000	0.1680
Constant	-3.0519	-3.2520	0.0010	N/A	N/A	N/A

Table 11: *The Table replicates the regression for Table 8, using the counter-factual FTS indicator variables. Panel A is for the Positive Bond Return Only sample, and Panel B is for the Negative Equity Returns Only sample.*

Counter-Factual Events and Property Price Appreciation One to Four Quarters Forward, 2001–2017

	Panel A: Positive Bond Returns Only				Panel B: Negative Equity Returns Only				
One quarter forward									
Variable	Coefficient	SE	t-Statistic	p-Value	Variable	Coefficient	SE	t-Statistic	p-Value
Constant	0.0083	0.0037	2.2500	0.0279	Constant	0.0107	0.0032	3.3200	0.0015
FTS Cluster	0.0035	0.0070	0.5000	0.6156	FTS Cluster	-0.0046	0.0092	-0.5000	0.6193
Two Quarters Forward									
Variable	Coefficient	SE	t-Statistic	p-Value	Variable	Coefficient	SE	t-Statistic	p-Value
Constant	0.0176	0.0074	2.3700	0.0209	Constant	0.0216	0.0063	3.4200	0.0011
FTS Cluster	0.0073	0.0133	0.5500	0.5846	FTS Cluster	-0.0053	0.0179	-0.3000	0.7671
Three Quarters Forward									
Variable	Coefficient	SE	t-Statistic	p-Value	Variable	Coefficient	SE	t-Statistic	p-Value
Constant	0.0276	0.0113	2.4500	0.0169	Constant	0.0325	0.0096	3.4000	0.0012
FTS Cluster	0.0124	0.0188	0.6600	0.5116	FTS Cluster	-0.0009	0.0248	-0.0400	0.9716
Four Quarters Forward									
Variable	Coefficient	SE	t-Statistic	p-Value	Variable	Coefficient	SE	t-Statistic	p-Value
Constant	0.0359	0.0153	2.3500	0.0220	Constant	0.0425	0.0130	3.2700	0.0018
FTS Cluster	0.0225	0.0240	0.9400	0.3522	FTS Cluster	0.0082	0.0303	0.2700	0.7875

Table 12: *The Table replicates the regression for Table 10, using the counter-factual FTS indicator variables. Panel A is for the Positive Bond Return Only sample, and Panel B is for the Negative Equity Returns Only sample.*

Appendix: Firm-Level Descriptive Statistics on REIT Sample, 1993–2016

Variable	N	Mean	SD	Min	Max
Lower Revenue 1Q	9,230	0.3262	0.4689	0.0000	1.0000
Lower Revenue 2Q	9,230	0.2932	0.4552	0.0000	1.0000
Lower Revenue 2Q	9,230	0.2603	0.4388	0.0000	1.0000
Lower Revenue 4Q	9,230	0.2283	0.4197	0.0000	1.0000
% Change in Total Revenue 1Q	9,230	0.0404	0.1398	-0.3749	0.7254
% Change in Total Revenue 2Q	9,230	0.0834	0.2171	-0.4252	1.2232
% Change in Total Revenue 3Q	9,230	0.1252	0.2833	-0.4724	1.6285
% Change in Total Revenue 4Q	9,230	0.1652	0.3420	-0.5171	2.0214
FTS	9,230	0.5554	0.4970	0.0000	1.0000
FTS Cluster	9,230	0.2636	0.4406	0.0000	1.0000
Rated	9,230	0.3499	0.4770	0.0000	1.0000
Institutional Ownership	9,230	0.5454	0.2609	0.0001	0.9997
Total Revenue to Total Assets	9,230	0.0434	0.0204	0.0201	0.1393
S&P 500	9,230	0.0703	0.2557	0.0000	1.0000
S&P 400	9,230	0.1009	0.3012	0.0000	1.0000
S&P 600	9,230	0.1056	0.3074	0.0000	1.0000
Market to Book	9,230	1.8798	1.5889	0.2670	12.1407
Size	9,230	20.5174	1.5613	14.7218	24.8424
Market Leverage	9,230	0.4870	0.1679	0.0392	0.8955
Recession	9,230	0.1026	0.3035	0.0000	1.0000
Residential	9,230	0.1802	0.3844	0.0000	1.0000
Office	9,230	0.1033	0.3043	0.0000	1.0000
Industrial	9,230	0.1667	0.3728	0.0000	1.0000
Retail	9,230	0.1961	0.3971	0.0000	1.0000
Other	9,230	0.0822	0.2747	0.0000	1.0000
Hotel	9,230	0.0972	0.2962	0.0000	1.0000
Diversified	9,230	0.0914	0.2883	0.0000	1.0000
Healthcare	9,230	0.0829	0.2757	0.0000	1.0000

Table A1: *The Table reports descriptive statistics for the 9,230 firm-quarter observations in our final firm-level sample over the period 1993 to 2016. Variables are defined as follows: Lower Revenue 1Q, 2Q 3Q, and 4Q are indicator variables equal to one if the firm had negative total revenue growth over following 1, 2, 3, and 4 quarters respectively. Percentage Change in Total Revenue 1Q, 2Q, 3Q, and 4Q are the percentage change in total revenue over the following 1, 2, 3, and 4 quarters respectively. Rated is a dummy variable equal to one if the firms has an investment grade credit rating with S&P or Moodys. Size is the natural log of the firm's equity market capitalization at the end of the quarter. Leverage is total liabilities plus preferred stock divided by market equity plus total liabilities and preferred stock at the end of the quarter. Total Institutional Ownership is the percentage of shares held by all institutional owners. Market to Book is the firm's equity market capitalization at the end of the quarter divided by the book value of equity. Residential, Office, Industrial, Retail, Other, Hotel Diversified, and Healthcare are property type dummy variables. S&P 500, S&P 400, and S&P 600 are dummy variables equal to one if the firm was a constituent of those indices during the quarter. Recession is a dummy variable equal to one if the quarter falls during an NBER recession. FTS is an indicator variable equal to one if there was an FTS event during the quarter, and FTS Cluster is an indicator variable equal to one if the was an FTS cluster event during the quarter. Underlying data for Leverage, and index dummy variable are from COMPUSTAT. SNL Financial provides data for total revenue and property type, and Thomson Reuter's 13(f) database for underlying ownership data.*

Appendix: FTS and Declines in REIT Revenue Two to Four Quarters Forward, 1993–2016

Variable	Coefficient on FTS Cluster	z-Statistic	p-Value	% Change Odds (unit change)	Control Variables	Property Type Effects	Recession Effect
Lower Revenue 2Q	0.1688	3.0440	0.0020	18.4000	Y	Y	Y
Lower Revenue 3Q	0.1199	1.8820	0.0600	12.7000	Y	Y	Y
Lower Revenue 4Q	0.1168	1.8790	0.0600	12.4000	Y	Y	Y

Table A2: *The Table reports logit results for an estimation of the lower revenue on FTS day or FTS cluster indicator variables and controls. The sample consists of 9,230 firm-quarter observations and covers the period 1993 to 2016. The dependent variable is an indicator for Lower Revenue 2Q, 3Q and 4Q into the future. Variables are defined as in Table A1. P-values are calculated from firm-clustered standard errors. % Change Odds is the percentage change in the odds for the firm having lower revenue for a unit change (in the case of dummy variables) or one standard deviation change (for continuous variables) in the independent variable, respectively. SD of X reports the standard deviation of the continuous independent variable.*