Macroeconomic Uncertainty and Predictability of Real Estate Returns: The Impact of Asset Liquidity*

Nandu Nayar
Lehigh University
Bethlehem, PA 18015
610.758.4161
nan2@lehigh.edu

S. McKay Price
Lehigh University
Bethlehem, PA 18015
610.758.4787
smp210@lehigh.edu

Ke Shen
Lehigh University
Bethlehem, PA 18015
610.758.1084
kes317@lehigh.edu

This draft dated: Dec-02-2022.

*We thank RCA, NAREIT, and the MIT Center for Real Estate for providing the real estate asset price level indices employed in this paper. We are grateful to Stephen Brown, David Geltner, Mariya Letdin, David Ling, Sterling Yan, and participants at the 2022 Annual Conference of the American Real Estate Society for helpful comments and suggestions. Nayar and Price are grateful for financial support from the Hans Julius Bär and the Collins-Goodman chairs, respectively.

Macroeconomic Uncertainty and Predictability of Real Estate Returns: The Impact of Asset Liquidity

ABSTRACT

Recent research has shown that macroeconomic uncertainty is a significant factor that is contemporaneously incorporated into asset returns. Therefore, it should not have a role in predicting future returns. At the same time, separate research has demonstrated that illiquidity is related to future returns. We examine the interplay between these two dynamics in a commercial real estate setting, where (il)liquidity is a defining characteristic of the asset class. Empirical tests confirm the absence of return predictability for liquid assets (publicly traded property portfolios). However, we find significant return predictability predicated on ex ante macroeconomic uncertainty when we examine assets that are not as liquid (directly held property portfolios). Our findings are robust to several refinements, including adjustments for delays in the transaction closing process to establish transaction prices in the directly held market, controls for leverage inherent in publicly traded real estate asset returns, and pro-cyclical liquidity variation in private real estate markets.

Keywords: Commercial real estate, Macroeconomic uncertainty, Price return predictability, Liquidity, Parallel markets

JEL Classification Codes: G12, G14, G23, E44, R30, R33

Macroeconomic Uncertainty and Predictability of Real Estate Returns: The Impact of Asset Liquidity

1. Introduction

This paper examines predictability of commercial real estate price returns. In particular, we are interested in predictability related to forward looking macroeconomic uncertainty under different underlying asset liquidity regimes. We take advantage of the parallel returns series observable in commercial property markets, where exposure to macroeconomic uncertainty is largely held constant while liquidity characteristics differ substantially for publicly and privately traded property portfolios (Ling and Naranjo 1997; Oikarinen, Hoesli, and Serrano, 2011; Bond and Chang, 2012). Our paper draws its motivation from literature relating to predictability of asset returns, macroeconomic uncertainty, liquidity of underlying assets, and commercial property markets.

First, in cross-sectional tests, Bali, Brown, and Tang (2017) demonstrate that equity returns are sensitive to a macroeconomic uncertainty index. Specifically, they show that uncertainty averse investors would pay more to hold assets that have a positive sensitivity to macroeconomic uncertainty and, thereby, willingly accept lower returns. More recently, Cooper, Mitrache, and Priestley (2021) show how global macroeconomic risk factors can explain returns on other characteristic-based portfolios. Together, these studies suggest that macroeconomic uncertainty known today should not have an impact on future returns since the market would have already priced that uncertainty into today's prices.

Second, Chen, Eaton, and Paye (2018) show that a measure of aggregate illiquidity in the market uncorrelated with volatility is related to future stock market returns. Their results suggest that liquidity, or rather the lack thereof, can lead to predictability. This appears to be the case in commercial property markets, where correlation between returns on indirectly and directly held real estate are not as strong in the short run as they are over longer horizons (Li, Mooradian, and Yang, 2009; Oikarinen et al., 2011). That is, publicly traded real estate returns tend to predict privately held real estate returns.

Commercial real estate provides an ideal setting in which to examine how asset liquidity relates to macroeconomic uncertainty and returns predictability. Importantly, real estate assets are well known to be sensitive to macroeconomic factors (Ling and Naranjo, 1997; Plazzi, Torous, and Valkanov, 2008; Anderson, Anderson, Guirguis, Proppe, and Seiler, 2021). Moreover, two parallel markets exist – one publicly traded and the other directly held – where the primary differentiating characteristic is liquidity. Oikarinen et al (2011) explain that indirect real estate investments are generally more informationally efficient than the direct property market due to greater liquidity in the publicly traded realm. Hence, "the prices of indirect real estate investments should react faster to shocks in the fundamentals than those of direct real estate" (p.73).

We examine this proposition as it relates to macroeconomic uncertainty. In our tests, we find that price returns of publicly traded REITs do not exhibit any return predictability to measures of macroeconomic uncertainty. Conversely, price returns from indices of sales of directly held real estate investments exhibit robust predictability to macroeconomic uncertainty. This phenomenon is not restricted to certain time periods. Further, the result is robust to empirical testing that addresses the Stambaugh (1999) critique of studies of return predictability, including adjustments that allow for the longer settlement time typically observed in directly held commercial real estate transactions. Our inferences are also robust to differences in leverage across returns series and controlling for intertemporal liquidity variation across metropolitan areas in the private asset market. The results clearly demonstrate that liquidity of the underlying assets plays a major role in return predictability. More importantly, we show that the predictability is predicated on a forward looking macroeconomic uncertainty measure.

We contribute the literature in several ways. This is the first study to examine predictability of asset returns due to macroeconomic uncertainty in the context of (il)liquidity. We find strong and robust evidence that the predictive power of macroeconomic uncertainty is contingent on the liquidity of the asset. Additionally, while the parallel markets observable in commercial real estate provide an ideal setting to test our hypothesis, the inferences have generalizable conclusions for the broader market that includes a wide variety of assets. This includes assets with the same underlying exposure to macroeconomic uncertainty that are traded on multiple markets, as well as assets with varying degrees of liquidity and macroeconomic sensitivity. We also add to the ongoing literature on public and private real estate markets with evidence that macroeconomic uncertainty related predictability peaks around 6 months in the private market and lessens over longer horizons as the direct and indirect commercial returns series start to move together. The 6 month window is long enough to allow for a typical commercial property transaction to be completed and adds support to the idea that directly held property markets are less informationally efficient than publicly traded assets. The slower incorporation of macroeconomic uncertainty into private market returns appears to be one reason why returns in the public sphere predict returns to directly held properties.

The rest of the paper is organized as follows. Section 2 reviews the literature on return predictability, macroeconomic uncertainty, liquidity, and our hypotheses. Our data sources are described in Section 3, while section 4 discusses our empirical methods and related results. We discuss robustness tests in Section 5, and conclude in Section 6.

2. Literature Review and Motivation

2.1. General Finance Framework

While the research on return predictability is voluminous, for the sake of brevity, we limit our discussion to a select group of papers. First, we observe that the evidence on predictability of asset returns is mixed. We begin with Welch and Goyal (2008) which examines time-series predictability of the equity premium. While Welch and Goyal (2008) examine actual macroeconomic variables, they do not examine macroeconomic uncertainty. They conclude, "... our article suggests only that the profession has yet to find some variable that has meaningful and robust empirical equity premium forecasting power, both IS and OOS."[1] However, since then, there are a number of papers reporting evidence of predictability.

First, Rapach, Strauss, and Zhou (2010) report that combining several variables provides improved predictability of the equity premium. Rapach, Ringgenberg, and Zhou (2016) mention, "...short interest is arguably the strongest known predictor of aggregate stock returns."[2] Golez and Koudijs (2018) study returns over four centuries and show that dividend yields predict returns. Chen et al. (2018), find, "... strong evidence that the component of illiquidity uncorrelated with volatility forecasts stock market returns." Lansing, LeRoy, and Ma (2020) observe that after controlling for stochastic volatility, a variable that measures investor sentiment can predict returns. Conversely, there is also work casting doubt on predictability of returns. Choi, Jacewitz, and Park (2016) using new techniques find no evidence of predictability using dividend-price and earnings-price ratios. Thus, we believe that while many recent papers suggest that returns are predictable, there is still some skepticism surrounding predictability. More importantly, what is driving the predictability? Are

[1]Also see Cooper and Gulen (2006) where they are skeptical about papers reporting the presence of predictability using the out-of-sample estimations, which they suspect as consistent with data snooping.

[2]Priestley (2019) reports that the Rapach et. al. (2016) results are highly sensitive to inclusion of data from the recession of 2008; specificially, excluding that recessionary period negates any evidence of predictability.

factors such as aggregate short interest, aggregate liquidity in the market, etc all related to macroeconomic uncertainty?

On this topic of macroeconomic uncertainty, Bali et al. (2017) are the first to show that higher sensitivity of a stock's return to macroeconomic uncertainty dictates a lower excess return in the next period. In their tests, they first perform a regression of stock returns against a macroeconomic uncertainty measure based on Jurado, Ludvigson, and Ng (2015).[3] They then create decile portfolios based on the regression coefficient of that stock's return to the uncertainty measure. Following this, they compute the excess return for that portfolio for the next period, and demonstrate that the higher the coefficient of the uncertainty measure, the lower is the excess return in the following period. In other words, higher sensitivity to macroeconomic uncertainty implies lower excess returns in the next period. The Bali et al. (2017) result is important because it clearly demonstrates that macroeconomic uncertainty is priced beyond the normal asset pricing factors. With respect to predictability related to macroeconomic uncertainty, Bali et al. (2017) state, "decile portfolios that are long in stocks with the lowest uncertainty beta and short in stocks with the highest uncertainty beta yield an annualized risk-adjusted return of 6%." However, Bali et al. (2017) do not examine predictability of future returns based on the actual value of the current macroeconomic uncertainty variable.Their ex-ante pricing model would suggest that there may not be any predictability associated with the actual measures of macroeconomic uncertainty in a traditional predictive regression framework. There is an important difference between our work and that of Bali et al. (2017). They consider the cross-section of returns but not the time series of aggregate returns. The latter is what we explore using a predictive regression framework to examine the relationship to lagged macroeconomic uncertainty factors.

[3]Bali et al. (2017) characterize the Jurado et al. (2015) macroeconomic uncertainty variable as "defined as the conditional volatility of the unforecastable component of a large number of economic indicators."

Additionally, Bali et al. (2014) find that hedge fund returns are sensitive to a lagged macroeconomic sensitivity measure but mutual fund returns are not. We speculate this result is driven by the liquidity of the investment vehicles themselves. Specifically, hedge fund investments are illiquid since they are not traded in a liquid market. Conversely, mutual funds are transparent portfolios, which can be bought and sold at the NAV, which is calculated and based on the prices of underlying assets (which are liquid themselves). Further, while we speculate this difference is liquidity based, a counter argument could be made that the nature of the underlying holdings in hedge funds versus mutual funds could be responsible for this differential sensitivity to macroeconomic uncertainty. Specifically, hedge funds may invest in non-traded assets like movie rights, logging land holdings, etc while mutual funds must invest in assets that have readily available market prices to ascertain a NAV for daily settlement.

The above discussion provides part of the motivation for our paper. The Bali et al. (2017) paper shows that macroeconomic uncertainty sensitivity is important for asset returns. However, can the macroeconomic uncertainty variable itself predict future returns? Secondly, based on Bali et al. (2014), is this predictability dependent on the nature of the underlying asset liquidity? Our study explores these questions using two real estate based asset return series which primarily differ in their liquidity. This negates criticism related to the nature of the underlying assets, as is applicable in the case of hedge funds versus mutual funds.

2.2. Real Estate Framework

The commercial real estate literature is immense, with streams that examine directly held markets in isolation, streams that investigate the publicly traded markets alone, and those which compare and contrast the two. Perhaps the most closely related line of work to the present study is the literature on price discovery. Barkham and Geltner (1995) examine public (REITs) and private (directly held) property markets in the United States and United

Kingdom and find evidence that price discovery occurs first in the REIT space and then transmits to the private markets. Notably, they show a lag of up to a year or more before the price information is fully transmitted into the direct market. Yavas and Yildirim (2011) present additional evidence for price discovery taking place in the securitized public market, but further show that this relation is dynamic. The extent to which public leads private can vary intertemporally. While noting that the fundamental asset is essentially the same in both public and direct commercial property markets,[4] Oikarinen, Hoesli, and Serrano (2011) find that returns in the direct market tend to adjust towards a long-run equilibrium with the returns in the public market.

However, not all studies suggest that the linkage between securitized and direct investment is one directional – at least, not in the long run. Boudry, Coulson, Kallberg, and Liu (2012) find robust evidence that the returns to REITs and the underlying real estate adjust towards a long run, shared equilibrium. The lead-lag relationship in the returns generating process appears to be a short run phenomenon. Ghent, Torous, and Valkanov (2019) show serial correlation for private returns to be large and positive, while serial correlation for public returns is close to zero. Chiang (2009) also finds support for the idea that public real estate markets are more efficient than the directly held side. He shows concurrent factor exposures for public returns, while lagged public returns are useful for predicting private returns. In addition to Chiang (2009), many other studies incorporate factor models in their examination of public and private property returns.

Based on our review of the literature, Ling and Naranjo (1997) are the first paper to examine whether macroeconomic risk factors are priced in private and public real estate returns. They identify fundamental macroeconomic returns drivers using a restrictive fixed-coefficient model (Ferson and Harvey, 1991) and the more relaxed time-varying method

[4]Additionally, in a recent overview of commercial real estate, Ghent, Torous, and Valkanov (2019) state that there are little to no systematic differentials between the quality of properties held by REITs and directly held by private institutional investors.

of Fama and MacBeth (1973). With the former, they find real per capita consumption and treasury yields are priced, while with the latter they find significance for the term structure of interest rates and unexpected inflation. The results are consistent across the private/public returns divide. In a related study, Ling and Naranjo (1999) look at the extent to which publicly traded real estate and directly held real estate are integrated with the general stock market. Using multifactor asset pricing models they find that public real estate returns move with the non-real estate stock returns, while the private real estate returns do not. More recently, Ling and Naranjo (2015) find a transmission channel in returns from public to private real estate markets but this relationship disappears when asset pricing variables are included. Thus, including traditional asset pricing variables appears essential when examining predictability relationships.

Sing (2004) examines various macroeconomic risk factors in an effort to explain the returns of securitized and direct real estate. Using a time-invariant model, he finds evidence that credit risk, unexpected inflation, and bond spreads are priced in the publicly held markets, while treasury yields and unexpected inflation are priced in direct property markets. Similarly, various factors load significantly for each market when relaxing the time-invariant constraint using Fama-MacBeth (1973) regressions. Plazzi, Torous, and Valkanov (2008) illustrate that intertemporal variation in returns can be explained by macroeconomic variables such as the term and credit spreads as well as inflation and the short rate of interest, while cross-sectional returns dispersion respond to negative economic shocks. Hardin, Jiang, and Wu (2017) examine differences in how private market actors (appraisers) and public market participants (investors) incorporate inflation expectations into pricing. They find that, while mispricing exists in commercial property markets, it does not appear to be linked to the inability of the actors/participants to properly incorporate inflation expectations.

Freybote and Seagraves (2018) find that investor sentiment is positively related to commercial property turnover when market liquidity is high and negatively related to property price when market liquidity is low. Relatedly, Beracha, Freybote, and Lin (2019) demonstrate that changes in commercial real estate sentiment, as reflected in survey results that ask respondents to rank investment conditions in commercial real estate markets, can predict changes in the ex ante risk premium for directly held returns. Extending beyond sentiment, Papastamos, Matysiak, and Stevenson (2018) compare forecasts of rents, and capital and total returns, with those for various macroeconomic series. They find that such forecasts are affected by economic uncertainty, as measured by disagreement across macro-forecasters, where increased macroeconomic uncertainty leads to decreased accuracy in their estimates.

In somewhat tangential work, Glascock and Lu-Andrews (2014) look at how the variation in macroeconomic variables affects REIT funding liquidity. That is, a REIT's ability to obtain debt. They find that macroeconomic conditions affect contemporaneous and future funding liquidity in a manner that varies across the business cycle/economic regimes. We note that they do not examine how macro factors affect stock liquidity as it relates to returns. However, DiBartolomeo, Gatchev, and Harrison (2021) examine REIT liquidity and find that REITs exhibit a negative sensitivity to market wide liquidity shocks. That is, when liquidity declines in the broader stock market, publicly traded real estate prices tend to increase relative to the broader stock market. Moreover, while it is well established that publicly traded assets are significantly more liquid than their private market counterparts, some studies find evidence of a degree of commonality in liquidity between public and private real estate markets. For example, Downs and Zhu (2022) find a positive relation between property market liquidity and REIT stock liquidity, while Hoesli, Kadilli, and Reka (2017) show that partial liquidity comovement is manifested during bad market conditions.[5]

On the traditional asset pricing factors side of things, Peng (2016) finds mixed results for Fama and French (1993) factors and the Pástor and Stambaugh (2003) liquidity factor when

[5]For additional insight into liquidity and real estate markets see Ametefe, Devaney, and Marcato (2016), who provide a nice overview.

looking at privately owned commercial real estate returns at the property level. Specifically, the study obtains support for the factors in a cross-sectional setting, while loadings are insignificant when using a time series approach. Guidolin, Pedio, and Petrova (2020) examine predictability of real estate returns using a markov switching framework which introduces time-variation in the parameters in the form of their state- or regime-specific values. We build on their work and contribute along several lines. First, we employ linear regression which is consistent with the traditional predictability regression framework that is standard in the literature. This helps in comparability to other predictability studies. Further, we use a macroeconomic uncertainty variable that is well accepted in the finance/economics literature as the key predictability factor. Additionally, we address the Stambaugh (1999) critique of predictability studies using a unique technique. Furthermore, we document that the predictability in illiquid commercial real estate returns is robust to controls for the Great Recession. This is important since Priestley (2019) provides evidence that predictability can vanish when data from the Great Recession are excluded.

Another source of motivation for our study is summarized by Van Dijk, Geltner, and Van de Minne (2020). While invoking the widely understood notion that privately traded commercial properties are comparatively illiquid relative to their publicly traded counterparts, they state that "price dynamics and liquidity dynamics must be viewed together" (p.1). Their study, and other past work (e.g. Fisher, Gatzlaff, Geltner, and Haurin, 2003, 2004; Fisher, Geltner, and Pollakowski, 2007; Bokhari and Geltner, 2011), collectively contend that intertemporal variation in commercial real estate trading volume renders the already illiquid property market to be excessively illiquid during market downturns. That is, the distributions of buyer and seller reservation prices separate, which results in less overlap and a reduced number of consummated transactions. Consequently, private market returns series will be less volatile as illiquidity leads to slower changes in aggregate price levels. Similarly, Li and Zhu (2022) derive a model of trading volume and volatility differences across the dual real estate markets (public and private) that predicts that public market investors' incentive to trade during down markets increases while that of their private market counterparts declines. In light of these studies, we argue that this liquidity dynamic may render private market returns to be predictable in the face of macroeconomic uncertainty. We further note that none of the aforementioned studies examine returns predictability in the context of liquidity. We build on the solid foundation of literature that takes great interest in real estate (il)liquidity and extend it by using this platform to examine differences in how/whether macroeconomic uncertainty predicts future returns.

3. Data

This study employs data on: (i) Real estate indices (ii) Macroeconomic uncertainty data (iii) Standard asset pricing factors, which we describe below.

3.1. Real Estate Indices

The FTSE Nareit All Equity REITs price index contains all tax-qualified REITs with more than 50 percent of total assets in qualifying real estate assets other than mortgages secured by real property that also meet minimum size and liquidity criteria.[6] Our data on the index is between 1971:12 and 2018:10. We calculate the monthly return series as:

$$R_{t,t+1}^{Nareit} = \frac{Nareit_{t+1} - Nareit_t}{Nareit_t}$$

where the subscript on the return variable on the left hand side indicates that the return is computed for the period spanning t to $t+1$.

The RCA Commercial Property Price Indices (RCA CPPI) are a suite of price indices

[6] https://www.reit.com/data-research/reit-indexes/ftse-nareit-us-real-estate-index-historical-values-returns

published by Real Capital Analytics (RCA). They are transaction-based and measure commercial real estate price movements using the current state-of-the-art repeat-sales regression methodology, utilizing Bayesian inference, of Van de Minne, Francke, Geltner, and White (2020). Furthermore, the RCA transaction database that serves as the source data for index construction is the most comprehensive set of commercial real estate transactions in existence; it captures roughly 90 percent of all US transactions over \$2.5M (Bokhari and Geltner, 2011; Van Dijk, Geltner, and Van de Minne, 2020). For our primary analysis, we use the RCA CPPI US national index that covers all commercial property types in the U.S. between 2000:12 and 2018:10.[7] We construct 5 return series on a rolling-month basis, each with return window j the 1-, 3-, 6-, 12-, and 24-month, as:

$$R^{CPPI}_{t+i,t+i+j} = \frac{CPPI_{t+i+j} - CPPI_{t+i}}{CPPI_{t+i}},$$

where $j = 1$, 3, 6, 12 and 24; $i = 1$, 2.

3.2. Macroeconomic Uncertainty Data

The macroeconomic uncertainty data is defined as in Jurado, Ludvigson, and Ng (2015) (hereafter JLN). JLN claim that "...what matters for economic decision making is not whether particular economic indicators have become more or less variable or disperse per se, but rather whether the economy has become more or less predictable; that is, less or more uncertain...". The macroeconomic uncertainty $U_t(h)$ is the h-period ahead uncertainty measure as of date, t, estimated from 132 mostly macroeconomic series used in Ludvigson and Ng (2010). The 132 macro series represent broad categories of macroeconomic time series: real output and income, employment and hours, real retail, manufacturing and trade sales, consumer spending, housing starts, inventories and inventory sales ratios, orders and

[7] https://www.rcanalytics.com/our-data/rca_cppi

unfilled orders, compensation and labor costs, capacity utilization measures, price indexes, bond and stock market indexes, and foreign exchange measures. Following JLN, we use the 1-, 3- and 12-month ahead uncertainty measures, $U_t(1)$, $U_t(3)$, and $U_t(12)$, respectively.[8] The uncertainty data span the period between 1960:07 and 2018:06.

3.3. Standard Pricing Factors

We include standard pricing factors in our predictive regression. They are: (1) MKT: excess return on the value-weighted NYSE/Amex/ Nasdaq Center for Research in Security Prices (CRSP) equity market index; (2) SMB: Fama-French (1993) size factor; (3) HML: Fama-French (1993) book-to-market factor; (4) MOM: Carhart (1997) momentum factor.[9]

3.4. Data details

We first merge these data sources, and keep the data covering a common time duration which spans the period 2000:12 to 2018:06. We provide descriptive statistics for the variables employed in our paper in Table 1. The first row contains statistics for one-month returns of the liquid NAREIT index, while the second row is for the one-month returns of the illiquid RCA-CPPI Index. While the mean returns appear higher for the more liquid index, a t-test (not shown) reveals that the mean returns for the two series are not statistically different from one another (p-value = 0.46). However, an unreported variance ratio test reveals a significant difference between the public and private returns' volatilities (p-value = 0.00). As described previously, the lower volatility of the less liquid asset form is partly why we expect to find predictability in the private commercial property market, where lower volatility leads to slower changes in price levels.

[8]The macroeconomic uncertainty data is available for download from Sydney Ludvigson's website. https://www.sydneyludvigson.com/data-and-appendixes. We are grateful for the availability of the data.

[9]We obtained the data from Kenneth French's website:
https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

In Table 2, we provide correlations between the different variables in our dataset. The correlation between the two one-month return series is small (about 0.05). However, the correlation between the liquid NAREIT one-month returns to the returns on the RCA-CPPI index increases with longer holding periods of the latter. This suggests that the one-month return of the NAREIT index leads the return of the illiquid RCA CPPI index. This, in effect, supports previous studies that find price discovery flowing from the liquid REIT market to the illiquid private real estate asset market and is consistent with our predictability hypothesis.

In probing for time series patterns in our data, we plot the profiles of the three macroeconomic uncertainty measures, $U_t(h), h \in [1, 3, 12]$ over our sample period in Figure 1. On this same graph, we also include the profile for the one-month RCA CPPI return, $R_{t,t+1}$. It is clear to see that the Great Recession coincides with a significant drop in the returns of our illiquid real estate price index.[10] Consequently, in robustness tests, we elect to drop data for a specific period surrounding the Great Recession. Also, Priestley (2019) demonstrates that evidence of return predictability is vulnerable to omission of data from the Great Recession. This robustness test is described later in this paper.

4. Empirical Procedures and Results

To be consistent with past research in the return-predictability arena, we first discuss the traditional predictive regression framework as presented in the relationship shown below:[11]

$$R_{t,t+1} = \alpha \ + \ \beta_u^h \, U_t(h) \ + \ e_{t+1}$$

where $R_{t,t+1}$ is the return on the asset for the period spanning dates, t to $t+1$, $U_t(h)$ is the macroeconomic uncertainty measure looking forward h periods from date t, and e_{t+1} is the

[10]According to the NBER, the time frame of the recession was December 2007 to June 2009.
[11]For example, see eq. (1) in Welch and Goyal (2008).

error term. Predictability is present if the regression coefficient, β_u^h is significant. Specifically, the macroeconomic uncertainty variable measured at time t can predict the return over the next period spanning t to $t+1$. However, given the results in Figure 1 and the related discussion, we modify the predictive relationship above to:

$$R_{t,t+1} = \alpha \ + \ \beta_u^h \, U_t(h) \ + \ \beta_c \, CRISIS_{t,t+1} + \ e_{t+1} \tag{1}$$

where we include $CRISIS_{t,t+1}$, which is a dummy variable covering the period of the Great Recession. In eq. (1) above, we include $CRISIS_{t,t+1}$ to account for the critique of predictability studies by Priestley (2019).[12]

In examining eq. (1), a criticism that could be leveled from a traditional asset pricing framework is the presence of omitted variables (see Ling and Naranjo, 2015). At the very minimum, one would expect the Fama-French factors to be included. Consequently, in our empirical tests, we also perform estimations to include the Fama-French factors. These modifications result in the following model:

$$\begin{aligned} R_{t,t+1} \ &= \ \alpha + \beta_u^h \, U_t(h) + \beta_{mkt} \, MKT_{t,t+1} + \beta_{smb} \, SMB_{t,t+1} + \beta_{hml} \, HML_{t,t+1} \\ &\quad + \beta_{mom} \, MOM_{t,t+1} + \beta_c \, CRISIS_{t,t+1} + e_{t+1} \end{aligned} \tag{2}$$

It is important to note that the asset pricing factors are contemporaneous with the return variable on the left hand side of the above equation, and the **only lagged independent variable** is the macroeconomic uncertainty measure, $U_t(h)$. In essence, we are trying to determine if predictability is present (with a significant β_u^h) after controlling for contemporaneous asset pricing factors.[13]

[12]Essentially, Priestley (2019) cautions against the possibility that predictability results are, in fact, driven by the economic shock during the Great Recession. Our analysis differs from Guidolin, et al. (2020) on this dimension, where they report predictability in real estate returns but do not control for the crisis period.

[13]In addition to the Fama-French factors, we also included the Pástor-Stambaugh aggregate market liq-

4.1. One period ahead return results

The regression models for eq. (1) and (2) are performed for the liquid NAREIT price return series and the results are provided in Table 3. The results from estimation of eq. (1) are provided in columns (1) - (3), for the 3 measures of macroeconomic uncertainty, $U_t(h), h \in [1, 3, 12]$, respectively. The coefficient of the macroeconomic uncertainty variable in all three models is statistically insignificant, implying that the macroeconomic uncertainty variable does not possess any predictability. Surprisingly, while the coefficient of the dummy variable for the crisis period of the Great Recession is negative, it is insignificant.[14] Further, the adjusted R-squared values are low at around 0.038 - 0.039 for these first three models. This result for the low adjusted R-squared values is as expected; specifically, when viewed from a standard asset pricing Fama-French perspective, those estimations suffer from omitted variables (see Ling and Naranjo, 2015).

To incorporate these factors, we estimate eq. (2) and the results appear in models (4) through (6) of Table 3 for the three macroeconomic uncertainty measures. Inclusion of the Fama-French factors increases the adjusted R-squared value substantially to around 0.51. However, none of the macroeconomic uncertainty variables, $U_t(h), h \in [1, 3, 12]$, have significant coefficients. These results demonstrate that NAREIT price index returns are not predictable using a lagged macroeconomic uncertainty measure.

We now turn our attention to the results for the illiquid real estate price index return series shown in Table 4. In models (1) through (3), we estimate eq. (1), and observe that the

uidity factor (see Pástor and Stambaugh, 2003; and Pástor and Stambaugh, 2019) in our estimations, but this did not affect any of our conclusions on predictability. In the interests of brevity, we have not included those results in our tables.

[14] There is nonstationarity with the returns series for privately held commercial property that is eliminated with one lag (first difference). However, we fail to reject the null in an Engle-Granger test for cointegration. Thus, the returns series and macroeconomic uncertainty variables are not cointegrated. We also check our results using Newey West standard errors to compute the t-statistics. This adjusts for heteroskedasticity and autocorrelation. In our regression results, we use both standard t-tests as well as Newey West t-statistics. The results are similar using both techniques for all our tests. We thank an anonymous reviewer for suggesting this line of analysis.

lagged macroeconomic uncertainty variables, $U_t(h), h \in [1, 3, 12]$, have negative and significant coefficients. Specifically, higher macroeconomic uncertainty predicts lower next period returns. The t-statistics for these three models indicate highly significant coefficients and this significance is robust to employing Newey-West standard errors. The adjusted R-squared values are quite high at roughly 0.70 for these three models compared to approximately 0.04 for the liquid NAREIT price index even without the inclusion of the standard Fama-French asset pricing factors. Interestingly, the coefficient for the *Crisis* variable is negative and significant whereas this is not the case for the liquid NAREIT price index return results shown in Table 3. This implies that even after controlling for the economic crisis period, the predictability of the macroeconomic uncertainty variable is still detected.

As was the case for the liquid NAREIT price index returns, we also estimate eq. (2) which incorporates the Fama-French factors to see if the predictability documented in models (1) - (3) is robust to the inclusion of these well known asset pricing factors. The results appear in models (4) - (6) of Table 4. The coefficients of all three macroeconomic uncertainty measures continue to be statistically significant. Specifically, inclusion of the Fama-French factors does not reduce the significance of the lagged macroeconomic uncertainty variables. Interestingly, while the market beta for the NAREIT price index return series is positive and significant (on the order of 0.80), the illiquid real estate price index return series appears to manifest a negative market beta (on the order of -0.02). The adjusted R-squared of models (4) - (6) improves marginally over their values for models (1) - (3). The divergence in the results of Table 3 and Table 4 support the hypothesis that liquid assets do not exhibit predictability to macroeconomic uncertainty. Conversely, returns of illiquid assets are predictable from lagged macroeconomic uncertainty measures.

4.2. Two period ahead returns

The inference of predictability as presented above may not be robust to the Stambaugh (1999) critique. We present a brief outline of this critique next. Consider a general predictive regression of the form in eq. (1), where we omit the crisis variable for ease of exposition, as shown below:

$$R_{t,t+1} = \alpha \ + \ \beta_u^h \, U_t(h) \ + \ e_{t+1} \tag{3}$$

While the return on the left hand side has a subscript of $t, t+1$, it is a variable that incorporates the price at time t. In other words, the return, $R_{t,t+1}$ is computed as:

$$R_{t,t+1} = \frac{P_{t+1} - P_t}{P_t}$$

Stambaugh (1999) points out that P_t may incorporate the same information as contained in $U_t(h)$, the lagged regressor of eq. (3), because they are both variables measured at date, t. As such, since both P_t and $U_t(h)$ are based on the same information set at date, t,

$$\text{Cov}(P_t, U_t(h)) \neq 0$$

Thus, any predictability in $R_{t,t+1}$ which is attributed to $U_t(h)$ may exist because of this contemporaneous-correlation in the measurement of the dependent variable. While there are other techniques for adjusting for this bias, we propose and implement a different strategy.

Specifically, we move the time scale and estimate a predictive model for $R_{t+1,t+2}$ using a predictor variable, $U_t(h)$. In other words, we are employing a predictor variable that is lagged by two periods, $U_t(h)$, relative to the dependent variable, $R_{t+1,t+2}$. Figure 2 illustrates the framework of our modification. Our basic model is now the following instead of eq. (1):

$$R_{t+1,t+2} = \alpha \ + \ \beta_u^h \, U_t(h) \ + \ \beta_c \, CRISIS_{t+1,t+2} + \ e_{t+2} \tag{4}$$

Note that the dependent variable is now $R_{t+1,t+2}$ in eq. (4) instead of $R_{t,t+1}$ as in eq. (1). Under the assumption that prices used in computing returns are a random walk, the primitives used to compute the dependent variable, $R_{t+1,t+2}$, are theoretically completely independent of the regressor variable, which is measured at time, t, i.e., with a lag of two periods. In other words, since:

$$R_{t+1,t+2} = \frac{P_{t+2} - P_{t+1}}{P_{t+1}}$$

and $\mathrm{Cov}(P_{t+1}, P_t) = 0$, due to a random walk in prices, this implies:

$$\mathrm{Cov}(P_{t+1}, U_t(h)) = 0$$

Consequently, there should not be any contemporaneous-correlation bias between returns two periods hence, $R_{t+1,t+2}$, and the predictor variable, $U_t(h)$. In effect, by this new configuration, we are weakening any predictability that may have existed. Specifically, we are not trying to predict returns from the macroeconomic uncertainty variable lagged one period. Instead, we are trying to see if the current macroeconomic uncertainty can predict the return measured at a point two periods in the future. Simple intuition suggests this backward movement of the time scale biases against finding predictability due to increasing the "staleness" of the predictor variable. We also modify eq. (4) to incorporate the Fama-French factors as in:

$$
\begin{aligned}
R_{t+1,t+2} &= \alpha + \beta_u^h\, U_t(h) + \beta_{mkt}\, MKT_{t+1,t+2} + \beta_{smb}\, SMB_{t+1,t+2} + \beta_{hml}\, HML_{t+1,t+2} \\
&\quad + \beta_{mom}\, MOM_{t+1,t+2} + \beta_c\, CRISIS_{t+1,t+2} + e_{t+2} \qquad (5)
\end{aligned}
$$

The results from estimations of eq. (4) and (5) for the liquid NAREIT price index and the illiquid real estate price index return series are presented in Tables 5 and 6, respectively. We first discuss Table 5 briefly and observe that the results mirror those of Table 3. Specifically, the coefficient of the macroeconomic uncertainty variable, $U_t(h)$, is insignificant for $h = [1, 3, 12]$, i.e., there is no predictability exhibited for the NAREIT price return series.

In Table 6, the results for the illiquid real estate price index monthly return series are similar to those in Table 4. The coefficient of the macroeconomic uncertainty variable, $U_t(h)$, is highly significant for all look-ahead periods of 1 month, 3 months, and 12 months as shown in columns (1) through (3). While the adjusted R-squared increases slightly, inclusion of the Fama-French factors in columns (4) through (6) does not change this predictability result when we estimate the model in eq. (5).

4.3. Delay in price manifestation

Introducing a two-month lag in the returns series to adjust for the Stambaugh (1999) critique may be insufficient in a directly held commercial property setting. Specifically, realized commercial real estate transaction prices are generally recorded a few months after those prices have been initially agreed upon, given the due diligence periods typically included in purchase contracts. While some variation in the timing exists, ninety days between the execution of a purchase contract and transaction settlement is common. Thus, to incorporate this delay in transaction prices, we extend the lag introduced in the analysis above by an additional three months such that returns are computed as:

$$R_{t+4,t+5} = \frac{P_{t+5} - P_{t+4}}{P_{t+4}}$$

which renders our basic model to be:

$$R_{t+4,t+5} = \alpha \ + \ \beta_u^h \, U_t(h) \ + \ \beta_c \, CRISIS_{t+4,t+5} + \ e_{t+5} \tag{6}$$

and when including the Fama-French factors, the full model becomes:

$$\begin{aligned} R_{t+4,t+5} \;\; &= \;\; \alpha + \beta_u^h \, U_t(h) + \beta_{mkt} \, MKT_{t+4,t+5} + \beta_{smb} \, SMB_{t+4,t+5} + \beta_{hml} \, HML_{t+4,t+5} \\ &\quad + \beta_{mom} \, MOM_{t+4,t+5} + \beta_c \, CRISIS_{t+4,t+5} + e_{t+5} \end{aligned} \tag{7}$$

The results from the estimations of eq. (6) and (7) for the liquid NAREIT price index and the illiquid real estate price index return series are presented in Tables 7 and 8, respectively. We observe no material differences in our inferences relative to the prior analyses when using two period ahead returns. While the macroeconomic uncertainty coefficients are not significant for the liquid NAREIT price returns series in all six columns of Table 6, they are highly significant and negative for the illiquid real estate price returns in all six columns of Table 7, thereby demonstrating predictability effects for macroeconomic uncertainty for illiquid real estate assets.

Summarizing the results to this point, the liquid NAREIT price index return series exhibits no predictability from the macroeconomic uncertainty variable. Conversely, we find robust evidence of predictability for the illiquid real estate price index series using one-month ahead, and two-months ahead returns. This evidence is even robust to employing five-month ahead returns to account for delays in transaction price reporting for directly held real estate assets.[15] While this may suggest an inefficient market for real estate assets, we have shown that this predictability result is primarily due to the illiquid (untraded) nature of the index since the liquid REIT index does not exhibit any predictability whatsoever.

4.4. Holding period and predictability

Having demonstrated the predictability for monthly holding period returns of the illiquid RCA CPPI return series, we now turn our focus to other holding periods for this index. Specifically, we explore different horizons for the holding period to investigate the sensitivity of the predictability. We use monthly returns to compute compounded holding period returns for four different periods: 3 months, 6 months, 12 months, and 24 months. These holding period returns are then used as the dependent variable in estimations of eq. (4) and (5). The corresponding results are presented in Table 9 through Table 12, which we discuss next.

First, a common theme across all the tables is the significant coefficient on the macroeconomic uncertainty measure, $U_t(h)$. This implies that there is strong predictability up to 24 months for the lagged macroeconomic uncertainty measure. The coefficient's t-statistics increases from the one-month holding period return regressions until they reach a maximum around the 6-month horizon, and then decline as the horizon is increased beyond that. The lowest t-statistics are obtained for the 24 month holding period. Thus, in terms of predictability for the holding periods that we examine, the maximum predictability seems to occur around 6 months.

Somewhat surprisingly, the market beta for the three-month and six-month holding periods (in Tables 9 and 10) is negative and significant. However, as the holding period horizon

[15]Another potential concern associated with the delay in recording transaction prices is the possibility that the returns series using those prices may manifest smoothing. To address this concern, in the spirit of Geltner (1991, 1993), Fisher, Geltner, and Webb (1994), and Cho, Kawaguchi, and Shilling (2003), we unsmooth the transaction price based monthly return series for use in our estimations. Our inferences regarding predictability associated with macroeconomic uncertainty are robust to using these "unsmoothed" transaction price-based returns. We thank an anonymous reviewer for suggesting this robustness test.

increases to 12 months and 24 months (in Tables 11 and 12), the market beta turns to become positive and significant. To our best knowledge, we believe that this is a new result in the real estate literature, that is, a market beta that is negative for short holding period returns, and a positive market beta for longer holding period returns. It is suggestive of short term diversification benefits, with long run market convergence. This is consistent with Boudry, et al. (2012), who find that private and public real estate asset returns adjust towards a long run equilibrium, only this additional result extends it a step further. That is, the returns on directly held commercial real estate exhibit a degree of long run convergence with the general stock market, not just securitized real estate portfolios.

5. Robustness Tests

In this section, we examine whether the evidence of predictability documented previously survives various robustness checks.

5.1. Estimations without Great Recession period data

In a critique of research investigating predictability of returns, Priestley (2019) promotes the idea that including data from the Great Recession may bias results and lead to evidence of predictability when it does not really exist for other periods. We examined this possibility by controlling for this period using the *Crisis* dummy variable in our previous estimations. Additionally, we also employ another set of tests, by **excluding data from April 2007 to November 2010** and estimating all our models with this censored dataset. Our justification for this censored dataset follows. Specifically, according to the NBER, the time frame of the crisis was December 2007 to June 2009. However, in examining the time series profile of the returns of the RCA CPPI index (see Figure 1), the time frame between the two peaks for this series surrounding the NBER recession is the period we elected to drop for our robustness tests. In these tests (not separately reported in a table), while the significance of the t-statistics declines, the tenor of our results is maintained. There is still significant predictability found for the macroeconomic uncertainty variable, $U_t(h)$.[16]

5.2. Further examination of Great Recession period

For this robustness check, in addition to the indicator variable, $Crisis$, for the Great Recession period, we employ an interaction variable computed as the product of that indicator variable and the macroeconomic uncertainty measure, $U_t(h)$. We, therefore, estimate the following models:

$$R_{t+1,t+2} = \alpha \ + \ \beta_u^h \, U_t(h) \ + \ \beta_{int} \, U_t(h) * CRISIS_{t+1,t+2} + \ \beta_c \, CRISIS_{t+1,t+2} + \ e_{t+2} \quad (8)$$

and with the Fama-French factors:

$$\begin{aligned} R_{t+1,t+2} \quad = \quad & \alpha + \beta_u^h \, U_t(h) + \beta_{int} U_t(h) * CRISIS_{t+1,t+2} \\ & + \beta_{mkt} \, MKT_{t+1,t+2} + \beta_{smb} \, SMB_{t+1,t+2} + \beta_{hml} \, HML_{t+1,t+2} \\ & + \beta_{mom} \, MOM_{t+1,t+2} + \beta_c \, CRISIS_{t+1,t+2} + e_{t+2} \qquad (9) \end{aligned}$$

Evidence of predictability exists if the coefficient, β_u^h is significant. The results for the models are presented in Table 13. Comparing those results against the results in Table 6, we see that the evidence of predictability still persists. Specifically, the coefficients of $U_t(h)$ are statistically significant and of the same sign as their analogs in Table 6 in each model that is estimated. Therefore, our predictability results are robust to controls for the economic crisis that ended in 2009.[17]

[16] Although not shown, in separate tests we also exclude the NBER-defined crisis period and obtain consistent results.

[17] Additionally, the positive coefficient on the interaction variable is positive and significant. This implies that while returns are negatively related to the macroeconomic uncertainty from two periods before, this

5.3. Contemporaneous macroeconomic uncertainty measure

Our next set of tests examines whether the evidence of predictability disappears if we include the macroeconomic uncertainty factor that is contemporaneous with the return as an added independent variable. Bali, et al. (2017) demonstrate that the macroeconomic uncertainty variable is a priced factor in an asset pricing framework to explain returns. Consequently, it is possible that $U_t(h)$, the lagged macroeconomic uncertainty variable, may lose its predictability when $U_{t+2}(h)$, the macroeconomic uncertainty factor that is contemporaneous with the return, $R_{t+1,t+2}$, is included as an independent variable in the predictive regression framework. To examine this possibility, we estimate the models below:

$$R_{t+1,t+2} = \alpha + \beta_u^h \; U_t(h) + \beta_{uC}^h \; U_{t+2}(h) + \beta_c \; CRISIS_{t+1,t+2} + \; e_{t+2} \tag{10}$$

and with the Fama-French factors:

$$\begin{aligned} R_{t+1,t+2} \;\; = \;\; & \alpha + \beta_u^h \; U_t(h) + \beta_{uC}^h \; U_{t+2}(h) \\ & + \beta_{mkt} \; MKT_{t+1,t+2} + \beta_{smb} \; SMB_{t+1,t+2} + \beta_{hml} \; HML_{t+1,t+2} \\ & + \beta_{mom} \; MOM_{t+1,t+2} + \beta_c \; CRISIS_{t+1,t+2} + e_{t+2} \end{aligned} \tag{11}$$

In these estimations, a positive and statistically significant coefficient, β_{uC}^h is supportive of the results in Bali, et al. (2017). Central to our predictability perspective, if predictability is robust, then the coefficient, β_u^h will be statistically significant even after including the contemporaneous macroeconomic uncertainty variable as an added independent variable.

Our results for the estimations of eq. (8) and (9) are presented in Table 14. In all the columns (1) through (6), the coefficient of the contemporaneous macroeconomic uncertainty variable is positive and statistically significant. This implies that consistent with the

effect is attenuated during the Great Recession period.

Bali, et. al. (2017) results, contemporaneous macroeconomic uncertainty is a priced factor. Specifically, the higher the macroeconomic uncertainty, the higher is the return that investors expect from the illiquid real estate price index. More important to our study of predictability, we report that β_u^h, the coefficient of the two period lagged macroeconomic uncertainty variable, $U_t(h)a$, is statistically significant and is of the same sign as its respective analog in Table 6 for each column (1) through (6) in Table 14. This is robust evidence that predictability is maintained even in the presence of the contemporaneous macroeconomic uncertainty variable for illiquid real estate assets.

5.4. Effect of leverage

One of the key differences related to returns from privately held real estate versus liquid REIT returns is that the former reflects the raw return of investment in the underlying real estate asset, whereas REIT returns do not. Specifically, REIT returns are the returns from investing in the common stock of the REITs, and therefore reflect the leverage that the REIT employs in its capital structure. Consequently, REIT returns do not perfectly reflect the returns of the underlying real estate assets (see, Ling and Naranjo, 2015). Given that the NAREIT price index returns are "levered" while our RCA price index returns are not, it is possible that the evidence of predictability that we observe with the latter is due to differences in leverage and not due to differences in liquidity. [18]

We test for this possibility by constructing a unlevered REIT price return series, $R_{t,t+1}^{ZimanU}$, aggregating across Equity REITs covered by the CRSP Ziman Real Estate Database.[19] The procedure we use follows Ling and Naranjo (2015). First, we delever the Ziman equity REIT price returns at the firm level to calculate the firm's unlevered return on assets. This process is detailed in the Appendix of Ling and Naranjo (2015). Afterward, an index of

[18] Oikarinen, Hoesli, and Serrano (2017) and Pagliari, Scherer, and Monopoli (2005) find that deleveraged publicly traded returns do not differ significantly from private market returns.

[19] Ziman includes a monthly return series (usdretx) that excludes dividends.

unlevered returns on total assets in month t, $R_{t,t+1}^{ZimanU}$, is calculated by summing over the weighted unlevered returns of each individual equity REIT. For comparison purposes, we also calculate an index of levered price returns on Ziman equity REITs, $R_{t,t+1}^{ZimanL}$, as the weighted levered returns of each individual equity REIT. As Table 1 shows, over our sample period between 2000:12 and 2018:06, the average monthly return of the unlevered equity REIT price index is 0.538%, versus 0.658% for the levered equity REIT price index. The standard deviation of the monthly returns of the unlevered equity REIT price index is 3.188%, versus 6.215% of the levered equity REIT price index. Although the levered equity REIT price index delivered a higher average monthly return, its standard deviation is nearly twice as large as that of the unlevered equity REIT index, thus implying that leverage can increase expected returns but also adds volatility.

We first estimate eq. (1) and (2) for the delevered CRSP Ziman REIT price return index. Our results for this estimation are provided in Table 15. In all the models in columns (1) through (6), there is no evidence of any predictability for the REIT sample using the delevered returns. These results are consistent with those for the levered NAREIT index that appear in Table 3. For completeness, we also present results for the levered CRSP Ziman REIT price return index in Table 16. Consistent with the results in Table 3 for the NAREIT price index, and in Table 15 for the delevered CRSP Ziman REIT price index return, there is no evidence of any predictability. We also perform the estimations of eq. (4) and (5) for the unlevered and levered CRSP Ziman REIT price index return, and provide the results in Table 17 and 18, respectively. Once again, no evidence of any predictability is present in either of these tables. The net upshot of the evidence in this section is that the difference in predictability documented for the privately held real estate asset index return series is not due to its unlevered nature; rather it is the difference in liquidity.

5.5. *Intertemporal variation in liquidity and market disaggregation*

It is well documented that private commercial real estate transactions are typically (but not always) pro-cyclical, where transaction frequency declines in down markets (e.g. Fisher, Gatzlaff, Geltner, and Haurin, 2003, 2004; Fisher, Geltner, and Pollakowski, 2007; Bokhari and Geltner, 2011; Van Dijk, Geltner, Van de Minne, 2020). That is, a relatively illiquid market (when compared to publicly traded stocks), tends to become even more illiquid under certain conditions. While (il)liquidity is an important feature of our study, we further examine whether our results hold when controlling for excessive illiquidity by incorporating "constant liquidity" commercial property price indices.

Originating with the Fisher, Gatzlaff, Geltner, and Haurin (2003), and then further developed through the series of papers listed above, the most sophisticated, refined, and current process is outlined in Van Dijk, Geltner, and Van de Minne (2020). In short, they present a computationally intensive process that utilizes observed repeat-sales of commercial properties and parses the demand side (buyers) and supply side (sellers) reservation prices using a Bayesian, structural time series approach to estimate the separate price distributions of the respective parties. The demand side reservation price movements are then used to derive price indices that preserve constant liquidity.[20] Some of the nice features of their approach are that they need not rely on appraisal data, they do not need rich property-specific information, and they can separately derive indices for distinct geographic markets.

We substitute the constant liquidity indices for six major metropolitan areas (Los Angeles, San Francisco, Chicago, Washington DC, Boston, and New York) into our analyses in place of the aggregated RCA CPPI index to check the robustness of our results to holding (il)liquidity constant, in addition to controlling for cross-sectional geographic differences. Specifically, the results in Table 19 present the coefficients from 18 separate regressions using

[20] We thank the Price Dynamics Platform at the MIT Center for Real Estate for providing the constant liquidity indices. See http://pricedynamicsplatform.mit.edu/team.html

eq. (4). For brevity, only the coefficients and t-statistics for the three different macroeconomic uncertainty measures are reported. While there is clearly some variation across markets, the results hold for 5 out of 6 major metro areas (15 out of 18 regressions), with the only market *without* negative and significant coefficients being Washington DC. Thus, our inferences are largely robust to intertemporal variation in private property market liquidity and geographic location.

6. Conclusions

Returns predictability is an ongoing area of interest to academics and industry. Recent work by Bali et al. (2017) demonstrates that factors which capture macroeconomic uncertainty are priced by investors. Specifically, markets contemporaneously incorporate information related to uncertainty in the broader economy into asset prices. We contend that, if markets are reasonably efficient, then such information *should not manifest itself in returns once it becomes stale*. In other words, macroeconomic uncertainty should not play a role in predicting returns beyond the present time. We explore the relation between macroeconomic uncertainty and returns predictability in the context of liquidity. This is motivated by recent work which makes a connection between illiquidity and future returns (Bali et al., 2014; Chen et al., 2018). Taken together, the implication is that less liquid assets may exhibit a component of predictability when it comes to macroeconomic uncertainty. However, the literature has been unable to cleanly examine this here-to-date.

We test for a relation between macroeconomic uncertainty and return predictability using a sample with distinctive (il)liquidity characteristics – commercial real estate. This asset class has the unique feature of parallel markets; investors are able to acquire properties either directly or indirectly. In the directly held market, institutional-grade commercial real estate is bought and sold between private investors. The properties are heterogeneous and the sales are infrequent. Pricing/liquidity is a perpetual challenge. In the indirect market, investors easily trade shares of stock which represent ownership in institutional-grade commercial real estate. Thus, holding the underlying assets relatively constant, we are able to obtain returns series with dramatically differing (il)liquidity features.

Utilizing various returns series that capture the two parallel markets, we find strong and robust evidence that the predictive power of macroeconomic uncertainty factors is contingent on the liquidity of the asset. Macroeconomic risk does not predict future returns to highly liquid securitized real estate portfolios (REITs). However, it strongly predicts the future returns of portfolios of illiquid, directly held real estate assets, even after allowing for price delays that stem from typical commercial real estate transaction settlement times. These results hold regardless of the particular returns series used and whether or not the financial crisis is included in the sample. Additionally, even when we include the contemporaneous macroeconomic uncertainty variable as an added independent variable in the predictive regression framework, we find that predictability continues to be present.[21] Further robustness tests that control for leverage in REIT returns shows that this predictability that we find is *not due to leverage differences.* The predictability peaks at around 6 months and tapers off in later periods. Moreover, we also find evidence that, as predictability lessens over longer horizons, directly held commercial real estate returns act as less of a hedge and start to move with the general stock market. That is, there may be at least a partial long-run equilibrium between these illiquid private properties and non-real estate stocks.

[21] Consistent with Bali, et al. (2017), we find that contemporaneous macroeconomic risk is a priced factor in an asset pricing context.

REFERENCES

Ametefe, F., Devaney, S., & Marcato, G. (2016). Liquidity: A review of dimensions, causes, measures, and empirical applications in real estate markets. Journal of Real Estate Literature, 24(1), 3-29.

Anderson, J., Anderson, R., Guirguis, H.S., Proppe, S., & Seiler, M.J. (2021). Time-Varying Correlations of REITs and Implications for Portfolio Management. Journal of Real Estate Research, 43(3), 317-334.

Bali, T.G., Brown, S.J., & Caglayan, M.O., (2014). Macroeconomic risk and hedge fund returns. Journal of Financial Economics 114(1), 1-19.

Bali, T.G., Brown, S.J., & Tang, Y., (2017). Is economic uncertainty priced in the cross-section of stock returns? Journal of Financial Economics 126(3), 471-489.

Barkham, R., & Geltner, D. (1995). Price discovery in American and British property markets. Journal of Real Estate Finance and Economics, 23(1), 21-44.

Beracha, E. I., Freybote, J., & Lin, Z. (2019). The determinants of the ex ante risk premiumin commercial real estate. Journal of Real Estate Research, 41(3), 411-442.

Bokhari, S., & Geltner, D. (2011). Loss aversion and anchoring in commercial real estate pricing: Empirical evidence and price index implications. Real Estate Economics, 39(4), 635–670.

Bond, S. A., & Chang, Q. (2012). Liquidity dynamics across public and private markets. Journal of International Money and Finance, 31(7), 1890-1910.

Boudry, W.I., Coulson, N.E., Kallberg, J.G., & Liu, C.H. (2012). On the hybrid nature of REITs. Journal of Real Estate Finance and Economics, 44(1/2), 230-249.

Carhart, M.M. (1997) On persistence in mutual fund performance. The Journal of Finance 52, 57-82.

Chen, Y, Eaton, G. W., & Paye, B. S., (2018). Micro(structure) before macro? The predictive power of aggregate illiquidity for stock returns and economic activity, Journal of Financial Economics, 130(1), 48-73.

Chiang, K.C.H. (2009). Discovering REIT price discovery: A new data setting. Journal of Real Estate Finance and Economics, 39(1), 74-91.

Cho, H., Kawaguchi, Y., & Shilling, J.D. (2003). Unsmoothing commercial property returns: A revision to Fisher-Geltner-Webb's unsmoothing methodology. Journal of Real Estate Finance and Economics, 27(3), 393–405.

Choi, Y., Jacewitz, S. & Park, J.Y. (2016). A reexamination of stock return predictability. Journal of Econometrics 192(1), 168-189.

Cooper, I., Mitrache, A. & Priestley, R. (2021). A global macroeconomic risk model for value, momentum, and other asset classes. Journal of Financial and Quantitative Analysis, In press.

Cooper, M., & Gulen, H. (2006) Is time-series-based predictability evident in real time? Journal of Business 79, 1263-1292.

DiBartolomeo, J. A., Gatchev, V. A., & Harrison, D. M. (2021). The liquidity risk of REITs. Journal of Real Estate Research, 43(1), 47-95.

Downs, D. H., & Zhu, B. (2022). Property market liquidity and REIT liquidity. Real Estate Economics.

Fama, E.F., & French, K.R. (1993). Common risk factors in the returns on stocks and bonds. Journal of Financial Economics 33 (1), 3-56.

Fama, E., & MacBeth, J.D. (1973). Risk, returns, and equilibrium: Empirical tests. Journal of Political Economy, 81(3), 607-636.

Ferson, W., & Harvey, C. (1991). The variation of economic risk premiums. Journal of Political Economy, 99(2), 385-415.

Fisher, J., Gatzlaff, D., Geltner, D., & Haurin, D. (2003). Controlling for the impact of variable liquidity in commercial real estate price indices. Real Estate Economics, 31(2), 269-303.

Fisher, J., Gatzlaff, D., Geltner, D., & Haurin, D. (2004). An analysis of the determinants of transaction frequency of institutional commercial real estate investment property. Real Estate Economics, 32(2), 239-264.

Fisher, J., Geltner, D., & Pollakowski, H. (2007). A quarterly transactions-based index of institutional real estate investment performance and movements in supply and demand. Journal of Real Estate Finance and Economics, 34(1), 5–33.

Fisher, J., Geltner, D. & Webb, B. (1994). Value indices of commercial real estate: A comparison of index construction methods. Journal of Real Estate Finance and Economics, 9, 137–164.

Freybote, J., & Seagraves, P. (2018). The impact of investor sentiment on commercial real estate market liquidity. Journal of Real Estate Research, 40(4), 597-628.

Geltner, D. (1991). Smoothing in appraisal-based returns. Journal of Real Estate Finance and Economics, 4, 327–345.

Geltner, D. (1993). Estimating market values from appraised values without sssuming an efficient market. Journal of Real Estate Research, 8:3, 325–345.

Ghent, A.C., Torous, W.N., & Valkanov, R.I. (2019). Commercial real estate as an asset class. Annual Review of Financial Economics, 11, 153-171.

Glascock, J., & Lu-Andrews, R. (2014). An examination of macroeconomic effects on the liquidity of REITs. Journal of Real Estate Finance and Economics, 49(1), 23-46.

Golez, B., & Koudijs, P.A.E. (2018). Four centuries of return predictability. Journal of Financial Economics 127, 248-263.

Guidolin, M., Pedio, M. & Petrova, M.T. (2020). The predictability of real estate excess returns: An out-of-sample economic value analysis. Journal of Real Estate Finance and Economics, `https://doi.org/10.1007/s11146-020-09769-2`.

Hardin III, W.G., Jiang, X., & Wu, Z. (2017). Inflation illusion, expertise and commercial real estate. Journal of Real Estate Finance and Economics, 55(3), 345-369.

Hoesli, M., Kadilli, A., & Reka, K. (2017). Commonality in liquidity and real estate securities. The Journal of Real Estate Finance and Economics, 55(1), 65-105.

Jurado, K., Ludvigson, S.C., & Ng, S., (2015) Measuring uncertainty, American Economic Review 105, 1177-1216.

Lansing, K.J., LeRoy, S.F., & Ma, J. (2020) Examining the sources of excess return predictability: Stochastic volatility or market inefficiency?, Federal Reserve Bank of San Francisco Working Paper 2018-14.

Li, L., & Zhu, B. (2022). Trading and volatility in dual market: Theory and evidence from real estate. Journal of Real Estate Research, 44(2), 151-183.

Li, J., Mooradian, R., & Yang, S. (2009). The information content of the NCREIF index.

Journal of Real Estate Research, 31(1), 93-116.

Ling, D.C., & Naranjo, A. (1997). Economic risk factors and commercial real estate returns. Journal of Real Estate Finance and Economics, 15(3), 283-307.

Ling, D.C., & Naranjo, A. (1999). The integration of commercial real estate markets and stock markets. Real Estate Economics, 27(3), 483-515.

Ling, D. C. & Naranjo, A. (2015). Returns and information transmission dynamics in public and private real estate markets. Real Estate Economics, 43(1), 163-208.

Ludvigson, S. C., & Ng, S. (2010). A factor analysis of bond risk premia. Handbook of Empirical Economics and Finance, Vol. 1, edited by Aman Ullah and David E. A. Giles, Boca Raton, FL: Chapman and Hall, 313–72.

Oikarinen, E., Hoesli, M., & Serrano, C. (2011). The long-run dynamics between direct and securitized real estate. Journal of Real Estate Research, 33(1), 73-104.

Pagliari Jr, J. L., Scherer, K. A., & Monopoli, R. T. (2005). Public versus private real estate equities: A more refined, long-term comparison. Real Estate Economics, 33(1), 147-187.

Papastamos, D., Matysiak, G., & Stevenson, S. (2018). A comparative analysis of the accuracy and uncertainty in real estate and macroeconomic forecasts. Journal of Real Estate Research, 40(3), 309-346.

Pástor, L., & Stambaugh, R.F. (2003). Liquidity risk and expected stock returns. Journal of Political Economy, 111, 642-685.

Pástor, L., & Stambaugh, R.F. (2019). Liquidity risk after 20 years. Critical Finance Review, 8, 277-299.

Peng, L. (2016). The risk and return of commercial real estate: A property level analysis. Real Estate Economics, 44(3), 555-583.

Plazzi, A., Torous, W., & Valkanov, R. (2008). The cross-sectional dispersion of commercial real estate returns and rent growth: Time variation and economic fluctuations. Real Estate Economics, 36(3), 403-439.

Priestley, R. (2019) Short Interest, Macroeconomic Variables and Aggregate Stock Returns. Working Paper, Electronic copy available at https://ssrn.com/abstract=3384620.

Rapach, D.E., Ringgenberg, M.C., & Zhou, G., (2016). Short interest and aggregate stock returns. Journal of Financial Economics 121(1), 46-65.

Rapach, D.E., Strauss, J. & Zhou, G. (2010) Out-of-sample equity premium prediction: Combination forecasts and links to the real economy. Review of Financial Studies 23, 821-862.

Sing, T.F. (2004). Common risk factors and risk premia in direct and securitized real estate markets. Journal of Property Research 21(3), 189-207.

Stambaugh, R.F. (1999). Predictive regressions. Journal of Financial Economics 54, 375—421.

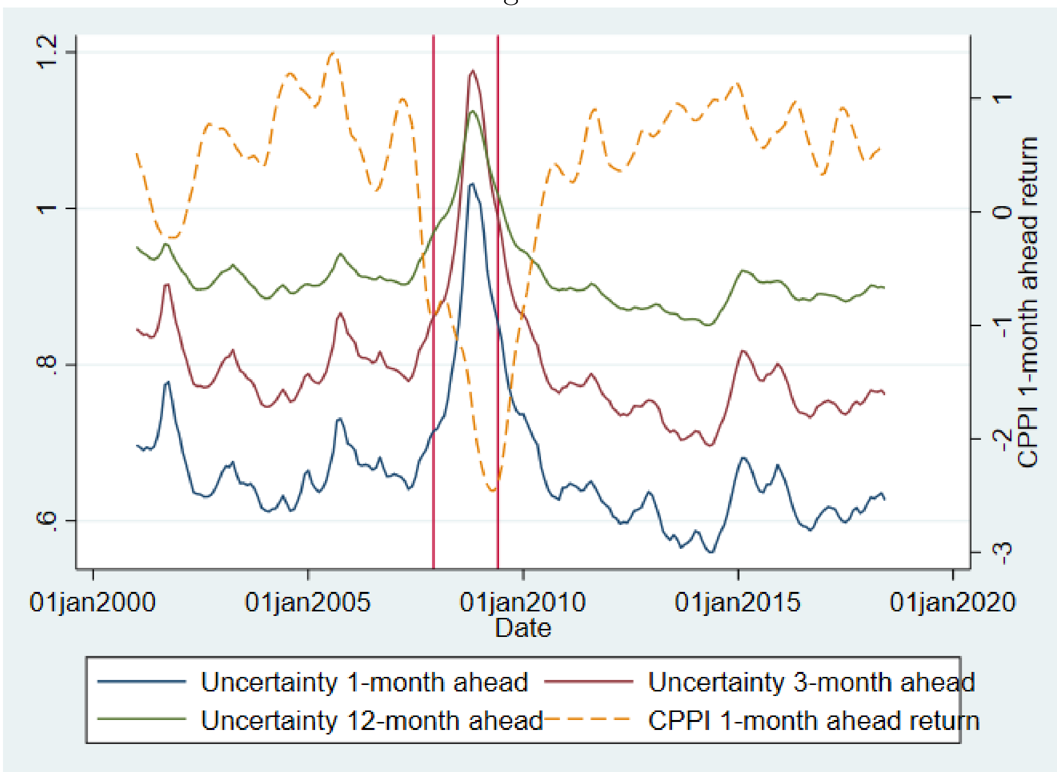
Van Dijk, D., Geltner, D., & Van de Minne, A. (2020). The dynamics of liquidity in commercial property markets: Revisiting supply and demand indexes in real estate. Journal of Real Estate Finance and Economics, Forthcoming.

Van de Minne, A., Francke, M., Geltner, D., & White, R. (2020). Using revisions as a measure of price index quality in repeat-sales models. Journal of Real Estate Finance and Economics, 60(4), 514–553.

Welch, I. & Goyal, A. (2008). A comprehensive look at the empirical performance of equity premium prediction. Review of Financial Studies 21, 1455-1508.

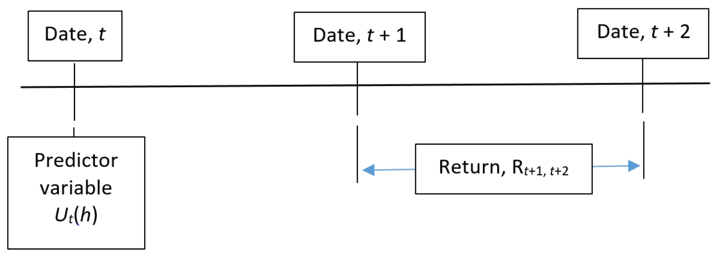
Yavas, A., & Yildirim, Y. (2011). Price discovery in real estate markets: A dynamic analysis. Journal of Real Estate Finance and Economics 42(1), 1-29.

Figure 1:



This figure illustrates the time-series trends of 1-, 3- and 12-month ahead macroeconomic uncertainty, $U_t(1)$, $U_t(3)$, and $U_t(12)$ as defined in Jurado, Ludvigson, and Ng (2015) and the 1-month return series of the RCA CPPI US National index, $R_{t,t+1}^{CPPI}$. The vertical lines mark the NBER crisis period between 2007:12 and 2009:06.

Figure 2:



This figure illustrates the framework for our modification to the time scale of the predictive model to address the Stambaugh (1999) critique of predictability studies.

Table 1: Summary statistics

	Count	Mean	SD	Min	P25	Median	P75	Max
$R_{t,t+1}^{Nareit}$	210	0.639	6.054	-31.910	-2.131	1.094	4.038	30.504
$R_{t,t+1}^{CPPI}$	210	0.328	0.826	-2.455	0.242	0.573	0.823	1.405
$R_{t,t+3}^{CPPI}$	210	1.008	2.445	-7.140	0.789	1.740	2.518	4.204
$R_{t,t+6}^{CPPI}$	209	2.085	4.765	-13.443	1.698	3.488	5.005	7.971
$R_{t,t+12}^{CPPI}$	203	4.428	9.066	-22.760	2.970	7.344	9.717	14.642
$R_{t,t+24}^{CPPI}$	191	9.665	16.760	-31.970	5.354	16.404	20.792	28.833
$U_t(1)$	210	0.667	0.085	0.560	0.617	0.646	0.687	1.032
$U_t(3)$	210	0.804	0.086	0.696	0.752	0.782	0.825	1.177
$U_t(12)$	210	0.916	0.050	0.851	0.889	0.903	0.925	1.125
$SMB_{t,t+1}$	210	0.330	2.533	-6.130	-1.400	0.290	2.020	7.630
$HML_{t,t+1}$	210	0.128	2.739	-11.100	-1.230	-0.100	1.600	12.900
$MOM_{t,t+1}$	210	0.124	5.131	-34.390	-1.550	0.380	2.910	12.540
$MKT_{t,t+1}$	210	0.538	4.236	-17.230	-1.880	1.060	3.120	11.350
$R_{t,t+1}^{ZimanU}$	210	0.538	3.188	-16.139	-1.007	0.834	2.519	12.575
$R_{t,t+1}^{ZimanL}$	210	0.658	6.215	-31.806	-2.148	1.205	4.050	30.407

This table shows the summary statistics of the return series of real estate indexes, macroeconomic uncertainties, and standard risk factors. $R_{t,t+1}^{Nareit}$ is the monthly return of Nareit All Equity REITs price index spanning time t to time $t+1$. $R_{t,t+1}^{ZimanU}$ is the monthly unlevered return of Ziman All Equity REITs price index spanning time t to time $t+1$. $R_{t,t+1}^{ZimanL}$ is the monthly levered return of Ziman All Equity REITs price index spanning time t to time $t+1$. $R_{t,t+1}^{CPPI}$ is the monthly return of RCA CPPI US National index spanning time t to time $t+1$. $R_{t,t+3}^{CPPI}$ is the 3-month return of RCA CPPI US National index spanning time t to time $t+3$. $R_{t,t+6}^{CPPI}$ is the 6-month return of RCA CPPI US National index spanning time t to time $t+6$. $R_{t,t+12}^{CPPI}$ is the 12-month return of RCA CPPI US National index spanning time t to time $t+12$. $R_{t,t+24}^{CPPI}$ is the 24-month return of RCA CPPI US National index spanning time t to time $t+24$. $U_t(1)$, $U_t(3)$, $U_t(12)$ are the 1-, 3-, and 12-month ahead macroeconomic uncertainties as of the beginning of month t, as defined in Jurado, Ludvigson, and Ng (2015). $SMB_{t,t+1}$, $HML_{t,t+1}$, $MOM_{t,t+1}$ and $MKT_{t,t+1}$ are the Fama-French-Carhart 4 factor returns spanning time t to time $t+1$.

Table 2: Correlation coefficients

	$R^{Nareit}_{t,t+1}$	$R^{ZimanU}_{t,t+1}$	$R^{ZimanL}_{t,t+1}$	$R^{CPPI}_{t,t+1}$	$R^{CPPI}_{t,t+3}$	$R^{CPPI}_{t,t+6}$	$R^{CPPI}_{t,t+12}$	$R^{CPPI}_{t,t+24}$	$U_t(1)$	$U_t(3)$	$U_t(12)$	SMB	HML	MOM	MKT
$R^{Nareit}_{t,t+1}$	1.0000														
$R^{ZimanU}_{t,t+1}$	0.9738	1.0000													
$R^{ZimanL}_{t,t+1}$	0.9940	0.9808	1.0000												
$R^{CPPI}_{t,t+1}$	0.0504	0.0550	0.0382	1.0000											
$R^{CPPI}_{t,t+3}$	0.0815	0.0830	0.0672	0.9913	1.0000										
$R^{CPPI}_{t,t+6}$	0.1269	0.1251	0.1110	0.9547	0.9831	1.0000									
$R^{CPPI}_{t,t+12}$	0.1685	0.1644	0.1541	0.8628	0.9030	0.9549	1.0000								
$R^{CPPI}_{t,t+24}$	0.1585	0.1567	0.1489	0.6869	0.7334	0.8002	0.9085	1.0000							
$U_t(1)$	-0.1915	-0.1693	-0.1693	-0.8288	-0.8527	-0.8727	-0.8516	-0.6861	1.0000						
$U_t(3)$	-0.1952	-0.1730	-0.1724	-0.8277	-0.8543	-0.8786	-0.8633	-0.6999	0.9982	1.0000					
$U_t(12)$	-0.1962	-0.1777	-0.1746	-0.8313	-0.8618	-0.8944	-0.8970	-0.7440	0.9823	0.9896	1.0000				
$SMB_{t,t+1}$	0.3126	0.3258	0.3303	-0.0651	-0.0636	-0.0613	-0.0404	0.0224	0.0621	0.0624	0.0684	1.0000			
$HML_{t,t+1}$	0.3136	0.2422	0.3042	0.0124	0.0306	0.0559	0.0866	0.0891	-0.0910	-0.0930	-0.0882	0.0200	1.0000		
$MOM_{t,t+1}$	-0.3342	-0.2650	-0.3431	0.1519	0.1418	0.1243	0.0773	0.0153	-0.1090	-0.1102	-0.1037	-0.1623	-0.0365	1.0000	
$MKT_{t,t+1}$	0.6560	0.6446	0.6568	0.0848	0.1004	0.1351	0.1879	0.1801	-0.2259	-0.2311	-0.2359	0.3200	0.0581	-0.4730	1.0000
Observations	191														

This table shows the correlation coefficients between pairs of the return series of real estate indexes, macroeconomic uncertainties, and standard risk factors. $R^{Nareit}_{t,t+1}$ is the monthly return of Nareit All Equity REITs price index spanning time t to time $t+1$. $R^{ZimanU}_{t,t+1}$ is the monthly unlevered return of Ziman All Equity REITs price index spanning time t to time $t+1$. $R^{ZimanL}_{t,t+1}$ is the monthly levered return of Ziman All Equity REITs price index spanning time t to time $t+1$. $R^{CPPI}_{t,t+1}$ is the monthly return of RCA CPPI US National index spanning time t to time $t+1$. $R^{CPPI}_{t,t+3}$ is the 3-month return of RCA CPPI US National index spanning time t to time $t+3$. $R^{CPPI}_{t,t+6}$ is the 6-month return of RCA CPPI US National index spanning time t to time $t+6$. $R^{CPPI}_{t,t+12}$ is the 12-month return of RCA CPPI US National index spanning time t to time $t+12$. $R^{CPPI}_{t,t+24}$ is the 24-month return of RCA CPPI US National index spanning time t to time $t+24$. $U_t(1)$, $U_t(3)$, $U_t(12)$ are the 1-, 3-, and 12-month ahead macroeconomic uncertainties as of the beginning of month t, as defined in Jurado, Ludvigson, and Ng (2015). $SMB_{t,t+1}$, $HML_{t,t+1}$, $MOM_{t,t+1}$ and $MKT_{t,t+1}$ are the Fama-French-Carhart 4 factor returns spanning time t to time $t+1$.

Table 3: 1-month Nareit All Equity REITs returns, $R^{Nareit}_{t,t+1}$

	(1)	(2)	(3)	(4)	(5)	(6)
$U_t(1)$	-7.665			-0.488		
	(-1.03)			(-0.09)		
$U_t(3)$		-8.199			-0.471	
		(-1.09)			(-0.08)	
$U_t(12)$			-14.94			-0.0820
			(-1.06)			(-0.01)
$SMB_{t,t+1}$				0.303**	0.303**	0.302**
				(2.45)	(2.45)	(2.44)
$HML_{t,t+1}$				0.587***	0.587***	0.587***
				(5.39)	(5.39)	(5.39)
$MOM_{t,t+1}$				-0.0603	-0.0603	-0.0594
				(-0.89)	(-0.89)	(-0.88)
$MKT_{t,t+1}$				0.801***	0.801***	0.802***
				(9.23)	(9.21)	(9.21)
Crisis	-2.123	-1.952	-1.725	-1.229	-1.230	-1.321
	(-0.96)	(-0.87)	(-0.70)	(-0.77)	(-0.76)	(-0.74)
Constant	5.943	7.405	14.48	0.476	0.529	0.234
	(1.23)	(1.26)	(1.13)	(0.13)	(0.12)	(0.02)
Observations	210	210	210	210	210	210
R^2	0.038	0.039	0.039	0.512	0.512	0.512

This table shows the results of regressing 1-month returns of Nareit All Equity REITs price index on 1-period lagged macroeconomic uncertainty and contemporaneous standard risk factors. The dependent variable is $R^{Nareit}_{t,t+1}$. $U_t(h)$ is the h-month ahead macroeconomic uncertainty index in Jurado, Ludvigson, and Ng (2015). $SMB_{t,t+1}$, $HML_{t,t+1}$, $MOM_{t,t+1}$ and $MKT_{t,t+1}$ are the Fama-French-Carhart 4-factor returns spanning time t to time $t+1$. *Crisis* is a dummy variable that takes the value 1 between 12/2007 and 06/2009 and 0 otherwise.

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: RCA CPPI 1-month return, $R^{CPPI}_{t,t+1}$

	(1)	(2)	(3)	(4)	(5)	(6)
$U_t(1)$	-6.442***			-6.699***		
	(-11.49)			(-11.85)		
$U_t(3)$		-6.440***			-6.726***	
		(-11.28)			(-11.66)	
$U_t(12)$			-12.02***			-12.60***
			(-11.11)			(-11.53)
$SMB_{t,t+1}$				0.00879	0.00893	0.0114
				(0.69)	(0.69)	(0.88)
$HML_{t,t+1}$				-0.0179	-0.0181	-0.0172
				(-1.60)	(-1.60)	(-1.52)
$MOM_{t,t+1}$				0.000894	0.000464	0.00133
				(0.13)	(0.07)	(0.19)
$MKT_{t,t+1}$				-0.0227**	-0.0235***	-0.0241***
				(-2.54)	(-2.60)	(-2.65)
Crisis	-0.614***	-0.575***	-0.357*	-0.635***	-0.591***	-0.356*
	(-3.69)	(-3.36)	(-1.89)	(-3.88)	(-3.51)	(-1.92)
Constant	4.679***	5.556***	11.36***	4.864***	5.799***	11.91***
	(12.86)	(12.39)	(11.63)	(13.21)	(12.76)	(12.04)
Observations	210	210	210	210	210	210
R^2	0.705	0.701	0.698	0.721	0.718	0.715

This table shows the results of regressing the 1-month returns of RCA CPPI index on 1-period lagged macroeconomic uncertainty and contemporaneous standard risk factors. The dependent variable is $R^{CPPI}_{t,t+1}$. $U_t(h)$ is the h-month ahead macroeconomic uncertainty index in Jurado, Ludvigson, and Ng (2015). $SMB_{t,t+1}$, $HML_{t,t+1}$, $MOM_{t,t+1}$ and $MKT_{t,t+1}$ are the Fama-French-Carhart 4-factor returns spanning time t to time $t+1$. *Crisis* is a dummy variable that takes the value 1 between 12/2007 and 06/2009 and 0 otherwise.

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: 1-month Nareit All Equity REITs returns, $R^{Nareit}_{t+1,t+2}$

	(1)	(2)	(3)	(4)	(5)	(6)
$U_t(1)$	-1.963			0.751		
	(-0.28)			(0.14)		
$U_t(3)$		-1.877			0.959	
		(-0.26)			(0.18)	
$U_t(12)$			-3.092			3.202
			(-0.23)			(0.32)
$SMB_{t+1,t+2}$				0.301**	0.300**	0.297**
				(2.43)	(2.42)	(2.40)
$HML_{t+1,t+2}$				0.587***	0.587***	0.587***
				(5.39)	(5.39)	(5.40)
$MOM_{t+1,t+2}$				-0.0576	-0.0571	-0.0556
				(-0.85)	(-0.84)	(-0.82)
$MKT_{t+1,t+2}$				0.805***	0.805***	0.808***
				(9.35)	(9.35)	(9.35)
$Crisis$	-3.425	-3.431	-3.421	-1.485	-1.533	-1.753
	(-1.63)	(-1.60)	(-1.45)	(-0.98)	(-0.99)	(-1.03)
Constant	2.259	2.459	3.781	-0.328	-0.594	-2.737
	(0.49)	(0.44)	(0.31)	(-0.10)	(-0.14)	(-0.30)
Observations	210	210	210	210	210	210
R^2	0.034	0.034	0.034	0.512	0.512	0.512

This table shows the results of regressing the 1-month returns of Nareit All Equity REITs price index on 2-period lagged macro-risk factors and contemporaneous standard risk factors. The dependent variable is $R^{Nareit}_{t+1,t+2}$. $U_t(h)$ is the h-month ahead macroeconomic uncertainty index in Jurado, Ludvigson, and Ng (2015). $SMB_{t+1,t+2}$, $HML_{t+1,t+2}$, $MOM_{t+1,t+2}$ and $MKT_{t+1,t+2}$ are the Fama-French-Carhart 4-factor returns spanning time $t+1$ to time $t+2$. $Crisis$ is a dummy variable that takes the value 1 between 12/2007 and 06/2009 and 0 otherwise.

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: RCA CPPI 1-month return, $R^{CPPI}_{t+1,t+2}$

	(1)	(2)	(3)	(4)	(5)	(6)
$U_t(1)$	-6.757***			-6.919***		
	(-13.61)			(-13.78)		
$U_t(3)$		-6.806***			-6.992***	
		(-13.51)			(-13.71)	
$U_t(12)$			-12.81***			-13.21***
			(-13.50)			(-13.77)
$SMB_{t+1,t+2}$				0.00863	0.00989	0.0135
				(0.72)	(0.83)	(1.13)
$HML_{t+1,t+2}$				-0.0181*	-0.0180*	-0.0164
				(-1.72)	(-1.71)	(-1.57)
$MOM_{t+1,t+2}$				-0.00272	-0.00325	-0.00208
				(-0.42)	(-0.50)	(-0.32)
$MKT_{t+1,t+2}$				-0.0196**	-0.0205**	-0.0220***
				(-2.37)	(-2.46)	(-2.64)
Crisis	-0.602***	-0.547***	-0.292*	-0.643***	-0.585***	-0.317*
	(-4.09)	(-3.62)	(-1.76)	(-4.40)	(-3.91)	(-1.94)
Constant	4.890***	5.850***	12.09***	5.012***	6.013***	12.47***
	(15.14)	(14.77)	(14.09)	(15.30)	(14.95)	(14.35)
Observations	210	210	210	210	210	210
R^2	0.745	0.743	0.743	0.756	0.755	0.756

This table shows the results of regressing the 1-month returns of RCA CPPI index on 2-period lagged macro-risk factors and contemporaneous standard risk factors. The dependent variable is $R^{CPPI}_{t+1,t+2}$. $U_t(h)$ is the h-month ahead macroeconomic uncertainty index in Jurado, Ludvigson, and Ng (2015). $SMB_{t+1,t+2}$, $HML_{t+1,t+2}$, $MOM_{t+1,t+2}$ and $MKT_{t+1,t+2}$ are the Fama-French-Carhart 4-factor returns spanning time $t+1$ to time $t+2$. *Crisis* is a dummy variable that takes the value 1 between 12/2007 and 06/2009 and 0 otherwise.

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: NAREIT 1-month return, $R^{NAREIT}_{t+4,t+5}$

	(1)	(2)	(3)	(4)	(5)	(6)
$U_t(1)$	3.120			1.707		
	(1.32)			(1.00)		
$U_t(3)$		2.603			1.417	
		(1.21)			(0.91)	
$U_t(12)$			2.435			1.460
			(0.84)			(0.70)
$SMB_{t+4,t+5}$				0.362^{***}	0.362^{***}	0.363^{***}
				(7.23)	(7.24)	(7.27)
$HML_{t+4,t+5}$				0.559^{***}	0.559^{***}	0.559^{***}
				(10.25)	(10.24)	(10.24)
$MOM_{t+4,t+5}$				-0.0677^{*}	-0.0681^{*}	-0.0692^{*}
				(-1.92)	(-1.93)	(-1.96)
$MKT_{t+4,t+5}$				0.660^{***}	0.660^{***}	0.660^{***}
				(18.31)	(18.30)	(18.29)
$Crisis$	-4.081^{***}	-3.996^{***}	-3.786^{***}	-1.852^{**}	-1.805^{**}	-1.707^{**}
	(-3.41)	(-3.37)	(-3.26)	(-2.13)	(-2.09)	(-2.02)
Constant	-0.885	-0.913	-1.084	-0.600	-0.609	-0.826
	(-0.56)	(-0.53)	(-0.40)	(-0.53)	(-0.49)	(-0.42)
Observations	558	558	558	558	558	558
R^2	0.021	0.020	0.019	0.501	0.501	0.500

This table shows the results of regressing the 1-month returns of NAREIT index on 5-period lagged macro-risk factors and contemporaneous standard risk factors. The dependent variable is $R^{NAREIT}_{t+4,t+5}$. $U_t(h)$ is the h-month ahead macroeconomic uncertainty index in Jurado, Ludvigson, and Ng (2015). $SMB_{t+4,t+5}$, $HML_{t+4,t+5}$, $MOM_{t+4,t+5}$ and $MKT_{t+4,t+5}$ are the Fama-French-Carhart 4-factor returns spanning time $t+4$ to time $t+5$. $Crisis$ is a dummy variable that takes the value 1 between 12/2007 and 06/2009 and 0 otherwise.

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: RCA CPPI 1-month return, $R^{CPPI}_{t+4,t+5}$

	(1)	(2)	(3)	(4)	(5)	(6)
$U_t(1)$	-6.636***			-6.701***		
	(-18.21)			(-17.88)		
$U_t(3)$		-6.742***			-6.831***	
		(-18.80)			(-18.48)	
$U_t(12)$			-12.58***			-12.77***
			(-19.58)			(-19.34)
$SMB_{t+4,t+5}$				0.00771	0.00919	0.0132
				(0.75)	(0.91)	(1.34)
$HML_{t+4,t+5}$				-0.00921	-0.00743	-0.00649
				(-1.01)	(-0.83)	(-0.75)
$MOM_{t+4,t+5}$				-0.00568	-0.00671	-0.00654
				(-1.00)	(-1.21)	(-1.21)
$MKT_{t+4,t+5}$				-0.00774	-0.00819	-0.0101
				(-1.09)	(-1.18)	(-1.49)
$Crisis$	-0.875***	-0.812***	-0.565***	-0.903***	-0.837***	-0.589***
	(-8.10)	(-7.55)	(-5.03)	(-8.14)	(-7.59)	(-5.14)
Constant	4.838***	5.827***	11.91***	4.887***	5.905***	12.09***
	(20.25)	(20.53)	(20.45)	(19.87)	(20.17)	(20.19)
Observations	210	210	210	210	210	210
R^2	0.814	0.822	0.831	0.817	0.824	0.834

This table shows the results of regressing the 1-month returns of RCA CPPI index on 5-period lagged macro-risk factors and contemporaneous standard risk factors. The dependent variable is $R^{CPPI}_{t+4,t+5}$. $U_t(h)$ is the h-month ahead macroeconomic uncertainty index in Jurado, Ludvigson, and Ng (2015). $SMB_{t+4,t+5}$, $HML_{t+4,t+5}$, $MOM_{t+4,t+5}$ and $MKT_{t+4,t+5}$ are the Fama-French-Carhart 4-factor returns spanning time $t+4$ to time $t+5$. $Crisis$ is a dummy variable that takes the value 1 between 12/2007 and 06/2009 and 0 otherwise.

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: RCA CPPI 3-month return, $R^{CPPI}_{t+1,t+4}$

	(1)	(2)	(3)	(4)	(5)	(6)
$U_t(1)$	-19.73***			-21.35***		
	(-14.42)			(-14.72)		
$U_t(3)$		-20.02***			-21.87***	
		(-14.52)			(-14.96)	
$U_t(12)$			-38.09***			-41.95***
			(-14.84)			(-15.60)
$SMB_{t+1,t+4}$				0.0371*	0.0427*	0.0562***
				(1.70)	(1.96)	(2.62)
$HML_{t+1,t+4}$				-0.0351**	-0.0356**	-0.0356**
				(-2.23)	(-2.28)	(-2.33)
$MOM_{t+1,t+4}$				-0.0256**	-0.0271**	-0.0216*
				(-2.10)	(-2.24)	(-1.85)
$MKT_{t+1,t+4}$				-0.0431***	-0.0466***	-0.0524***
				(-3.12)	(-3.40)	(-3.87)
Crisis	-2.073***	-1.879***	-1.067**	-2.242***	-2.026***	-1.114**
	(-5.10)	(-4.54)	(-2.38)	(-5.60)	(-5.00)	(-2.57)
Constant	14.36***	17.27***	36.00***	15.52***	18.84***	39.61***
	(16.13)	(15.93)	(15.52)	(16.27)	(16.24)	(16.22)
Observations	210	210	210	210	210	210
R^2	0.779	0.781	0.785	0.794	0.797	0.806

This table shows the results of regressing the 3-month returns of RCA CPPI index on 2-period lagged macro-risk factors and contemporaneous standard risk factors. The dependent variable is $R^{CPPI}_{t+1,t+4}$. $U_t(h)$ is the h-month ahead macroeconomic uncertainty index in Jurado, Ludvigson, and Ng (2015). $SMB_{t+1,t+4}$, $HML_{t+1,t+4}$, $MOM_{t+1,t+4}$ and $MKT_{t+1,t+4}$ are the Fama-French-Carhart 4-factor returns spanning time $t+1$ to time $t+4$. *Crisis* is a dummy variable that takes the value 1 between 12/2007 and 06/2009 and 0 otherwise.

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: RCA CPPI 6-month return, $R^{CPPI}_{t+1,t+7}$

	(1)	(2)	(3)	(4)	(5)	(6)
$U_t(1)$	-36.02***			-39.76***		
	(-14.47)			(-14.33)		
$U_t(3)$		-36.97***			-41.45***	
		(-14.92)			(-14.96)	
$U_t(12)$			-71.96***			-81.38***
			(-16.04)			(-16.29)
$SMB_{t+1,t+7}$				0.0388	0.0482*	0.0772***
				(1.32)	(1.67)	(2.76)
$HML_{t+1,t+7}$				-0.0157	-0.0138	-0.0208
				(-0.72)	(-0.64)	(-1.02)
$MOM_{t+1,t+7}$				-0.0487***	-0.0544***	-0.0503***
				(-2.89)	(-3.28)	(-3.22)
$MKT_{t+1,t+7}$				-0.0264	-0.0319*	-0.0442***
				(-1.53)	(-1.88)	(-2.69)
Crisis	-5.137***	-4.690***	-2.967***	-5.345***	-4.854***	-2.970***
	(-6.95)	(-6.31)	(-3.78)	(-7.14)	(-6.50)	(-3.82)
Constant	26.58***	32.25***	68.28***	29.20***	35.98***	77.02***
	(16.42)	(16.55)	(16.83)	(15.93)	(16.31)	(16.95)
Observations	209	209	209	209	209	209
R^2	0.807	0.813	0.827	0.816	0.824	0.840

This table shows the results of regressing the 6-month returns of RCA CPPI index on 2-period lagged macro-risk factors and contemporaneous standard risk factors. The dependent variable is $R^{CPPI}_{t+1,t+7}$. $U_t(h)$ is the h-month ahead macroeconomic uncertainty index in Jurado, Ludvigson, and Ng (2015). $SMB_{t+1,t+7}$, $HML_{t+1,t+7}$, $MOM_{t+1,t+7}$ and $MKT_{t+1,t+7}$ are the Fama-French-Carhart 4-factor returns spanning time $t+1$ to time $t+7$. *Crisis* is a dummy variable that takes the value 1 between 12/2007 and 06/2009 and 0 otherwise.

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11: RCA CPPI 12-month return, $R^{CPPI}_{t+1,t+13}$

	(1)	(2)	(3)	(4)	(5)	(6)
$U_t(1)$	-52.68***			-57.30***		
	(-10.51)			(-12.21)		
$U_t(3)$		-54.92***			-60.31***	
		(-11.03)			(-12.94)	
$U_t(12)$			-112.5***			-121.1***
			(-12.78)			(-14.26)
$SMB_{t+1,t+13}$				-0.105***	-0.0939**	-0.0558
				(-2.81)	(-2.57)	(-1.58)
$HML_{t+1,t+13}$				0.129***	0.135***	0.128***
				(4.14)	(4.44)	(4.43)
$MOM_{t+1,t+13}$				-0.0363*	-0.0405*	-0.0480**
				(-1.67)	(-1.91)	(-2.37)
$MKT_{t+1,t+13}$				0.0775***	0.0732***	0.0532***
				(4.03)	(3.90)	(2.94)
$Crisis$	-14.00***	-13.16***	-9.806***	-12.22***	-11.39***	-8.744***
	(-9.44)	(-8.83)	(-6.38)	(-8.21)	(-7.74)	(-5.86)
Constant	40.96***	49.90***	108.5***	43.54***	53.74***	116.0***
	(12.54)	(12.73)	(13.62)	(14.16)	(14.57)	(15.06)
Observations	203	203	203	203	203	203
R^2	0.786	0.793	0.817	0.841	0.849	0.862

This table shows the results of regressing the 12-month returns of RCA CPPI index on 2-period lagged macro-risk factors and contemporaneous standard risk factors. The dependent variable is $R^{CPPI}_{t+1,t+13}$. $U_t(h)$ is the h-month ahead macroeconomic uncertainty index in Jurado, Ludvigson, and Ng (2015). $SMB_{t+1,t+13}$, $HML_{t+1,t+13}$, $MOM_{t+1,t+13}$ and $MKT_{t+1,t+13}$ are the Fama-French-Carhart 4-factor returns spanning time $t+1$ to time $t+13$. $Crisis$ is a dummy variable that takes the value 1 between 12/2007 and 06/2009 and 0 otherwise.

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 12: RCA CPPI 24-month return, $R^{CPPI}_{t+1,t+25}$

	(1)	(2)	(3)	(4)	(5)	(6)
$U_t(1)$	-60.79***			-60.92***		
	(-4.38)			(-6.65)		
$U_t(3)$		-64.76***			-64.75***	
		(-4.65)			(-7.04)	
$U_t(12)$			-141.7***			-129.9***
			(-5.55)			(-7.58)
$SMB_{t+1,t+25}$				0.00837	0.0216	0.0405
				(0.14)	(0.37)	(0.70)
$HML_{t+1,t+25}$				0.347***	0.347***	0.356***
				(7.16)	(7.27)	(7.64)
$MOM_{t+1,t+25}$				0.172***	0.171***	0.161***
				(5.06)	(5.09)	(4.90)
$MKT_{t+1,t+25}$				0.299***	0.297***	0.284***
				(14.35)	(14.47)	(14.17)
$Crisis$	-25.98***	-24.71***	-19.50***	-16.53***	-15.50***	-12.55***
	(-6.40)	(-5.99)	(-4.41)	(-5.80)	(-5.42)	(-4.18)
Constant	53.12***	64.53***	141.7***	46.12***	57.41***	124.2***
	(5.85)	(5.86)	(6.13)	(7.86)	(8.05)	(8.06)
Observations	191	191	191	191	191	191
R^2	0.533	0.539	0.558	0.839	0.843	0.848

This table shows the results of regressing the 24-month returns of RCA CPPI index on 2-period lagged macro-risk factors and contemporaneous standard risk factors. The dependent variable is $R^{CPPI}_{t+1,t+25}$. $U_t(h)$ is the h-month ahead macroeconomic uncertainty index in Jurado, Ludvigson, and Ng (2015). $SMB_{t+1,t+25}$, $HML_{t+1,t+25}$, $MOM_{t+1,t+25}$ and $MKT_{t+1,t+25}$ are the Fama-French-Carhart 4-factor returns spanning time $t+1$ to time $t+25$. $Crisis$ is a dummy variable that takes the value 1 between 12/2007 and 06/2009 and 0 otherwise.
t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 13: RCA CPPI 1-month return, $R^{CPPI}_{t+1,t+2}$

	(1)	(2)	(3)	(4)	(5)	(6)
$U_t(1)$	-7.959***			-7.984***		
	(-13.25)			(-13.18)		
$U_t(1) \times Crisis$	3.441***			3.128***		
	(3.39)			(3.01)		
$U_t(3)$		-8.027***			-8.082***	
		(-13.17)			(-13.12)	
$U_t(3) \times Crisis$		3.490***			3.192***	
		(3.39)			(3.03)	
$U_t(12)$			-14.35***			-14.54***
			(-13.02)			(-13.08)
$U_t(12) \times Crisis$			5.518***			4.865**
			(2.65)			(2.29)
$SMB_{t+1,t+2}$				0.0106	0.0122	0.0152
				(0.91)	(1.04)	(1.28)
$HML_{t+1,t+2}$				-0.0116	-0.0113	-0.0116
				(-1.10)	(-1.07)	(-1.09)
$UMD_{t+1,t+2}$				-0.000693	-0.00118	-0.000473
				(-0.11)	(-0.18)	(-0.07)
$MKT_{t+1,t+2}$				-0.0177**	-0.0187**	-0.0203**
				(-2.17)	(-2.29)	(-2.46)
$Crisis$	-3.316***	-3.789***	-5.828***	-3.103***	-3.544***	-5.193**
	(-4.07)	(-3.91)	(-2.78)	(-3.74)	(-3.59)	(-2.44)
Constant	5.668***	6.807***	13.48***	5.698***	6.864***	13.66***
	(14.53)	(14.22)	(13.53)	(14.47)	(14.18)	(13.59)
Observations	210	210	210	210	210	210
R^2	0.759	0.757	0.752	0.767	0.766	0.762

This table shows the results of regressing the 1-month returns of RCA CPPI index on 2-period lagged macro-risk factors and contemporaneous standard risk factors. The dependent variable is $R^{CPPI}_{t+1,t+2}$. $U_t(h)$ is the h-month ahead macroeconomic uncertainty index in Jurado, Ludvigson, and Ng (2015). $SMB_{t+1,t+2}$, $HML_{t+1,t+2}$, $MOM_{t+1,t+2}$ and $MKT_{t+1,t+2}$ are the Fama-French-Carhart 4-factor returns spanning time $t+1$ to time $t+2$. $Crisis$ is a dummy variable that takes the value 1 between 12/2007 and 06/2009 and 0 otherwise.

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 14: RCA CPPI 1-month return, $R^{CPPI}_{t+1,t+2}$

	(1)	(2)	(3)	(4)	(5)	(6)
$U_t(1)$	-9.342***			-9.267***		
	(-8.77)			(-8.48)		
$U_{t+2}(1)$	3.196***			2.905**		
	(2.73)			(2.41)		
$U_t(3)$		-10.30***			-10.24***	
		(-9.32)			(-8.97)	
$U_{t+2}(3)$		4.279***			3.977***	
		(3.53)			(3.16)	
$U_t(12)$			-21.69***			-21.53***
			(-10.16)			(-9.79)
$U_{t+2}(12)$			10.68***			10.01***
			(4.60)			(4.17)
$SMB_{t+1,t+2}$				0.00677	0.00862	0.0132
				(0.57)	(0.73)	(1.15)
$HML_{t+1,t+2}$				-0.0202*	-0.0204*	-0.0179*
				(-1.94)	(-1.96)	(-1.77)
$UMD_{t+1,t+2}$				-0.00446	-0.00560	-0.00534
				(-0.68)	(-0.86)	(-0.84)
$MKT_{t+1,t+2}$				-0.0164*	-0.0157*	-0.0164**
				(-1.96)	(-1.89)	(-2.01)
Crisis	-0.785***	-0.784***	-0.603***	-0.805***	-0.797***	-0.601***
	(-4.90)	(-4.84)	(-3.49)	(-5.04)	(-4.94)	(-3.49)
Constant	4.500***	5.246***	10.48***	4.657***	5.451***	10.95***
	(12.88)	(12.41)	(11.74)	(13.04)	(12.57)	(11.98)
Observations	209	209	209	209	209	209
R^2	0.754	0.758	0.767	0.763	0.767	0.775

This table shows the results of regressing the 1-month returns of RCA CPPI index on 2-period lagged macro-risk factors, contemporaneous macro-risk factors, and contemporaneous standard risk factors. The dependent variable is $R^{CPPI}_{t+1,t+2}$. $U_t(h)$ is the h-month ahead macroeconomic uncertainty index in Jurado, Ludvigson, and Ng (2015). $SMB_{t+1,t+2}$, $HML_{t+1,t+2}$, $MOM_{t+1,t+2}$ and $MKT_{t+1,t+2}$ are the Fama-French-Carhart 4-factor returns spanning time $t+1$ to time $t+2$. *Crisis* is a dummy variable that takes the value 1 between 12/2007 and 06/2009 and 0 otherwise.

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 15: 1-month Ziman Equity REITs price index unlevered returns, $R^{ZimanU}_{t,t+1}$

	(1)	(2)	(3)	(4)	(5)	(6)
$U_t(1)$	-3.142			1.105		
	(-0.80)			(0.37)		
$U_t(3)$		-3.414			1.152	
		(-0.86)			(0.38)	
$U_t(12)$			-6.790			1.864
			(-0.91)			(0.32)
$SMB_{t,t+1}$				0.182***	0.182***	0.182***
				(2.66)	(2.66)	(2.66)
$HML_{t,t+1}$				0.234***	0.234***	0.234***
				(3.90)	(3.90)	(3.90)
$MOM_{t,t+1}$				0.0217	0.0219	0.0214
				(0.58)	(0.59)	(0.58)
$MKT_{t,t+1}$				0.446***	0.447***	0.446***
				(9.34)	(9.32)	(9.30)
$Crisis$	-1.137	-1.055	-0.879	-0.679	-0.695	-0.696
	(-0.98)	(-0.89)	(-0.67)	(-0.78)	(-0.78)	(-0.71)
Constant	2.736	3.377	6.836	-0.470	-0.658	-1.439
	(1.07)	(1.08)	(1.01)	(-0.24)	(-0.27)	(-0.28)
Observations	210	210	210	210	210	210
R^2	0.031	0.031	0.032	0.466	0.466	0.466

This table shows the results of regressing 1-month unlevered returns of Ziman Equity REITs price index on 1-period lagged macroeconomic uncertainty and contemporaneous standard risk factors. The sample period is between 2001 and 2018. The dependent variable is $R^{UnleveredREITs}_{t,t+1}$. $U_t(h)$ is the h-month ahead macroeconomic uncertainty index in Jurado, Ludvigson, and Ng (2015). $SMB_{t,t+1}$, $HML_{t,t+1}$, $MOM_{t,t+1}$ and $MKT_{t,t+1}$ are the Fama-French-Carhart 4-factor returns spanning time t to time $t+1$. $Crisis$ is a dummy variable that takes the value 1 between 12/2007 and 06/2009 and 0 otherwise.

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 16: 1-month Ziman All Equity REITs price index levered returns, $R^{ZimanL}_{t,t+1}$

	(1)	(2)	(3)	(4)	(5)	(6)
$U_t(1)$	-6.613			0.596		
	(-0.86)			(0.11)		
$U_t(3)$		-7.055			0.724	
		(-0.91)			(0.13)	
$U_t(12)$			-13.20			1.716
			(-0.91)			(0.16)
$SMB_{t,t+1}$				0.349***	0.349***	0.348***
				(2.75)	(2.75)	(2.73)
$HML_{t,t+1}$				0.585***	0.585***	0.585***
				(5.23)	(5.23)	(5.23)
$MOM_{t,t+1}$				-0.0676	-0.0673	-0.0670
				(-0.98)	(-0.97)	(-0.97)
$MKT_{t,t+1}$				0.821***	0.822***	0.823***
				(9.22)	(9.21)	(9.20)
$Crisis$	-2.057	-1.915	-1.671	-1.139	-1.170	-1.244
	(-0.91)	(-0.82)	(-0.66)	(-0.70)	(-0.70)	(-0.68)
Constant	5.254	6.501	12.90	-0.261	-0.442	-1.426
	(1.06)	(1.07)	(0.98)	(-0.07)	(-0.10)	(-0.15)
Observations	210	210	210	210	210	210
R^2	0.030	0.031	0.031	0.512	0.512	0.512

This table shows the results of regressing 1-month levered returns of Ziman All Equity REITs price index on 1-period lagged macroeconomic uncertainty and contemporaneous standard risk factors. The sample period is between 2001 and 2018. The dependent variable is $R^{Nareit}_{t,t+1}$. $U_t(h)$ is the h-month ahead macroeconomic uncertainty index in Jurado, Ludvigson, and Ng (2015). $SMB_{t,t+1}$, $HML_{t,t+1}$, $MOM_{t,t+1}$ and $MKT_{t,t+1}$ are the Fama-French-Carhart 4-factor returns spanning time t to time $t+1$. $Crisis$ is a dummy variable that takes the value 1 between 12/2007 and 06/2009 and 0 otherwise.
t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 17: 1-month Ziman Equity REITs price index unlevered returns, $R^{ZimanU}_{t+1,t+2}$

	(1)	(2)	(3)	(4)	(5)	(6)
$U_t(1)$	-0.219			1.812		
	(-0.06)			(0.63)		
$U_t(3)$		-0.195			1.930	
		(-0.05)			(0.66)	
$U_t(12)$			-0.664			3.728
			(-0.09)			(0.68)
$SMB_{t+1,t+2}$				0.180***	0.180***	0.179***
				(2.65)	(2.64)	(2.61)
$HML_{t+1,t+2}$				0.234***	0.234***	0.234***
				(3.91)	(3.91)	(3.90)
$MOM_{t+1,t+2}$				0.0239	0.0243	0.0240
				(0.64)	(0.65)	(0.65)
$MKT_{t+1,t+2}$				0.448***	0.448***	0.449***
				(9.45)	(9.45)	(9.44)
$Crisis$	-1.797	-1.801	-1.753	-0.814	-0.850	-0.935
	(-1.62)	(-1.59)	(-1.41)	(-0.98)	(-1.00)	(-1.00)
Constant	0.847	0.857	1.305	-0.931	-1.271	-3.126
	(0.35)	(0.29)	(0.20)	(-0.50)	(-0.55)	(-0.63)
Observations	210	210	210	210	210	210
R^2	0.028	0.028	0.028	0.466	0.467	0.467

This table shows the results of regressing 1-month unlevered returns of Ziman Equity REITs price index on 2-period lagged macroeconomic uncertainty and contemporaneous standard risk factors. The sample period is between 2001 and 2018. The dependent variable is $R^{UnleveredREITs}_{t,t+1}$. $U_t(h)$ is the h-month ahead macroeconomic uncertainty index in Jurado, Ludvigson, and Ng (2015). $SMB_{t+1,t+2}$, $HML_{t+1,t+2}$, $MOM_{t+1,t+2}$ and $MKT_{t+1,t+2}$ are the Fama-French-Carhart 4-factor returns spanning time $t+1$ to time $t+2$. $Crisis$ is a dummy variable that takes the value 1 between 12/2007 and 06/2009 and 0 otherwise.

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 18: 1-month Ziman All Equity REITs price index levered returns, $R^{ZimanL}_{t+1,t+2}$

	(1)	(2)	(3)	(4)	(5)	(6)
$U_t(1)$	-0.607			1.996		
	(-0.08)			(0.37)		
$U_t(3)$		-0.472			2.246	
		(-0.06)			(0.41)	
$U_t(12)$			-0.921			5.131
			(-0.07)			(0.50)
$SMB_{t+1,t+2}$				0.346***	0.345***	0.343***
				(2.73)	(2.72)	(2.69)
$HML_{t+1,t+2}$				0.585***	0.585***	0.585***
				(5.24)	(5.24)	(5.23)
$MOM_{t+1,t+2}$				-0.0640	-0.0633	-0.0626
				(-0.92)	(-0.91)	(-0.90)
$MKT_{t+1,t+2}$				0.825***	0.826***	0.828***
				(9.34)	(9.34)	(9.34)
$Crisis$	-3.416	-3.442	-3.420	-1.420	-1.484	-1.687
	(-1.58)	(-1.55)	(-1.41)	(-0.91)	(-0.93)	(-0.97)
Constant	1.372	1.349	1.811	-1.171	-1.640	-4.517
	(0.29)	(0.23)	(0.14)	(-0.34)	(-0.38)	(-0.49)
Observations	210	210	210	210	210	210
R^2	0.027	0.027	0.027	0.512	0.512	0.513

This table shows the results of regressing 1-month levered returns of Ziman All Equity REITs price index on 2-period lagged macroeconomic uncertainty and contemporaneous standard risk factors. The sample period is between 2001 and 2018. The dependent variable is $R^{Nareit}_{t,t+1}$. $U_t(h)$ is the h-month ahead macroeconomic uncertainty index in Jurado, Ludvigson, and Ng (2015). $SMB_{t+1,t+2}$, $HML_{t+1,t+2}$, $MOM_{t+1,t+2}$ and $MKT_{t+1,t+2}$ are the Fama-French-Carhart 4-factor returns spanning time $t+1$ to time $t+2$. $Crisis$ is a dummy variable that takes the value 1 between 12/2007 and 06/2009 and 0 otherwise.

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 19: 1-quarter demand-side index returns by major metro area

	LA	SF	CHI	DC	BOS	NYC
$U_t(1)$	-11.63***	-17.90***	-10.15**	13.45	-8.81*	-24.65*
	(-3.51)	(-4.85)	(-2.46)	(1.00)	(-1.76)	(-1.90)
$U_t(3)$	-11.73***	-18.00***	-10.53**	10.74	-9.27*	-26.35**
	(-3.50)	(-4.82)	(-2.54)	(0.79)	(-1.83)	(-2.01)
$U_t(12)$	-24.41***	-35.16***	-20.89***	12.67	-17.87*	-53.61**
	(-4.13)	(-5.32)	(-2.78)	(0.50)	(-1.94)	(-2.26)

This table shows the condensed results from 18 separate regressions of 1-quarter demand-side index returns on 2-period lagged macroeconomic uncertainty and contemporaneous standard risk factors. Each column shows the coefficients of the 2-period macroeconomic uncertainty over different time horizons, by major metro area. The sample period is between 2005 and 2018 with 54 quarterly observations. $U_t(h)$ is the h-month ahead macroeconomic uncertainty index in Jurado, Ludvigson, and Ng (2015). The control variables, $SMB_{t+1,t+2}$, $HML_{t+1,t+2}$, $MOM_{t+1,t+2}$, $MKT_{t+1,t+2}$, and $Crisis$ (a dummy variable that takes the value 1 between 12/2007 and 06/2009 and 0 otherwise), are omitted and not shown here.

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$