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Economic Policy Uncertainty and Real Estate Market: Evidence from U.S. REITs

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We examine how economic policy uncertainty (EPU) affects the monthly performance of U.S. real estate investment trusts (REITs) from 1985 to 2018. First, a positive shock in EPU impairs contemporaneous REIT returns but predicts higher positive future returns. Such a return reversion has not been previously documented, and we provide some explanations. Second, although EPU can explain for the current returns of both equity and mortgage REITs, EPU is unable to predict the future returns of mortgage REITs. Third, breaking down the main EPU index into its four components, we find that the impact of EPU is primarily from the broad newspaper coverage of policy-related economic uncertainties while the other components are less influential. Our results indicate that policy uncertainty can affect the value of real estate assets, and EPU is an economically important factor for understanding and pricing REITs.

Keywords

Economic Policy Uncertainty, Real Estate Market, REITs, Causality, Forecasting

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1. Introduction

Economic policy uncertainty or EPU is a term recently coined by Baker et al. (2016),[1] which is primarily based on newspaper coverage frequency. This index has been tested in many areas, such as accounting, economics, and finance (see for example, Gulen and Ion, 2016; Bonaime et al., 2017; Nguyen and Phan, 2017; Nagar et al., 2019). However, very few studies have examined how EPU affects the performance of U.S. real estate investment trusts (REITs).[2] Thus, we fill this gap in the literature by investigating the relationship between EPU and REIT performance and how changes in EPU influence the real estate market.

To measure policy-related economic uncertainty, Baker et al. (2016) construct an index from four underlying components. The first component (NEWS) quantifies the newspaper coverage of policy-related economic uncertainties. The second component (TAX) reflects the number of federal tax code provisions set to expire in future years. The third component (CPI) uses discrepancies among the consumer price index (CPI) forecasts and the fourth component(FSL) is the federal/state/local purchase disagreements measure. The EPU is then the average value of these four components.

In this study, we offer several significant findings to the extant literature. First, we provide evidence that changes in EPU Granger cause REIT returns. Second, our lead-lag robust regressions reveal that a positive shock in EPU impairs contemporaneous REIT returns but can predict higher positive future returns. In previous studies on EPU, none have ever reported a return reversion. In this study, we also provide explanations on this return reversion. Third, although EPU can explain for the current returns of both equity and mortgage REITs (EREITs and MREITs), EPU cannot predict the future returns of MREITs. Last, breaking down the main EPU index into its four components, we find that the source of the impact of EPU on REITs comes primarily from the broad newspaper coverage of policy-related economic uncertainties while the other three elements are less influential.

2. The Link Between EPU and REIT Returns

REITs are unique publicly-traded securities and we argue that it is worthwhile to study the relationship between EPU and REITs. We list several vital differences between REITs and traditional stocks here.

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[1] http://www.policyuncertainty.com/index.html

[2] Very few studies have looked into the effect of EPU on the real estate market (see André et al. 2017).

First, both REITs and general stocks can provide a steady stream of income for investors. However, some stocks do not pay dividends, while REITs have strict requirements for dividend policies. At least ninety percent of the taxable income of REITs is required by tax laws to be distributed as dividends. Second, for typical stocks, dividend increases may signal the confidence of management in the economic outlook and potential company growth. REITs consistently distribute this cash to investors. These dividend payments can fluctuate from one period to another, but the changes in these distributions do not necessarily indicate management signals of growth prospects. Third, REITs are typically capitalized with lower levels of debt, as compared to typical corporations. Fourth, the main advantage of a REIT status is no corporate or trust taxation. With qualifying REITs, only the dividends are taxed at the taxation rate of the investors. Common stocks, on the other hand, are subject to double taxation.

In this study, we focus on the relationship between the changes in the EPU index and REIT returns. Why would economic uncertainty be related to REIT returns? We provide our rationale as follows.

First, higher uncertainty reduces REIT investments. The importance of timing or delay real option is expected to be higher for irreversible investment projects with more uncertainty, according to Bernanke (1983), Rodrik (1991), and Riedel and Su (2011). Managers wait for additional information and delay projects, with the aim to better gauge the profitability of their investment projects. This delay reduces their current investments under more uncertainty. Also, since the uncertainty increases defaults, the cost of external financing would, therefore, be higher (Gilchrist et al., 2014). Thus, uncertainty would increase equity risk premiums and the cost of equity (Pástor and Veronesi, 2013). Wisniewski and Lambe (2015) find that variations in EPU affect credit default swap (CDS) spread. Under such an environment with financial friction where the cost of capital increases due to higher uncertainty, REIT managers are less willing and discouraged from making more investments. Using EPU data, Gulen and Ion (2016) show that there is a significant and negative relationship between corporate investments and uncertainty.

Second, high levels of uncertainty impact the typical REIT capital structure as REITs tend to use more external financing. Feng et al. (2007) list several attributes that make REITs unique and attractive in capital structure studies as a separate industry. REITs are tax-exempt, as long as they distribute the minimum amount of dividends. Since REITs distribute most of their earnings as dividends, managers face constraints in growing and using internal funding due to rules around their existence and legal status. Therefore, they need to rely on external financing for growth opportunities. As a result, increased economic uncertainty likely has an impact on REIT returns because REITs use leverage in their capital structure.

Third, higher uncertainty increases cash flow uncertainty that affect the dividend payout of REITs. REITs are unique because the regulatory environment forces them to pay dividends that yield high payout ratios. Baker and Wurgler (2006) relate sentiment to dividends. They propose that investors are likely to switch and migrate between asset classes under certain circumstances, in the search for stable dividends. EPU affects investor sentiment, and Baker and Wurgler (2004) argue that companies could change dividends to cater to the needs and demands of investors. Hardin and Hill (2008) investigate the determinants of discretionary REIT dividends and argue that access to external capital affects the dividend policy of managers. Thus, a higher cost of capital for both debt and equity caused by higher uncertainty also reduces excess dividend payments. Therefore, EPU has an impact on the decision of managers to pay dividends that exceed the regulated minimum. Bradley et al. (1998) show that REITs with higher volatility in cash flow uncertainty have lower dividend payout ratios.

Fourth, a significant dynamic relationship is found between EPU and macroeconomic variables. Baker et al. (2016) find that an increase in EPU foreshadows a decline in economic growth and employment in the following months. Many earlier studies, such as Chan et al. (1990) and Ling and Naranjo (1997), suggest that certain macroeconomic variables are associated with U.S. real estate asset returns. The macroeconomic variables in Chen et al. (1986) have all been extensively tested in the literature (see Lee and Chiang, 2004, and Liu and Zhang, 2008), and many of these variables are significantly related to REIT returns (Lee and Chiang, 2004 and Hansz et al., 2017). Ample evidence convinces us that REIT returns are related to certain macroeconomic variables, which are then affected by EPU.

The remainder of the paper proceeds as follows: we describe our data in Section 3; Section 4 covers our empirical methodology; we present our results in Section 5, and Section 6 is a discussion of the findings and conclusion.

3. Data

We obtain the monthly EPU index and data of its four components from www.policyuncertainty.com.[3] Meanwhile, we collect monthly REIT data from the CRSP/Ziman U.S. Real Estate Data Series from 1985 to 2018.[4] The CRSP/Ziman database includes all REITs traded on the NYSE, AMEX, and

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[3] Note that EPU and its related data started in January 1985, while CRSP/Ziman REIT data started in January 1980.

[4] Findings based on equally weighted indices are substantively similar. In the interest of brevity, we report only the value-weighted results. Full results are available from the authors upon request.

NASDAQ exchanges since 1980.[5] The database compiles REIT indices based on a universe of REITs that fit its selection criteria. The CRSP/Ziman database further separates this REIT universe into EREITs and MREITs.[6] The CRSP/Ziman database also provides sectoral REIT indices, including healthcare, industrial/office, residential, lodging/resort, retail, self-storage, and unclassified.[7] Finally, this database also reports monthly dividend yield and price appreciation for the entire REIT industry.

Other than the EPU and REIT data, we collect macroeconomic variables used in previous real estate studies (Chan et al., 1990; Ling et al., 2000; Lee and Chiang, 2004; Hansz et al., 2017). We obtain the relevant macroeconomic factors, including the industrial production growth (IPG) rate, unexpected inflation rate (UIR), term structure, risk premium, 30-year fixed mortgage rates, and new privately-owned housing, from the Federal Reserve Bank of St. Louis (see Liu and Zhang, 2008). Our control variable, the seasonally adjusted institutional money funds (IMF) proxied for funding liquidity, is also obtained from the Federal Reserve Bank of St. Louis.[8]

4. Methodologies

4.1 EPU Index and REIT Returns

As mentioned earlier, the EPU baseline index is a combination of four components: NEWS, TAX, and (CPI+FSL). However, different components have different weight when constructing the EPU index. To create an overall index of policy-related economy uncertainty, Baker et al. (2016) first normalize each component by its standard deviation before January 2012.

They then calculate the average component values, by using weights of 1/2 on their index of broad newspaper coverage of policy-related economic uncertainties (NEWS) and 1/6 on each of the other measures (TAX, CPI, and FSL).

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[5] Combining data on stock prices and returns with carefully researched information regarding the population, characteristics, and history of REITs, the CRSP/Ziman database provides firm-specific information and indices essential to REIT analyses. The CRSP/Ziman database is widely used in recent REIT-related studies, including Ling, Naranjo and Ryngaert (2012) and Ling and Naranjo (2015) and others.

[6] The CRSP/Ziman database categorizes REITs into equity, mortgage, and hybrid REITs. Hybrid REITs hold a mix of EREITs and MREITs, and are not included in our study.

[7] According to the CRSP, an “unclassified” sector is a catch-all category for asset returns that do not fit into any of the six explicit classifications (see Ro and Ziobrowski, 2011 for detailed explanation of this category).

[8] Data is from https://fred.stlouisfed.org/series/IMFSL

On the one hand, variables in a regression model must be stationary without unit root representation. As such, based on our unit root test results, we use the first difference of the natural log of the EPU baseline index as follows:

$$\Delta EPU_t = \ln(EPU_t) - \ln(EPU_{t-1}) \tag{1}$$

On the other hand, also based on our unit root test results, the REIT total market value index (TIND) is non-stationary with unit root representation. Therefore, we also use the first difference of the TIND index in our statistical models. We define the total returns of REITs (TRET), as follows:

$$TRET_t = \ln(TIND_t) - \ln(TIND_{t-1}) \tag{2}$$

where *v* is a REIT firm, *i* is the market value at time *t*, and ln() is a natural logarithm function.

4.2 Granger Causality Test

We apply a Granger (1969) causality test to investigate the causal relationship between ΔEPU and REIT returns.[9] A Granger causality test identifies if one variable improves the forecasting performance of another variable. In other words, this test measures if lags of the ΔEPU explain for current REIT returns. We use the Granger causality test as follows:

$$\Delta X_t = \upsilon + \Gamma_1 \Delta X_{t-1} + \ldots + \Gamma_k \Delta X_{t-k} + \varepsilon_t, \qquad t = 1, \ldots, \mathrm{T} \tag{3}$$

where ΔX_t is a (2 x 1) matrix of annual $TRET_t$ and ΔEPU_t. υ is a (2 x 1) vector of constants, Γ is a (2 x 2) matrix of beta coefficients. ΔX_{t-k} is a (2 x 1) matrix of lagged endogenous variables. *k* is the number of lags determined by the selection of the optimal lag length tests and ε_t is a (2 x 1) matrix of white noise error terms. Thus, ΔEPU Granger-causes TRET if the F-test statistic that measures the coefficients of all of the lagged ΔEPU is jointly significant.

In addition to the Granger-causality test, we conduct impulse response function (IRF) and Cholesky variance decomposition (CVD) tests to see if ΔEPU and TRET affect each other equally. We report the percentage of the forecast error variance of one variable explained by both itself and another variable. The IRF shows how the return of one index responds to a standard deviation shock to itself and the return of another index (see Wheaton, 1999). We report up to 6 periods (months) for the IRF after the shock. The IRF results help us to

[9] We conduct the Johansen (1991) tests for cointegration between the total value of the REIT and the adjusted level of the EPU index. Given that EPU is stationary, we convert it into a non-stationary index in the cointegration test. Thus, we first demean (subtract by 100) each EPU value, and then divide it by 1000. We use a base value of 100 for 198,501), and find no cointegration relation between these two variables. Therefore, we do not consider the Granger (1988) causality test conditional on cointegration.

understand if shocks of one variable have a permanent or transitory effect on another variable in the system.

4.3 Contemporaneous and Lead-Lag Forecasting Models

We investigate the relationship between ΔEPU and the TRET: contemporaneous and forecasted. In the contemporaneous model (n = 0), the endogenous variable—TRET and the exogenous variable—ΔEPU, and all of the other control variables are measured in the same month. We also test the predictive power of ΔEPU by lagging it one month at a time, and report up to six-months of forecasting results (n = 1,…,6), which is six months after an innovation occurs in the ΔEPU index.[10] We construct the model as follows:

$$TRET_t = \alpha_0 + \beta_1{}^{*}\Delta EPU_{t-n} + B^{*}X_t + \varepsilon_t, \qquad n = 0,1,\dots,6. \tag{4}$$

where X is a vector of factors [IPG, UIR, TSR, DRP, MTR, and NHS] that have been used frequently in the real estate literature to control for macroeconomic risks (see Lee and Chiang, 2004, Liu and Zhang, 2008, Hansz et al., 2017, and Zhang and Hansz, 2022). IPG is the U.S. industrial production growth rate, UIR is the unexpected inflation rate, TSR is the difference between the 20-year and 1-year U.S. Treasury yields, which measure the term structure of the yield curve. DRP is the yield difference between the BAA-AAA credit ratings, which measures the default risk premium; MTR is the change in the U.S. 30-year fixed mortgage rate; and NHS is the change in new private housing starts. B is a vector of the coefficients for these macroeconomic factors from β_2 to β_7. The vector of coefficients, from β_2 to β_7, show the risk exposure of each macroeconomic factor, respectively. We focus on the magnitude and sign of the coefficient β_1 on the ΔEPU. To most investors, the ability to predict subsequent REIT returns is more important than explaining for contemporaneous returns. Thus, we pay close attention to the past ΔEPU to see if any lagged ΔEPU can predict future REIT returns. We test each lagged ΔEPU in a separate regression. For instance, we test the one-month predictive power of ΔEPU_{t-1} by lagging the variable by one month (n = 1). In all of our lead-lag models, we control for heteroscedastic errors by using robust statistics and control for multicollinearity by using a variance inflation factor (VIF).

4.4 Controlling for REIT Sectors

Feng et al. (2011) show that property sectors have different profit margins, expense and dividend payout ratios, and operating characteristics. Ghysels et al. (2012) show that property sectors could exhibit different predictability factors. Alcock et al. (2013) report that the degree of concentration varies in

[10] We test the predictive power of ΔEPU up to 12 months and find no significant results after the sixth month. Results after t=6 are not tabulated but available from the authors upon request.

different property sectors. The CRSP/Ziman database categorizes the REIT industry into seven sectors. Each sector has individual characteristics that may or may not influence the predictive power of EPU. We conduct separate regressions to control for the REIT sectors. We also control for macroeconomic factors in our separate regressions to assess the result of ΔEPU on the performance of sectoral REITs:

$$\mathrm{R}_{i,t} = \theta_0 + \theta_1{}^{*}\Delta EPU_{t-n} + \mathrm{C}^{*}\mathrm{X}_t + \mathrm{e}_t, \qquad n = 0,1,\dots,6. \tag{5}$$

where $R_{i,t}$ represents the return of a sectoral REIT in sector *i* in month *t*. θ_2 to θ_7, represented by vector C, are coefficients of controlled macroeconomic factors in vector X. e_t is the error term in the model.

4.5 Controlling for Funding Liquidity

Institutional investor trading has been proven to be related to REIT returns. Chan et al. (1998) state that institutional investors did not participate actively in REIT investments before 1990. However, after 1990, institutional investors started to invest more of their funds in REITs than in other market stocks.

When studying real estate assets, several researchers have suggested that a common factor induced by institutional investor trading should be considered (e.g., Lee et al., 1991; Goetzmann and Massa, 2003; Gallo and Zhang, 2010; among others). Thus, we add the monthly change in the seasonally adjusted IMF (ΔIMF) as a proxy for funding liquidity in our model as follows:[11]

$$TRET_t = \alpha_0 + \beta_1{}^{*}\Delta EPU_{t-n} + \beta_2{}^{*}\Delta\mathrm{IMF}_t + \mathrm{B}^{*}\mathrm{X}_t + \varepsilon_t, n = 0,1,\dots,6. \tag{6}$$

where X is a vector of controlled macroeconomic factors defined above. B is a vector of the coefficients for these macroeconomic factors from β_3 to β_8. We focus on the magnitude and sign of the coefficient β_1 on ΔEPU and β_2 on ΔIMF.

4.6 Controlling for Lagged Dividend Yield

Chiang (2015) argues that there is a positive lagged relationship between dividend yield and REIT return. Since the former has an important role in REIT return forecasting, it is necessary to include the lagged dividend yield as an additional controlled factor. Thus, other than the six macroeconomic factors, we add the monthly REIT dividend yield (DIY) in our model as follows:

$$TRET_t = \alpha_0 + \beta_1{}^{*}\Delta EPU_{t-n} + \beta_2{}^{*}\mathrm{DIY}_{t-n} + \mathrm{B}^{*}\mathrm{X}_t + \varepsilon_t, n = 0,1,\dots,6. \tag{7}$$

where X is a vector of controlled macroeconomic factors defined above. B is a vector of the coefficients for these macroeconomic factors from β_3 to β_8.

[11] The IMF data is collected by the Investment Company Institute (ICI), a trade association for the investment company industry, and provided to the Federal Reserve Bank of St. Louis. IMF are included in the M3 money measure.

Similarly, we focus on the magnitude and sign of the coefficient β_1 on ΔEPU and β_2 on DIY.

5 Empirical Results

5.1 Descriptive Statistics

We list our primary and related variables in Table 1. In Panel A, TRET has a mean of 0.83% per month over the period of 1985-2018, with a standard deviation of 4.78%. The minimum one-month return is -30.14%, and maximum one-month return is 27.68%. The ΔEPU ranges from -64.30% to 80.25%, with a mean of 0.07% per month, and a standard deviation of 16.38%.

We provide the monthly macroeconomic variables in the regression models in Panel B. The mean IPG rate is 0.17%, mean UIR is 0.01%, mean term structure of the yield curve (TSR) is 1.97%, mean default risk premium (DRP) is 0.99%, mean fixed-rate MTR is -0.26%, and the changes in the mean NHS is -0.06%. In Panel C, we report the EREIT and MREIT return summary. The mean return of EREIT is higher than that of MREIT on average (0.88% versus 0.62%). The revenue of EREIT comes primarily from rental income and appreciation of asset reversions, while MREITs generate revenue primarily by interest earned on mortgage loans. In Panel D, we show the four components of the EPU: NEWS, TAX, and (CPI+FSL). The ΔNEWS component has an average monthly value of 0.19%, and TAX has a mean value of 0.46%. For the third component, we show that CPI has a mean value of -0.18% per month, while the fourth component, FSL has a similar mean value of -0.15% per month. Notably, the second component, TAX, has the most substantial standard deviation of 32.04% and an extensive range between its minimum value of -290.46% and its maximum value of 349.09%. Such a wide range reflects considerable uncertainty about the number of federal tax code provisions set to expire in the later years.

We plot our two main variables, ΔEPU and TRET, in Figure 1. On the one hand, TRET experienced a volatile stage during the 2007-2009 subprime mortgage crisis period. TRET decreased by -8.89% in July 2007 and continued to decline another -8.92% in the following month. TRET then fell by -16.99% in total during November 2007 to February 2008. The most significant market crash due to the subprime mortgage crisis took place in late 2008 and early 2009. For instance, the REIT market dropped by -30.14% in just one month in October 2008. The market continued to decline by -21.25% in November 2008. Moreover, from January to February 2009, the REIT market continued to fall by another -35.82% in just the two months. However, the market recovered quickly in 2009, evidenced by a 27.50% jump in April 2009 and another 28.70% increase from July to September 2009.

Table 1 Descriptive Statistics (1985-2018)

Panel A Main Variables

	Mean	Std. Dev.	Min.	Max.
TRET	0.83%	4.78%	-30.14%	27.68%
ΔEPU	0.07%	16.38%	-64.30%	80.25%

Panel B Macroeconomic Control Variables

	Mean	Std. Dev.	Min.	Max.
IPG	0.17%	0.61%	-4.30%	2.06%
UIR	0.01%	0.26%	-1.72%	0.97%
TSR	1.97%	1.20%	-0.32%	4.30%
DRP	0.99%	0.38%	0.55%	3.38%
MTR	-0.26%	3.58%	-15.75%	15.75%
NHS	-0.06%	7.43%	-20.86%	22.25%

Panel C Different REIT Return Variables

	Mean	Std. Dev.	Min.	Max.
ETRET	0.88%	4.98%	-31.37%	30.65%
MTRET	0.62%	5.26%	-25.85%	15.65%

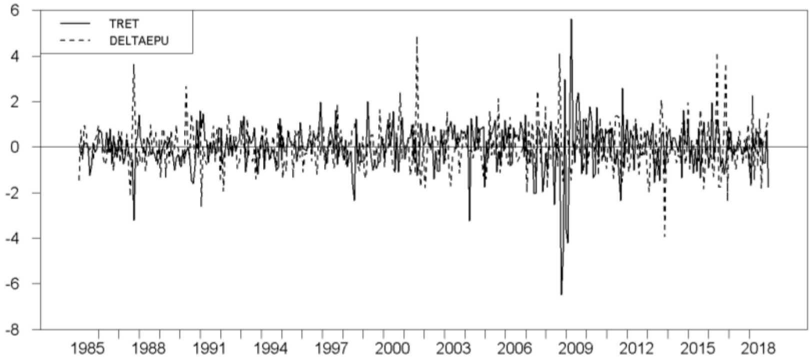
Panel D Breakdown of EPU Index

	Mean	Std. Dev.	Min.	Max.
ΔNEWS	0.19%	25.38%	-91.89%	107.65%
ΔTAX	0.46%	32.04%	-290.46%	349.09%
ΔCPI	-0.18%	16.48%	-104.15%	129.93%
ΔFSL	-0.15%	14.00%	-73.62%	59.50%

Notes: There are 408 months during our sample period from January 1985 to December 2018. ΔEPU, which has 407 months, is the monthly change of the Economic Policy Uncertainty baseline index, TRET is the total returns of REITs. EREIT represents equity REIT, MREIT represents mortgage REIT, and HREIT represents hybrid REIT. NEWS, TAX, CPI, and FED refer to news, tax code, consumer price index, and federal, state, and local expenditures components, respectively. IPG is industrial production, UIR is an unexpected inflation rate, TSR is the term structure, DRP is the default risk premium, MTR is the mortgage rate, and NHS is the new private housing starts.

On the other hand, ΔEPU also experienced some significant peaks and troughs. For example, EPU jumped 59.78% in October 1987, as well as another big spike of 39.02% in November 2000. ΔEPU had a -43.90% change from March 2003 to July 2003. As expected, EPU also experienced a very volatile period during the subprime mortgage crisis. For instance, EPU almost doubled with a 67.20% jump in September 2008. However, EPU quickly dropped by -24.37% in November 2008. These are the most prominent ups and downs in the history of the EPU index shown in Figure 1.

Figure 1 Delta EPU and REIT Total Market Return (1985-2018) Standard Normal Distribution



Notes: There are 408 months during our sample period from January 1985 to December 2018. DELTAEPU (ΔEPU), which has 407 months, is the monthly change of the Economic Policy Uncertainty baseline index, TRET is the total return of REITs. Both variables are standard normally distributed with a mean of 0 and a standard deviation of 1.

Using our entire data sample, we report the pairwise correlation among our main variables, including TRET and ΔEPU, and six other conventional macroeconomic factors commonly used in the real estate literature. In Table 2, we document a negative -0.09 correlation between TRET and ΔEPU, which implies a negative relationship between the two in the same month. Such a negative correlation suggests a positive shock in EPU is associated with a contemporaneous decline in TRET. Interestingly, we also reveal a significantly negative correlation between TRET and MTR (corr = -0.21), which implies that a higher mortgage rate results in a lower REIT return. REIT investors hold shares in a trust that owns and manages a collection of real estate properties and/or mortgages. Thus, a higher mortgage rate would discourage home buyers from taking mortgage loans and reduce real estate investments, which reduces REIT returns due to an overall decline in the real estate market. The negative correlation between ΔEPU and MTR (corr = -0.11) is well expected since the U.S. Central Bank tends to ease the rate when they see economic uncertainty. Also, we notice that when the term structure of the yield curve becomes wider, which implies a healthier economy with an upward sloping curve, REIT returns tend to be higher. Next, we discuss the causality between ΔEPU and TRET before we conduct the regression analyses.

Table 2 Correlation Matrix

	TRET	ΔEPU	IPG	UIR	TSR	DRP	MTR	NHS
TRET	1							
ΔEPU	-0.09	1						
IPG	-0.06	-0.04	1					
UIR	0.02	0.04	-0.01	1				
TSR	0.06	-0.04	-0.01	0.09	1			
DRP	-0.08	-0.01	-0.38	-0.01	0.29	1		
MTR	-0.21	-0.11	0.14	0.14	-0.01	-0.15	1	
NHS	-0.06	-0.04	0.09	0.06	0.07	-0.10	-0.03	1

Notes: The test period is 407 months from January 1985-December 2018. TRET is the monthly total returns of REITs, ΔEPU is the monthly change of the Economic Policy Uncertainty baseline index, IPG is the industry production, UIR is the unexpected inflation rate, TSR is the term structure, DRP is the default risk premium, MTR is the mortgage rate, and NHS is the new private housing starts.

5.2 Causality Between ΔEPU and REIT Returns

We apply the Granger causality test on ΔEPU and TRET. A Granger causality test requires all variables to be stationary in the vector autoregressive (VAR, hereafter) system. We conduct four-unit root tests on TRET and ΔEPU to determine if they contain unit-roots. The result shows that these two variables do not have unit root representation, thus implying stationary. This is shown in Panel A of Table 3, and evidenced by the significant test statistics in the augmented Dickey-Fuller (TRET = -10.71, ΔEPU = -14.29), Phillips-Perron (TRET = -18.62, ΔEPU = -31.26), Zivot-Andrews (TRET = -5.81, ΔEPU = -7.35), as well as the insignificant Kwiatkowski, Phillips, Schmidt, Shin or KPSS statistics (TRET = 0.04, ΔEPU = 0.04).[12] Collectively, the unit root tests merit the implementation of the Granger methodology to detect causality between the two stationary variables.

Using a standard procedure, we determine the number of lags in the VAR that contain these two stationary variables before employing the Granger causality test. Previous research studies show that overfitting (a higher-order lag length) can cause an increase in the mean squared forecast errors of the VAR, while under-fitting (a lower order lag length) can often generate auto-correlated errors, as seen in Lütkepohl (1993). Also, Hafer and Sheehan (1989) argue that forecast accuracy from VAR models varies substantially for alternative lag lengths.

We consider several criteria in the selection of the optimal lag length in our time series analyses: the final prediction error (FPE), Akaike information criterion (AIC), Hannan-Quinn information criterion (HQIC), and Schwarz

[12] Note that the KPSS test has a null hypothesis of no unit root representation, while the other three tests have a null hypothesis of a unit root.

Table 3 Ganger Causality Test between TRET and EPU

Panel A Unit Root Tests

Index	ADF	PP	KPSS(mu)	Z.A.
TRET	-10.71***	-18.62***	0.04	-5.81**
ΔEPU	-14.29***	-31.26***	0.04	-7.35***

Panel B Lag Length (Endogenous: TRET and Exogenous: ΔEPU, cons)

Lag	L.L.	LR	df	p	FPE	AIC	HQIC	SBIC
0	659.9190	-	-	-	0.0023	-3.2410	-3.2332	-3.2213
1	660.9020	1.9648	1	0.1610	0.0023	-3.2409	-3.2292	-3.2113
2	664.0260	6.2490*	1	0.0120	0.0023*	-3.2514*	-3.2357	-3.2119

Panel C: General Granger Causality F-test with Two Lags

Endogenous/Exogenous	ΔEPU (X)	Durbin-Watson Statistic
TRET (Y)	2.4453*	1.95825
P-value	0.0880	

Notes: The test period is 408 months from January 1985-December 2018. TRET is the monthly total returns of REITs. ΔEPU is the monthly change of the Economic Policy Uncertainty baseline index. Four unit root tests are performed on the price levels of each sample data series: augmented Dickey-Fuller (ADF), Phillips-Perron (P.P.), Kwiatkowski, Phillips, Schmidt, Shin (KPSS), and Zivot-Andrews (Z.A.). ADF, P.P., and Z.A. tests all examine the null hypothesis of a unit root and non-stationary against the alternative hypothesis that no unit root is present, and the data series is stationary. KPSS tests the null hypothesis of no unit root present with stationary data. All unit root tests allow for a maximum of twelve lags. The Z.A. test uses AIC criteria to decide the lag length from a maximum of twelve lags. The results of an ADF test of unit root critical values are: 1% = -3.44, 5% = -2.87, and 10% = -2.57; P.P. unit root test critical values are: 1% = -3.448, 5% = -2.869, and 10% = -2.571; Z.A. unit root test (Model C allowing break = both, maximum of twelve lags) critical values are: 1% = -5.57, 5% = -5.08, and 10% = -4.82; KPSS unit root test with *mu* statistics (H0: stationary around a level) critical value: 1% = 0.739, 5% = 0.463, and 10% = 0.347. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. In Panel B, Lag represents the number of lags, L.L. is the log-likelihood, df is the degree of freedom, and p is the p-value for L.R. statistics. We report five test statistics, including likelihood ratio (L.R.), final prediction error (FPE), Akaike information criterion (AIC), Hannan-Quinn information criterion (HQIC), and Schwarz Bayesian information criterion (SBIC). * denotes the suggested optimal lag based on the test results. In Panel C, (Y) represents the endogenous variable, while (X) represents the exogenous variable.

Bayesian information criterion (SBIC). We use a sufficiently large number of lags when we estimate the VAR model conditional on the number of observations to choose an optimal lag length. We also test whether the same model could be estimated with fewer lags on the same variables examined. Finally, we consider cross-equation restrictions by using the likelihood ratio

(L.R.) test. If the L.R. test decision prefers a more restricted model, then the VAR model should be estimated by using fewer lags. Hence, we choose the appropriate lag lengths by paring down the lag length with the L.R. statistics. We find that two lags exist when TRET is the endogenous variable, and ΔEPU is the exogenous variable in the VAR. The results are shown in Panel B of Table 3. We consider two lags to be appropriate for our study since we focus on ΔEPU as an exogenous variable and how it predicts the endogenous variable - TRET.

We report our Granger causality test results in Panel C of Table 3. We test if the coefficients of the lagged exogenous variable ΔEPU are jointly significant (measured by the F-test statistic) when TRET is the endogenous variable (Y). We find that TRET is Granger-caused by the lagged EPU ($\text{F-test}_{\Delta EPU(X)}$ = 2.4453, *P-value* = 0.0880). The Durbin-Watson statistic of 1.95825 implies no autocorrelation in either test. These results suggest that causality runs from ΔEPU to TRET, and past ΔEPU has predictive power over future REIT returns.

For testing of robustness, we report the CVD up to 6 months in Panel A of Table 4. When we examine the decomposition of variance for ΔEPU, the results in the right panel suggest that 100% of the 1-month ahead forecast error variance of ΔEPU is explained by itself. Up to 2-months (6- months) ahead, TRET explains for only 0.36% (0.81%) of the ΔEPU variance. In contrast, the results of the variance decomposition for TRET, in the left panel, suggest that TRET partially explains for 98.93% of its own 1- month ahead forecast error variance and the rest, 1.07%, can be explained by ΔEPU. The explanatory power of ΔEPU on TRET increases to 3.41% in 6 months. The results suggest that, in the first 6 months, some of the TRET forecast error variances can be explained by ΔEPU but almost no ΔEPU forecast error variances can be explained by TRET. This supports the unilateral causality that runs from ΔEPU to TRET.

Furthermore, the IRF test detects the speed with which a one-standard-deviation shock in an index is transferred to the return of an asset. We report up to 6 months after the initial shock. As shown in Panel B of Table 4, a one-standard-deviation shock from ΔEPU produces a contemporaneous increase in itself by 0.0442 and TRET by -0.0149 units. After one period, ΔEPU is still 0.0033 units above the initial value whereas TRET is still -0.0180 units below its initial value and this impact from ΔEPU continues in the subsequent months. On the contrary, a one-standard-deviation shock from TRET has no contemporaneous effect (0.0000) on ΔEPU even though it impacts itself by 0.1437 units. After 6 months, TRET is still 0.0106 units above its initial value. The IRF shows that TRET responds significantly to contemporaneous shocks from ΔEPU and the response continues for several months after the initial shocks in ΔEPU. However, ΔEPU does not respond to contemporaneous shocks from TRET. We conclude that ΔEPU affects TRET returns and the direction is unidirectional. Results from both the CVD and IRF tests are consistent with the Granger-causality test, thus confirming that causality runs from ΔEPU to TRET.

Table 4 Cholesky Variance Decomposition and Impulse Response Function

Panel A: Cholesky Variance Decomposition (CVD)

	CVD for Series TRET		CVD for Series ΔEPU	
Step	TRET	ΔEPU	TRET	ΔEPU
1	98.93%	1.07%	0.00%	100.00%
2	97.76%	2.24%	0.36%	99.65%
3	97.68%	2.32%	0.36%	99.65%
4	97.51%	2.49%	0.59%	99.41%
5	97.50%	2.50%	0.62%	99.38%
6	96.59%	3.41%	0.81%	99.19%

Panel B: Impulse Response Function (IRF)

	Response to Shock in TRET		Response to Shock in ΔEPU	
Entry	TRET	ΔEPU	TRET	ΔEPU
1	0.1437	0.0000	-0.0149	0.0442
2	-0.0562	-0.0026	-0.0180	0.0033
3	-0.0266	-0.0001	-0.0060	-0.0013
4	-0.0169	0.0022	-0.0072	0.0045
5	0.0023	-0.0008	-0.0015	0.0039
6	0.0106	-0.0020	0.0156	-0.0001

Notes: The test period is 408 months from January 1985-December 2018. TRET is the monthly total returns of REITs, ΔEPU is the monthly change of the Economic Policy Uncertainty baseline index. In Panel A, the Cholesky variance decomposition depicts what percentage of the forecast error variance of one index can be explained by both itself and another index up to five steps ahead. In Panel B, the impulse response function shows how the return of one index responds to a 1-standard deviation shock to its own returns and the returns of another index.

5.3 The relationship between ΔEPU and REIT returns

We conduct cross-sectional and time-series regression models to further investigate the relationship between ΔEPU and TRET. All models are free of heteroscedasticity and multicollinearity. We report up to six periods of forecasting results (n = 0 to n = 6) and focus on the predictive power of ΔEPU. Across all results, we find that several macroeconomic factors significantly explain for the REIT returns in the contemporaneous or forecasting models, such as the TSR, changes in MTR, and NHS. We are not surprised by these findings because REIT returns are significantly related to many of these macroeconomic level variables (see Chan et al., 1990; Seck, 1996; and Ling et al. , 2000).

Table 5 Lead-lag Robust Regressions

TRET (Y)	Current 0	Forecast 1	Forecast 2	Forecast 3	Forecast 4	Forecast 5	Forecast 6
ΔEPU	-0.0364	-0.0258	-0.0096	0.0132	-0.0132	-0.0284	0.0295
	-2.14**	-1.41	-0.55	0.85	-0.87	-1.55	2.32**
IPG	-0.7276	-0.6393	-0.7273	-0.6651	-0.7113	-0.6742	-0.7000
	-1.44	-1.26	-1.36	-1.24	-1.34	-1.25	-1.32
UIR	1.0506	0.8012	0.8536	0.8925	0.9045	0.9905	0.8912
	0.54	0.42	0.44	0.46	0.46	0.50	0.46
TSR	0.4480	0.4500	0.4632	0.4720	0.4634	0.4475	0.4766
	2.43**	2.45**	2.50**	2.56**	2.50**	2.41**	2.59***
DRP	-2.4482	-2.3329	-2.3906	-2.4130	-2.3565	-2.2671	-2.4943
	-1.30	-1.25	-1.25	-1.27	-1.23	-1.18	-1.29
MTR	-0.3304	-0.3127	-0.3102	-0.3073	-0.3097	-0.3046	-0.3204
	-3.88***	-3.74***	-3.66***	-3.62***	-3.63***	-3.54***	-3.74***
NHS	-0.0622	-0.0578	-0.0589	-0.0592	-0.0589	-0.0542	-0.0552
	-1.83*	-1.70*	-1.72*	-1.73*	-1.72*	-1.62	-1.62
Intercept	0.0238	0.0225	0.0230	0.0230	0.0226	0.0220	0.0237
	1.42	1.35	1.34	1.35	1.33	1.28	1.38
N	407	406	405	404	403	402	401

Notes: The test period is 408 months from January 1985-December 2018. TRET is the monthly total returns of REITs, ΔEPU is the monthly change of the Economic Policy Uncertainty baseline index, IPG is the industrial production, UIR is the unexpected inflation rate, TSR is the term structure, DRP is the default risk premium, MTR is the mortgage rate, and NHS is the new private housing starts. N is the number of observations in the test. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

By focusing on the coefficients of ΔEPU across all of the results, we find that the current month ΔEPU is negatively and significantly associated with the REIT return ($Coeff_{\Delta EPU,t0}$ =-0.0364, T-stat = -2.14). This finding implies that when the EPU increases by 1%, it reduces the same-month REIT performance by 364 basis points, and is statistically significant. This finding is in line with those in previous studies in the literature, which document a contemporaneous negative relationship between changes in EPU and stock returns (see Baker et al., 2016 and Christou et al., 2017). We find that ΔEPU is insignificantly related to REIT returns in the next five months (t=1,…,5). Importantly, and also unexpectedly, we find that ΔEPU can significantly and positively forecast REIT returns in the sixth month ($Coeff_{\Delta EPU,t6}$= 0.0295, T-stat = 2.32). We conclude that EPU negatively influences contemporaneous REIT returns, but can positively predict future REIT returns. Specifically, a positive shock (1%) in EPU predicts a 295 basis point positive return in REITs six months after the innovations in EPU, and this is statistically significant. Such a return reversion phenomenon has not been previously documented in the literature. We provide some explanations below regarding the return reversion when it comes to forecasting future REIT performance.

Baker et al. (2016) argue that at the macro level, innovations in policy uncertainty foreshadow declines in investment in the U.S. With substantial policy uncertainty, investors tend to reduce their investment in stocks because of flight to safety. Investors tend to switch to safer fixed-income securities.[13] Investors often consider REITs as an alternative option for fixed income. So as bond yields decrease (investors buy up bonds due to flight to safety), investors tend to decrease bond allocations due to higher bond price and increase REIT allocations, ceteris paribus. Thus, a higher EPU level (signaling more substantial uncertainty and risks) would incentivize investors to invest more in REITs, which explains why we find higher EPU predicts positive returns in the subsequent months in REITs.

Moreover, investors often consider REITs an inflation hedge as real estate prices have historically matched or exceeded inflation rates. General stocks are not viewed as inflation hedges. Inflation uncertainty is part of the EPU index (through the CPI); thus, when there is a significant positive shock in CPI (increase in inflation), investors tend to favor REITs over other investment vehicles. This preference also explains why higher EPU predicts return reversion in the subsequent months in REITs. From our results, we see that return reversion is insignificant until six months after the EPU shock which implies that investors require several months to understand the EPU shock, internalize the CPI news and increase their allocation in REITs.

[13] When investors perceive increased economic uncertainty, they tend to withdraw their money from some of the more risky assets such as stocks and put more of their money in safer options, which include cash, bonds and gold.

5.4. Differential Predictability

EREITs own and operate real estate assets while MREITs invest in mortgages secured by real estate assets. Although both EREITs and MREITs trade on major stock exchanges, Glascock et al. (2000) argue that EREITs act more "stock-like" and MREITs act more "bond-like." The revenue of EREITs is derived from rental income and asset appreciation, while that of MREITs is generated primarily from mortgage interest. Given these discrepancies, we separate EREITs from MREITs when studying the relationship between EPU and REIT returns. The results are reported in Table 6.

Since we focus on the effect from ΔEPU on returns, the coefficients are not reported on the macroeconomic variables, but available upon request. We report that ΔEPU has a significant and negative explanation for both the current returns of EREITs and MREITs. However, for the latter, we do not find significant predictive power of ΔEPU on its future returns ($Coeff_{\Delta EPU,t6}$= 0.0091, T-stat = 0.62), which implies that MREIT investors, whose primary income comes from mortgage payments, are not responsive to economic policy risks after an innovation occurs in the EPU index. Meanwhile, a positive ΔEPU which indicates higher economic policy risks still foreshadows a higher future return in EREITs ($Coeff_{\Delta EPU,t6}$= 0.0318, T-stat = 2.43) due to the same flight to safety rationale.

Table 6 Equity REIT Versus Mortgage REIT

	EREIT (Y)		MREIT (Y)	
	ΔEPU		ΔEPU	
Current 0	-0.0379	-2.10**	-0.0349	-2.14**
Forecast 1	-0.0264	-1.37	-0.0218	-1.39
Forecast 2	-0.0085	-0.47	-0.0209	-1.27
Forecast 3	0.0125	0.78	0.0220	1.56
Forecast 4	-0.0137	0.86	-0.0038	-0.27
Forecast 5	-0.0314	-1.62	0.0082	0.52
Forecast 6	0.0318	2.43 ***	0.0091	0.62

Notes: Macroeconomic control variables are not reported to conserve space. The test period is 408 months, from January 1985-December 2018. ΔEPU is the monthly change of the Economic Policy Uncertainty baseline index. EREIT represents equity REIT, MREIT represents mortgage REIT. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

5.5. Decomposition of EPU Index

As mentioned above, EPU is the average value of the four normalized components, by using weights of 1/2 on the NEWS index, 1/6 on TAX, 1/6 on the CPI forecast disagreement measure, and 1/6 on the FSL purchase disagreement measure. Not all the economic policies are relevant to the REIT industry, and we ought to break them down into different components. Thus, instead of using the EPU baseline index, we replace the index with each component in Equation 4, and Table 7 reports the results. We find that the source of the impact of the ΔEPU is primarily produced by NEWS, while the other components are less influential.

Specifically, the contemporaneous negative effect comes primarily from ΔNEWS ($Coeff_{\Delta NEWS, t0}$ = -0.0256, T-stat = -2.29). All of the other components, ΔTAX, ΔCPI, and ΔFSL, do not have a significant impact on the same-month REIT return. For forecasting, we see that ΔNEWS almost follows ΔEPU in that it can predict higher REIT returns in the sixth month. ΔTAX can predict the second and fifth months with significantly negative coefficients, while ΔCPI can predict only the second month, also with a significantly negative coefficient. Surprisingly, FSL does not have predictive power over the future returns of REITs. We propose three explanations for this phenomenon as follows: 1. NEWS carries the largest weight in the EPU index; 2. NEWS is a large determinant of asset price movement, see Brzeszczyński et al. (2015) and Shahzad et al. (2017); 3. NEWS is related to investor sentiment; see Baker and Wurgler (2004), Tetlock (2007), and Da et al. (2015). Thus, we conclude that the NEWS dominates other EPU components when it comes to explaining and predicting REIT returns.

5.6. Controlling for Sectors

As stated earlier, the CRSP/Ziman database classifies REITs into seven property sectors or sub-industries: healthcare, industrial/office, residential, lodging/resort, retail, self-storage, and unclassified. Due to many variations in risk/return profiles among the different property sectors, we hypothesize that the characteristics of each property sector could influence and distort the overall explanatory and predictive power of EPU. Thus, we conduct separate sectoral regressions to control for the REIT sectors. We also control for the macroeconomic factors in separate regressions. These results are presented in Table 8.

We find that REIT performance, as measured by TRET, is consistently negatively related to contemporaneous ΔEPU in most of the sectors. More importantly, the positive predictive power of ΔEPU on the sixth month REIT return remains in many sectors. We reach the consistent result of a significantly inverse relationship between the current returns of ΔEPU and REITs, and ΔEPU can positively predict REIT returns six months after an innovation occurs in the EPU index.

Table 7 Breakdown of EPU Baseline Index

TRET (Y)	Current 0	Forecast 1	Forecast 2	Forecast 3	Forecast 4	Forecast 5	Forecast 6
Component 1							
(1/2 weight)							
ΔNEWS	-0.0256	-0.0130	-0.0066	0.0107	-0.0088	-0.0166	0.0160
	-2.29***	-1.08	-0.57	1.01	-0.86	-1.47	1.90*
Component 2							
(1/6 weight)							
ΔTAX	0.0010	-0.0138	-0.0050	0.0014	0.0052	-0.0091	0.0064
	0.15	-2.94***	-0.90	0.15	1.24	-2.05**	1.24
Component 3							
(1/6 weight)							
ΔCPI	-0.0033	-0.0172	-0.0132	-0.0080	-0.0009	-0.0156	0.0100
	-0.31	-1.66*	-1.10	0.64	-0.06	-1.13	0.75
Component 4							
(1/6 weight)							
ΔFSL	0.0098	0.0071	0.0273	-0.0184	0.0010	0.0094	0.0120
	0.61	0.45	1.59	-1.18	0.08	0.33	0.84

Notes: Macroeconomic control variables are not reported to conserve space. The test period is 408 months, from January 1985-December 2018. TRET is the monthly total returns of REITs. NEWS, TAX, CPI, and FED refer to news component, tax code component, consumer price index component, and federal, state, and local expenditures component, respectively. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 8 Control for Sectors

ΔEPU	Current 0	Forecast 1	Forecast 2	Forecast 3	Forecast 4	Forecast 5	Forecast 6
Healthcare	-0.0049	-0.0096	-0.0331	0.0239	-0.0110	-0.0265	0.0203
	-0.36	-0.57	-1.64	1.41	-0.70	-1.55	1.69*
Industrial/Office	-0.0456	-0.0330	-0.0211	0.0286	-0.0245	-0.0260	0.0369
	-2.28**	-1.34	-1.03	1.33	-1.46	-1.32	2.62***
Residential	-0.0224	-0.0195	-0.0127	0.0008	-0.0094	-0.0296	0.0384
	-1.61	-1.02	-0.77	0.06	-0.62	-1.67*	2.78***
Lodging/Resort	-0.0921	-0.0390	0.0256	0.0104	-0.0068	-0.0300	0.0228
	-2.68***	-1.31	0.89	0.43	-0.26	-0.95	1.12
Retail	-0.0295	-0.0230	-0.0097	0.0109	-0.0274	-0.0317	0.0209
	-1.95*	-1.02	-0.45	0.67	-1.51	-1.58	1.47
Self-storage	-0.0290	0.0000	-0.0192	0.0079	-0.0136	-0.0262	0.0220
	-1.85*	0.00	-1.05	0.42	-0.71	-1.57	1.67*
Unclassified	-0.0462	-0.0093	0.0181	0.0162	-0.0064	-0.0422	0.0286
	-3.40***	-0.53	1.28	1.25	-0.44	-2.88***	2.05**
N	407	406	405	404	403	402	401

Notes: Macroeconomic control variables are not reported to conserve space. The test period is 408 months, from January 1985-December 2018. TRET is the monthly total returns of REITs, ΔEPU is the monthly change of the Economic Policy Uncertainty baseline index, IPG is the industrial production, UIR is the unexpected inflation rate, TSR is the term structure, DRP is the default risk premium, MTR is the mortgage rate, and NHS is the new private housing starts. N is the number of observations in the test. N of Groups is the number of groups in the test, while N per Group is the number of observations in each group in the test. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

5.7. Control for Funding Liquidity

Given that previous studies suggest the IMF flow variable should be considered besides the six traditional macroeconomic variables mentioned earlier, we add the IMF flow variable, which proxies for funding liquidity. We are particularly interested in whether the predictive power of ΔEPU will be reduced by adding this variable and how ΔIMF affects REIT returns. The following statistics are not tabulated to conserve space: ΔIMF has a mean of 0.82%, standard deviation of 1.97%, minimum change of -5.29%, and maximum change of 7.18%. Finally, the ΔIMF variable has a -0.0177 correlation with TRET.

Table 9 reports the regression results. We find that ΔEPU is still negatively associated with contemporaneous REIT returns ($Coeff_{\Delta EPU,t=0}$ = -0.0367, T-stat = -2.17). More importantly, one percent of a positive shock in EPU can still predict a positive 299 basis points on REIT returns six months later. Surprisingly, the ΔIMF is not a significant factor that affects current and future REIT returns once ΔEPU is presented in the model. Based on the results from Table 9, we find that the predictive power of ΔEPU persists despite incorporating ΔIMF into the model, and our conclusions hold.

Table 9 Control for Institutional Money Fund Flow

	TRET (Y)			
	ΔEPU		ΔIMF	
Current 0	-0.0367	-2.17**	-0.0783	-0.67
Forecast 1	-0.0253	-1.36	-0.0449	-0.37
Forecast 2	-0.0092	-0.53	-0.0635	-0.54
Forecast 3	0.0137	0.87	-0.0749	-0.62
Forecast 4	-0.0131	0.68	-0.0680	-0.56
Forecast 5	-0.0283	-1.64	-0.0691	-0.55
Forecast 6	0.0299	2.33**	-0.0858	-0.66

Notes: Macroeconomic control variables are not reported to conserve space. The test period is 408 months, from January 1985-December 2018. TRET is the monthly total returns of REITs, ΔEPU is the monthly change of the monthly Economic Policy Uncertainty baseline index, ΔIMF is the change of monthly seasonal adjusted institutional money funds. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

5.8. Control for REIT Dividend Yield

To conserve space, we do not tabulate the summary statistics of the DIY variable. DIY has a mean of 0.56% per month in our sample. DIY also has a small standard deviation of 0.29% and a positive correlation (0.1198) with TRET. Other than the six macroeconomic variables, we control for the monthly dividend yield in the REIT industry, and our regression results are reported in Table 10.

Table 10 Control for Lagged Dividend Yield

	TRET (Y)			
	ΔEPU		DIY	
Current 0	-0.0367	-2.12**	2.1756	2.60***
Forecast 1	-0.0261	-1.41	0.3858	0.41
Forecast 2	-0.0089	-0.51	-0.8147	-1.04
Forecast 3	0.0124	0.79	1.2178	1.53
Forecast 4	-0.0138	-0.91	0.9092	0.87
Forecast 5	-0.0289	-1.64	0.4801	0.64
Forecast 6	0.0288	2.27**	0.6645	0.92

Notes: Macroeconomic control variables are not reported to conserve space. The test period is 408 months, from January 1985-December 2018. TRET is the monthly total returns of REITs, ΔEPU is the monthly change of the monthly Economic Policy Uncertainty baseline index, DIY is the monthly REIT dividend yield. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

We find a significantly positive relationship between DIY and TRET but this relationship only exists contemporaneously ($Coeff_{DIY,t=0}$ = 2.1756, T-stat = 2.60). Although the positive signs seem to suggest a positive relationship between lagged dividend yield and TRET, they are statistically insignificant. Meanwhile, adding the control variable DIY does not affect the ΔEPU finding. In sum, we argue that our findings are not due to the positive lagged relationship between dividend yield and REIT return as documented in Chiang (2015).

5.9. Control for 1993 REIT Industry Regime Shift

According to Chan et al. (2005), the Tax Reform Act of 1986 allowed REITs to use internal advisors. However, the impact of this allowance was not apparent and measurable until the early 1990s. They argue that in the 1990s, the typical REIT portfolio became more extensive, liquid, and focused on property sectors as compared to the pre-1990s era. Also, REITs in the 1990s had significantly more substantial amounts of inside ownership and used different capital structures and management strategies. Due to these differences, and to test our results over this regime shift, we conduct our main tests by using a sample from 1993-2018.[14]

[14] In the 1990s, REITs moved away from their original fund-like structure, taking on characteristics similar to other firms traded in the equity market. Chan et al. (1998) also state that institutional investors did not participate actively in REITs prior to 1990, focusing more of their funds in stocks rather than REITs. After 1990, they started to invest more of their funds in REITs than in other stocks in the market.

After controlling for this REIT industry regime shift, we come to an interesting finding as shown in Table 11. The ΔEPU can no longer significantly explain the same-month return post-1993 ($Coeff_{\Delta EPU,t=0}$ = -0.0290, T-stat = -1.56). This finding implies that the contemporaneous explanatory power of ΔEPU on REIT returns became ineffective after the REIT industry regime shift. However, on the other hand, ΔEPU still positively and significantly predicts future REIT returns six months after an innovation occurs in the ΔEPU index. Collectively, its overall predictive power is unchallenged by using the post-regime shift data from 1993 to 2018.

Table 11 Control for 1993 REIT Industry Regime Shift

	TRET (Y)	
	ΔEPU	
Current 0	-0.0290	-1.56
Forecast 1	-0.0294	-1.37
Forecast 2	-0.0148	-0.74
Forecast 3	0.0154	0.84
Forecast 4	-0.0132	-0.73
Forecast 5	-0.0363	-1.57
Forecast 6	0.0292	1.90*

Notes: Macroeconomic control variables are not reported to conserve space. The test period is 312 months, from January 1993-December 2018. TRET is the monthly total returns of REITs, ΔEPU is the monthly change of the Economic Policy Uncertainty baseline index. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

5.10. Control for Stress Periods, Innovation(s) in GDP and Market Sentiment

Not surprisingly, the spikes of the EPU index coincide with stress periods, such as the Long-Term Capital Management (LTCM) collapse, September 11th, 2001, and Lehman Brothers bankruptcy.[15] One would question the extent that the findings in this study can be explained by these stress periods. Thus, we add an indicator, labelled as Crisis in our analyses, which is a binary variable =1 if it was a crisis month, and =0 otherwise. We find consistent results after controlling for these stress periods. One would also want to know if controlling for the innovation(s) in GDP and funding liquidity make a difference to the findings. We add the innovation(s) in GDP to our model and find consistent

[15] Stress periods are provided by Baker et al. (2016) and https://www.policyuncertainty.com

results.[16] Finally, we find that ΔNEWS explains for the majority of the return predictability of EPU. While this finding indeed helps to understand the channel through which EPU predicts REIT returns, one would question the high correlation between EPU, especially ΔNEWS, and the sentiment index. Thus, we add one sentiment index, University of Michigan Consumer Sentiment Index, to our analysis and find consistent results.[17] All of these robustness results are not tabulated to conserve space but available upon request from the authors.

5.11. REITs Resemble Real Estate or Stock?

Many REITs are publicly traded on major securities exchanges. Thus, the returns of publicly traded REITs are affected by both the stock and property markets. We want to know whether REITs resemble their underlying assets or the general stock market. Specifically, the impact of EPU on the performance of the general stock market and the property market returns is worth studying. If our finding of the reversion effect holds for the property market but not the stock market, it would imply that the reversion effect we observe in the REIT market is indicative of future property market performance, and vice versa.

To answer this question, we conduct two tests and our results are presented in Table 12. In Panel A, we run the regression with US property market monthly returns as the dependent variable while the change in EPU is the independent variable plus several of the aforementioned control variables. The results of the control variables are not tabulated but available upon requestion. We use property data (1994/12 to 2018/12) from MSCI and calculate their monthly returns with the use of daily prices.[18]

The results with this US property data shows that the reversion effect ($Coeff_{\Delta EPU,t=6}$ = 0.0617, T-stat = 2.07) holds for the property market. However, this reversion effect is not found in Panel B in which we use US market S&P500 as the dependent variable. More importantly, the change in EPU cannot significantly predict stock market return six months later ($Coeff_{\Delta EPU,t=6}$ = 0.0190, T-stat = 1.06). Thus, from the results presented in Table 12, we conclude that the reversion effect holds for the property market but not the stock market.

[16] For GDP innovations data, we use "Brave-Butters-Kelley Real Gross Domestic Product, Annualized Percent Change from Preceding Period, Monthly, Seasonally Adjusted" from https://fred.stlouisfed.org

[17] Data is from https://fred.stlouisfed.org/series/UMCSENT

[18] https://app2.msci.com/eqb/reit/performance/24125.40.all.html

Table 12 REITs Resemble Real Estate or Stock?

Panel A Property Market

	USProperty (Y)	
	ΔEPU	
Current 0	-0.0293	-1.43
Forecast 1	-0.0416	-1.68*
Forecast 2	-0.0189	-0.71
Forecast 3	0.0016	0.07
Forecast 4	0.0092	0.33
Forecast 5	-0.0206	-0.75
Forecast 6	0.0617	2.07**

Panel B Stock Market

	SP500 (Y)	
	ΔEPU	
Current 0	-0.0647	-3.76***
Forecast 1	-0.0213	-1.53
Forecast 2	0.0225	1.41
Forecast 3	0.0127	0.86
Forecast 4	0.0260	1.45
Forecast 5	-0.0049	-0.27
Forecast 6	0.0190	1.06

Notes: Macroeconomic control variables are not reported to conserve space. USProperty is the monthly MSCI property returns from December 1994 to December 2018. SP500 is the monthly Standard and Poor 500 market returns from January 1985-December 2018, ΔEPU is the monthly change of the Economic Policy Uncertainty baseline index. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

5.12. Dividend Yield Versus Capital Gain

REIT returns consist of two components: dividend yield and capital gain. Thus, one would ask the question whether the reversion effect holds for both dividend yield and capital gain or just one of them? To answer this question, we conduct two further analyses: one is with the divided yield as the dependent variable while the other is with the capital gain as the dependent variable. As usual, the change in EPU is the independent variable plus several of the aforementioned control variables. The results of the control variables are not tabulated but available upon requestion. The results are presented in Table 13.

Logically, the dividend yield is more of a fixed than variable term. Thus, we do not expect the change in EPU would have a much significant impact on the dividend yield. Indeed, that is what we find in Panel A; the reversion effect does not hold for dividend yield ($Coeff_{\Delta EPU,t=6}$ = 0.0018, T-stat = 1.21). On the other hand, capital gain is more of a variable than fixed term, thus we expect that a change in EPU would have more prominent predictive power on it. As shown in Panel B, we find that the reversion effect of the REIT returns primarily come from their capital gain component ($Coeff_{\Delta EPU,t=6}$ = 0.0507, T-stat = 2.48). Therefore, we conclude that the reversion effect that we document for REIT returns holds for capital gains but not for dividend yield.

Table 13 Dividend Yield Versus Capital Gain

Panel A Dividend Yield

	Dividend Yield (Y)	
	ΔEPU	
Current 0	0.0006	0.65
Forecast 1	-0.0012	-1.22
Forecast 2	0.0000	0.01
Forecast 3	0.0028	2.90***
Forecast 4	-0.0022	-1.65
Forecast 5	0.0008	0.56
Forecast 6	0.0018	1.21

Panel B Capital Gains

	Capital Gain (Y)	
	ΔEPU	
Current 0	-0.0369	-2.18**
Forecast 1	-0.0275	-1.46
Forecast 2	-0.0139	-0.70
Forecast 3	0.0044	0.26
Forecast 4	0.0088	0.44
Forecast 5	-0.0195	-0.96
Forecast 6	0.0507	2.48**

Notes: Macroeconomic control variables are not reported to conserve space. Capital Gain is the monthly capital gain yields for REITs from January 1985 to December 2018. Dividend Yield is the monthly dividend yields for REITs from January 1985-December 2018, ΔEPU is the monthly change of the Economic Policy Uncertainty baseline index. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

6. Conclusions

Economic policy uncertainty has been studied by many researchers in many disciplines, such as accounting, economics, and finance. However, studies on how EPU impacts the real estate market have been scarce. Using REITs as a proxy for the real estate market, we address the gap in the literature and explore the relationship between EPU and U.S. TRET by using monthly data from January 1985 to December 2018.

The conclusions of this study have four immediate contributions to the real estate literature. First, we find evidence that changes in EPU Granger cause REIT returns, thus suggesting the lagged ΔEPU can predict future REIT returns. Second, lead-lag regressions reveal that a positive shock in EPU reduces REIT contemporaneous returns but can predict future higher positive REIT returns. This finding suggests that EPU is an essential economic factor that affects both current and future REIT performances. Such a return reversion phenomenon has not been previously discussed in the literature. Third, although ΔEPU provides a significant and negative explanation for both the current returns of EREITs and MREITs, ΔEPU does not predict future MREIT returns due to their stable income streams. Last, breaking down the main EPU index into its four components, we find that the source of the impact of EPU primarily comes from the broad newspaper coverage of policy-related economic uncertainties, while the other components are less influential. Also, we conduct several robustness tests, and our results are rigorous and reflect that policy uncertainty can affect real estate assets, and EPU is an economically important factor for understanding and pricing REITs. Other studies have not previously reported these findings.

Our results may indicate a market inefficiency, as investors who have a better understanding of the relationship between the returns of EPU and REITs might perform better than those who do not. Our results also have implications for the pricing of REIT securities and real estate portfolio construction. Since we control for other traditional macroeconomic factors, this suggests that EPU is likely a systematic economic factor when pricing REITs. The implications of this study are limited to the U.S. EPU index and U.S. REITs. It is interesting to consider how these results hold for international REITs and real estate holding companies. Given the fact that www.policyuncertainty.com provides EPU indices of more than 20 developed and developing countries/regions, such as Japan, India, and Hong Kong, these data series will produce many exciting projects in the future.

Moreover, the website also lists U.S. categorical EPU indices (U.S. Policy Categories), which include a range of sub-indices based solely on news data. These are derived by using results from the Access World News database of over 2,000 US newspapers. These extensions remain promising areas of future research.

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