Received 13 May 2024
Revised 25 July 2024
Accepted 27 July 2024

The relative importance of economic policy uncertainty and geopolitical risk on U.S. REITs returns

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Abstract

Purpose – Our aim in this study is to investigate the relative importance of the economic policy uncertainty and of the geopolitical risk on U.S. REITs (Real Estate Investment Trusts) returns with a special focus on the different real estate sectors.

Design/methodology/approach – We use an augmented Fama-French (1993)'s asset pricing model, including economic policy uncertainty indices (EPU), introduced by Baker *et al.* (2016), and geopolitical risk indices (GPR) recently developed by Caldara and Iacoviello (2022), to price the potential risk factors for U.S. Nareit indices returns. To obtain robust economic results, we correct for the problems of errors-in-variables in linear asset pricing models; we advocate the use of higher moments estimators as instruments in a generalized method of moments (GMM) framework.

Findings – Our results report that economic policy uncertainty (EPU), and geopolitical risk (GPR) are priced for the different Nareit sectors for the last three decades. The GPR index stands as a relevant risk factor. The coefficient estimates are low compared to Fama-French risk factors. They are higher for Shopping Centers, Retail and Region Malls and lower for Health Care and Lodging/Resorts. EPU indices are also priced and less statistically significant. Health Care sector, followed by Shopping Centers and Retail are the most policy-sensitive sectors.

Practical implications – In their "2023–2024 Top Ten Issues Affecting Real Estate" "political unrest and global economic health" is ranked 1 issue by the Counselors of Real Estate. Our results report that economic policy uncertainty and geopolitical risk are priced for the different Nareit sectors. They suggest implications for investors, insurers, bankers, policymakers and other stakeholders. The geopolitical risk index (GPR) stands as a relevant and significant risk factor for REITs returns.

Originality/value – Based on parsimonious robust asset pricing models, the results shed a new light on the relative importance of geopolitical risk and economic policy uncertainty in the real estate sector, with a special focus on the different U.S. REITs sectors. They suggest possible implications for investors, insurers, bankers, policymakers and other stakeholders in a context marked by higher uncertainty shocks and geopolitical risks.

Keywords Geopolitical risk, Economic policy uncertainty, REITs, Asset pricing, Multifactor models, GMM

Paper type Research paper

1. Introduction

In this article, we analyze the relative impacts of economic political uncertainty, as defined by Baker *et al.* (2016), and geopolitical risks, as recently introduced by Caldara and Iacoviello (2022), on the performance of U.S. Nareit returns since the "new REITs era" (1993) (Pagliari *et al.*, 2005).

JEL Classification — F51, F60, G12, G15, R3

A version of this article was written when Alain Coën was visiting the GREFA at the University of Sherbrooke. We are also grateful to Kola Akinsomi, Martin Hoesli, Daniel Huerta, Andres Jauregui, Stephen Lee, Benoit Lefebvre, Ariel Sun, participants at the 30th European Real Estate Society Conference (2024), two anonymous referees and to the editor, Nick French, for their very helpful comments and suggestions. The usual disclaimer applies.

Journal of Property Investment & Finance
Vol. 42 No. 6, 2024
pp. 576-590

1463-578X
DOI 10.1108/JPIF-05-2024-0064

As reported by Caldara and Iacoviello (2022), the Bank of England defines economic and policy uncertainty, with geopolitical risk, as an "uncertainty trinity" with significant consequences on real business cycles dynamics. Since the work of Niederhoffer (1971), quoted by Jorion and Goetzmann (1999) (among many others), an extensive economic literature has been devoted to the analysis of world events and global economic and financial markets. After the recent introduction of economic policy uncertainty indices, *EPU* (Baker *et al.*, 2016), and geopolitical risk indices, *GPR* (Caldara and Iacoviello, 2022), a renewed and growing interest for this important economic topic has been observed, with special focuses on asset prices, returns and volatility (energy, commodities, gold, financial assets . . . and in a lesser extent for real estate) [1].

In their *"2023–2024 Top Ten Issues Affecting Real Estate"* "political unrest and global economic health" is ranked first issue by the Counselors of Real Estate, while it was ranked 2 issue in their 2022–2023 report, as mentioned by Korogolos (2022) (before "obsolescence and devaluation", ranked 2, "AI", ranked 4, "population shock", ranked 6, "interest rates and inflation", ranked 7, and well before "energy" and "ESG requirements") [2].

Following Baker *et al.* (2016) and Caldara and Iacoviello (2022), who respectively report a positive exposure to the economic policy uncertainty and to the geopolitical risks for the real estate industry, a recent housing and real estate economic literature has been growing. André *et al.* (2017) show that economic policy uncertainty significantly affects US real housing returns and volatility. Using a time-varying parameter factor augmented vector autoregression modeling (TVP-FAVAR), Christou *et al.* (2019) demonstrate that uncertainty shocks negatively impact the US housing prices. Yuni *et al.* (2024) analyze in a quantile regression framework the effects of GPR indices on a small sample of five daily global and regional house prices indices during the COVID-19 pandemic period. Ahiadu and Abidoye (2024) review existing literature on the impact of economic uncertainty on property performance. They show that economic uncertainty negatively influences investment volumes, returns and performances. Very recently, Coën and Desfleurs (2024) use an extended conditional version of Fama and French (1993) asset pricing model to analyze the influence of *GPR* indices on the dynamics of REITs returns. For U.S. REITs, grouped into portfolios, they report that the geopolitical risks are priced.

In this article, we extend Coën and Desfleurs (2024) study, focusing on U.S. Nareit property sectors and subsectors. Our contribution is twofold. First, using an extension of the standard Fama and French (1993) model (as suggested by Hsieh and Peterson (2000), Bond *et al.* (2003), Lee *et al.* (2008), Van Nieuwerburgh (2019) among many others in the literature), we consider the *EPU* indices and the *GPR* indices, separately and simultaneously, as potential risk factors to analyze the decomposition of U.S. Nareit indices returns since the "new REITs era" (1993). With this approach, we are able to compare the relative importance of economic policy uncertainty and geopolitical risks on U.S. REITs returns. Second, we shed light on the different sensitivities of Nareit sectors to these two distinct exogenous sources of risks. These differences may have indeed important consequences and implications for investors, insurers, bankers and other stakeholders in the real estate industry. Therefore, we give weight to the concerns and "top issues" mentioned by the real estate industry, as described above by the Counselors of Real Estate, and suggest a partial solution. To obtain robust economic results, we correct for the problems of errors-in-variables (biased estimates: see Durbin (1954), Davidson and MacKinnon (2004)) in the linear asset pricing models, using the instruments suggested by Dagenais and Dagenais (1997) [3]. Our results report that geopolitical risk, *GPR*, and economic policy uncertainty, *EPU*, are priced for U.S. REITs. Based on the critical value introduced by Harvey *et al.* (2016), the *GPR* index may be reasonably considered as a relevant risk factor in the pricing of REITs returns.

The article is organized as follows. In Section 2, we introduce the econometric method and the asset pricing model. In Section 3, we present the data. In Section 4, we report empirical results and provide robustness checks. In Section 5, we draw our conclusions by summarizing our main findings.

2. The asset pricing model: theory and econometric method

Following the financial literature and the seminal work of Fama and French (1993), we use a linear multifactor asset pricing model to analyze REITs returns.

$$R_{i,t} = \alpha_i + \sum_{k=1}^{K} \beta_{i,k}\tilde{X}_{k,t} + \epsilon_{i,t}, \tag{1}$$

where R, stands for the excess return, $\tilde{X}_{k,t}$ is the true (unobserved) risk factor k realization in period t, $\beta_{i,k}$ is the factor k loading, $i = 1, \ldots 10$ is the US Nareit index, t is the time index and $\epsilon_{i,t}$ is the error term. α_i is a constant term defined as the security's abnormal return in this unconditional asset pricing framework.

Our aim here is to report robust and consistent estimates for our analysis of linear asset pricing models (APM). Therefore, following Coën and Racicot (2007) and Carmichael and Coën (2008), we advocate the use of the Dagenais and Dagenais (1997) higher moment estimators as instruments in a Generalized Method of Moments (GMM) procedure as defined by Hansen (1982) (more precisely, we use iterated GMM: iGMM). As it is well acknowledged in economic literature, the presence of errors-in-variables (EIV) leads to biased and inconsistent OLS parameter estimates (Durbin, 1954; Hansen, 1982; Pal, 1980; Erickson and Whited, 2000, among many others).

To deal with this inference problem, a common solution is the use of instrumental variables. This approach has drawbacks as highlighted by Pal (1980): the main problem is the choice of instruments. We follow Coën and Racicot (2007), Carmichael and Coën (2008), Erickson and Whited (2012), and Coën and Lecomte (2019) (among others), who suggest the use of Dagenais and Dagenais (1997)' higher moment estimators (DDHME) as instrumental variables to deal with the problem of EIV. As put forward by Dagenais and Dagenais (1997) and detailed thereafter by Carmichael and Coën (2008), the relevant instruments are: $z_1 = x*x$, $z_2 = x*x*x - 3x[E(x'x/N)*I_K]]$ and a constant. x_{ij} are the elements of the matrix x and $x = AX$ where $A = I_N^{-ii'/N}$. The matrix x is the $T \times K$ matrix X calculated in mean deviation, standing for the matrix of K factor loadings where T is here the number of observations. The symbol * is the Hadamard element-by-element matrix multiplication operator. As suggested by Davidson and MacKinnon (2004), we run Durbin-Wu-Hausman (DWH hereafter) type test (see Hausman, 1978) to detect the presence of EIV [4].

3. Data

We consider the "new REITs area" (Pagliari *et al.*, 2005; Ambrose *et al.*, 2007), including 360 monthly returns from January 1994 to December 2023, to analyze the impacts of economic policy uncertainty and geopolitical risk.

We use the FTSE Nareit U.S. Real Estate Index Series to track the performance of U.S. REIT industry at the sector level to shed light on the differences among the different sectors during the full period. Our sample includes the following monthly property index returns: (1) Apartments; (2) Diversified; (3) Health Care; (4) Industrial; (5) Lodging/Resorts; (6) Office; (7) Regional Malls; (8) Residential; (9) Retail; and (10) Shopping Centers [5]. The detailed descriptive statistics are reported in Tables 1 and 2.

3.1 The risk factors

As we use the standard three factor Fama and French (1993)'s asset pricing model, the market excess return $MKT = r_m - r_f$, and the factors addressing the anomalies for size (*SMB*) and value (*HML*), are taken from Kenneth French's data library [6]. The variations of the

	Mean	STD	Skew	Kurt	Min	Max
Portfolios: REIT size						
Apart	0.975	5.696	−0.628	3.541	−26.832	23.141
Diver	0.699	6.324	−0.425	8.086	−31.960	39.687
Health	0.985	6.204	−0.623	4.358	−33.449	27.730
Indus	1.229	8.207	0.227	23.057	−56.188	70.483
Lodging	0.748	9.056	0.874	11.203	−36.555	67.525
Office	0.817	6.505	−0.233	4.290	−31.796	32.458
Regio	1.107	8.189	−0.318	14.828	−53.979	59.091
Resid	0.997	5.536	−0.714	3.570	−26.656	22.242
Retail	0.945	6.767	−0.763	12.174	−42.678	43.516
Shop	0.889	6.952	−0.545	10.440	−41.617	39.573

Note(s): This table reports the means (percent), standard deviations (STD), skewness (Skew), kurtosis (Kurt), minima (Min) and maxima (Max) of the return for the FTSE Nareit US Real Estate Index considered in the paper. The sample includes monthly observations from January 1994 to December 2023. The real estate sectors considered are: (1) Apartments; (2) Diversified; (3) Health Care; (4) Industrial; (5) Lodging/Resorts; (6) Office; (7) Regional Malls; (8) Residential; (9) Retail; (10) Shopping Centers
Source(s): Table created by authors

Table 1. Summary statistics: Nareit returns (January 1994–December 2023)

	Mean	STD	Skew	Kurt	Min	Max
MKT	0.718	4.527	−0.595	1.013	−17.23	13.65
SMB	0.179	3.221	0.739	8.896	−17.20	21.36
HML	0.380	3.493	0.701	2.117	−13.87	12.75
GPR	0.314	22.913	2.192	17.637	−60.01	205.13
GPT	0.114	24.941	0.769	4.339	−78.37	154.98
GPA	0.319	29.147	2.069	14.017	−80.93	241.88
GPRUS	0.188	22.266	1.769	12.694	−56.00	183.94
EPU1	0.097	17.794	0.470	2.407	−64.30	80.25
EPU2	0.090	26.384	0.466	1.595	−91.89	107.65

	MKT	*SMB*	*HML*	*GPR*	*GPT*	*GPA*	*GPRUS*	*EPU1*	*EPU2*
MKT	1								
SMB	0.243	1							
HML	−0.087	−0.207	1						
GPR	−0.045	−0.052	0.147	1					
GPT	−0.021	−0.025	0.135	0.905	1				
GPA	−0.078	−0.065	0.142	0.814	0.523	1			
GPRUS	−0.037	−0.072	0.136	0.911	0.832	0.719	1		
EPU1	−0.022	−0.115	−0.035	0.008	0.005	0.012	0.044	1	
EPU2	−0.218	−0.120	−0.011	−0.002	−0.007	0.002	0.041	0.970	1

Note(s): The top part of this table reports the means, standard deviations (STD), skewness (Skew), kurtosis (Kurt), minima (Min) and maxima (Max) of the factors considered in the paper. The sample includes monthly observations from January 1994 to December 2023. The bottom part of the table reports the symmetric factor correlation matrix
Source(s): Table created by authors

Table 2. Summary statistics: factors (January 1994–December 2023)

geopolitical risk (*GPR*) index, with its two broad components, the *GPA* index (geopolitical acts), the *GPT* index (geopolitical threats), and the domestic U.S. GPR index, *GPRUS*, are extracted from Caldara and Iacoviello (2022) data base [7]. The variations of the U.S. Policy

Uncertainty indices, as defined by Baker *et al.* (2016), are from Policy Uncertainty website (https://www.policyuncertainty.com/ [8]). As suggested by Baker *et al.* (2016), we consider both the "Three Components Index", *EPU*1, and the "News Based Policy Uncertainty Index", *EPU*2.

4. Empirical analysis

4.1 Geopolitical risk and asset pricing models

Here, we extend the Fama and French (1993) model (the benchmark model in the financial literature), first with the geopolitical risk factors (*GPR*, *GPRUS*, then with *GPT* and *GPA*), second with the U.S. economic policy uncertainty indices (*EPU*1, *EPU*2) to test their explanatory power on monthly returns between January 1994 and December 2023. Tables 3 and 4 report the results of the extended Fama-French model with *GPR*, the global geopolitical risk factor, and *GPRUS*, the domestic U.S. geopolitical risk factor. In the Appendix, we also report the results for the geopolitical risk threats, *GPT*, and the geopolitical acts, *GPA* respectively (Table A1). First, as expected, we note that *MKT* is highly statistically significant for all Nareit indices, followed by the book-to-market factor, *HML*, and by the size factor, *SMB*. The robust coefficient estimates for *MKT* rank from 0.740 for Residential to 1.361 for Regional Malls. Very interestingly and as suggested by Coën and Desfleurs (2024), *GPR* is highly statistically significant at 1% for all Nareit indices. All robust *t*-statistics are indeed higher than 3, the critical value reported by Harvey *et al.* (2016) to valid a potential risk factor in linear asset pricing models. It suggests that *GPR* is a relevant factor to price REITs. The estimates, although highly statistically significant, are low compared to Fama-French factors. They rank from 0.021 for Diversified (*t*-stat: 3.86) and Health Care (*t*-stat: 4.77), to 0.042 for Regional Malls (*t*-stat: 6.42) and 0.041 for Shopping Centers (*t*-stat: 6.93), followed by Retail (0.038, *t*-stat: 6.83) and Office (0.038, *t*-stat: 5.53), with an average coefficient of 0.0312. As a robustness check of these results in a GMM framework, we can highlight that the baseline model's J_T statistics (test of overidentifying restrictions) exhibit all *p*-values well within the usual acceptance region. This leads to the interpretation that the inclusion of *GPR* significantly improves the Fama-French model. It contributes to the pricing of U.S. Nareit indices, giving weight to Korogolos (2022) and to the Counselors of Real Estate (CRE) position on the importance of geopolitical risk. This result is confirmed by the average pricing errors, (α): all coefficients are not statistically significant (except for Lodging). The null hypothesis of no average pricing errors cannot indeed be rejected for this asset pricing modeling.

The pricing of geopolitical risk is also confirmed in Table 4, where we report the relative contribution of the U.S. geopolitical risk, *GPRUS*. As previously observed for the global geopolitical index, the U.S. index is statistically significant at 1% for all U.S. Nareit indices. The estimates rank from 0.022 for Diversified (*t*-stat: 3.56) and Health Care (*t*-stat: 3.38) to 0.047 for Regional Malls (*t*-stat: 5.58), followed by Shopping Centers (0.044, *t*-stat: 6.67) and Retail (0.041, *t*-stat: 6.19) with an average of 0.0327. Interestingly, we also report in the Appendix that the geopolitical acts, *GPA* (average: 0.0236), are overall highly statistically significant for U.S. Nareit indices, while geopolitical threats, *GPT* (average: 0.0205), are less significant during the last 3 decades. As observed by Coën and Desfleurs (2024), we confirm that the Nareit indices are more sensitive to geopolitical acts than to geopolitical threats. Based on these robust results, we may conclude that global (*GPR*) and U.S. (*GPRUS*) geopolitical risks have a significant impact on the dynamics of U.S. Nareit indices from January 1994 to December 2023. We also notice that Retail Reits, including Regional Malls Reits and Shopping Centers Reits are more sensitive to geopolitical risks. This observation is also valid for Office Reits. As defined by Nareit, "Retail Reits include Reits that focus on large regional malls, outlet centers, grocery-anchored shopping centers and power centers

Table 3.
Fama-French asset pricing model and *GPR*

Portfolio: NAREITs indices (January 1994–December 2023)

					GMM − BIC					
	p_1	p_2	p_3	p_4	p_5	p_6	p_7	p_8	p_9	p_{10}
	−20.26	−20.58	−19.96	−22.63	−22.03	−20.88	−20.22	−20.07	−20.64	−21.06
	J_{T_1}	J_{T_2}	J_{T_3}	J_{T_4}	J_{T_5}	J_{T_6}	J_{T_7}	J_{T_8}	J_{T_9}	$J_{T_{10}}$
	3.29	2.97	3.58	0.92	1.51	2.67	3.32	3.47	2.89	2.48
	(0.52)	(0.57)	(0.47)	(0.92)	(0.82)	(0.62)	(0.51)	(0.49)	(0.58)	(0.65)
	DW_1	DW_2	DW_3	DW_4	DW_5	DW_6	DW_7	DW_8	DW_9	DW_{10}
	2.23	2.24	2.18	2.34	2.11	2.26	2.26	2.23	2.27	2.26
	DWH_1	DWH_2	DWH_3	DWH_4	DWH_5	DWH_6	DWH_7	DWH_8	DWH_9	DWH_{10}
	2.87	1.99	4.55	2.07	0.57	1.92	4.10	2.92	5.55	4.98
	α_1	α_2	α_3	α_4	α_5	α_6	α_7	α_8	α_9	α_{10}
	0.181	−0.330	0.229	0.369	−0.707	−0.129	−0.222	0.258	−0.217	−0.341
	(0.71)	(1.44)	(0.87)	(1.09)	(2.92)	(0.53)	(0.64)	(1.06)	(0.79)	(1.22)
	$\beta_{k,1}$	$\beta_{k,2}$	$\beta_{k,3}$	$\beta_{k,4}$	$\beta_{k,5}$	$\beta_{k,6}$	$\beta_{k,7}$	$\beta_{k,8}$	$\beta_{k,9}$	$\beta_{k,10}$
MKT	0.807	1.017	0.780	0.979	1.344	1.031	1.361	0.740	1.187	1.257
	(7.55)	(10.39)	(11.03)	(3.58)	(11.99)	(7.19)	(7.34)	(7.05)	(8.55)	(8.08)
SMB	0.223	0.373	0.062	0.008	0.420	0.200	0.440	0.198	0.290	0.246
	(4.97)	(5.24)	(0.65)	(0.06)	(6.74)	(3.04)	(3.73)	(4.24)	(3.16)	(2.71)
HML	0.618	0.898	0.556	0.263	1.024	0.628	1.052	0.579	0.853	0.899
	(6.16)	(6.70)	(3.44)	(0.91)	(10.05)	(4.95)	(4.17)	(5.61)	(4.59)	(5.16)
GPR	0.028	0.021	0.021	0.033	0.024	0.038	0.042	0.026	0.038	0.041
	(4.61)	(3.86)	(4.77)	(3.52)	(3.98)	(5.53)	(6.42)	(4.60)	(6.83)	(6.93)

Note(s): This table reports the average pricing errors (α_i), coefficients of $\beta_{k,i}$ and four goodness-of-fit statistics obtained from the GMM estimation of system (1) using monthly data from January 1994 to December 2023. We use the FTSE Nareit U.S. REIT indices for 10 real estate sectors. *p*1: Apartment; *p*2: Diversified; *p*3: Healthcare; *p*4: Industrial; *p*5: Lodging Resorts; *p*6: Office; *p*7: Regional Malls; *p*8: Residential; *p*9: Retail; *p*10: Shopping Centers. J_T is Hansen's statistic (to test the model's over-identifying restrictions) and *p*-values are provided in parentheses. *GMM − BIC* is Andrews (1999) Bayesian information criterion. *DW* is Durbin and Watson's statistic (to test for the autocorrelation in the residuals), and *DWH* is Durbin, Wu and Hausmann specification test. The model is the four-factor APM. The factors are the market excess return (*MKT*), *SMB* and *HML* the Fama and French size (small minus big) and book-to-market (high minus low) factors, and the geopolitical risk index (*GPR*), introduced by Caldara and Iacoviello (2022). For the estimates (α and β) the *t*-stats are provided in parentheses. The table reports the results of the augmented Fama and French asset pricing models, adding the *GPR* index. N.B. critical values for *t*-stats are 1.645 (at 10%), 1.960 (at 5%), 2.576 (at 1%)
Source(s): Table created by authors

Table 4.
Fama-French asset pricing model and *GPRUS*

Portfolio: NAREITs indices (January 1994–December 2023)

	GMM − BIC									
	p_1	p_2	p_3	p_4	p_5	p_6	p_7	p_8	p_9	p_{10}
	−19.73	−20.02	−20.18	−21.87	−21.60	−20.54	−20.19	−19.52	−20.26	−20.95
	J_{T_1}	J_{T_2}	J_{T_3}	J_{T_4}	J_{T_5}	J_{T_6}	J_{T_7}	J_{T_8}	J_{T_9}	$J_{T_{10}}$
	3.82	3.52	3.36	1.67	1.95	3.00	3.35	4.02	3.28	2.59
	(0.43)	(0.48)	(0.50)	(0.80)	(0.75)	(0.56)	(0.51)	(0.41)	(0.51)	(0.63)
	DW_1	DW_2	DW_3	DW_4	DW_5	DW_6	DW_7	DW_8	DW_9	DW_{10}
	2.24	2.25	2.19	2.36	2.12	2.27	2.27	2.24	2.28	2.27
	DWH_1	DWH_2	DWH_3	DWH_4	DWH_5	DWH_6	DWH_7	DWH_8	DWH_9	DWH_{10}
	2.76	1.79	4.45	1.96	0.50	1.92	4.27	2.82	5.56	4.97
	α_1	α_2	α_3	α_4	α_5	α_6	α_7	α_8	α_9	α_{10}
	0.189	−0.309	0.242	0.335	−0.683	−0.119	−0.211	0.262	−0.194	−0.332
	(0.76)	(1.37)	(0.93)	(1.00)	(2.84)	(0.49)	(0.62)	(1.09)	(0.72)	(1.20)
	$\beta_{k,1}$	$\beta_{k,2}$	$\beta_{k,3}$	$\beta_{k,4}$	$\beta_{k,5}$	$\beta_{k,6}$	$\beta_{k,7}$	$\beta_{k,8}$	$\beta_{k,9}$	$\beta_{k,10}$
MKT	0.796	1.016	0.772	1.026	1.363	1.024	1.363	0.740	1.177	1.254
	(7.83)	(10.61)	(11.61)	(3.91)	(12.23)	(7.25)	(7.42)	(7.22)	(8.86)	(8.31)
SMB	0.231	0.376	0.064	0.040	0.425	0.219	0.448	0.206	0.300	0.261
	(5.19)	(5.34)	(0.68)	(0.32)	(7.06)	(3.39)	(3.77)	(4.42)	(3.25)	(2.94)
HML	0.618	0.888	0.552	0.308	1.011	0.641	1.023	0.578	0.837	0.897
	(6.16)	(6.63)	(3.45)	(1.09)	(10.32)	(4.99)	(3.95)	(5.59)	(4.45)	(5.24)
GPRUS	0.027	0.022	0.022	0.035	0.027	0.037	0.047	0.025	0.041	0.044
	(2.75)	(3.56)	(3.38)	(2.58)	(4.78)	(3.71)	(5.58)	(2.61)	(6.19)	(6.67)

Note(s): This table reports the average pricing errors (α_i), coefficients of $\beta_{k,i}$ and four goodness-of-fit statistics obtained from the GMM estimation of system (1) using monthly data from January 1994 to December 2023. We use the FTSE Nareit U.S. REIT indices for 10 real estate sectors. $p1$: Apartment; $p2$: Diversified; $p3$: Healthcare; $p4$: Industrial; $p5$: Lodging Resorts; $p6$: Office; $p7$: Regional Malls; $p8$: Residential; $p9$: Retail; $p10$: Shopping Centers. J_T is Hansen's statistic (to test the model's over-identifying restrictions) and p-values are provided in parentheses. $GMM - BIC$ is Andrews (1999) Bayesian information criterion. DW is Durbin and Watson's statistic (to test for the autocorrelation in the residuals), and DWH is Durbin, Wu and Hausmann specification test. The model is the four-factor APM. The factors are the market excess return (*MKT*), *SMB* and *HML* the Fama and French size (small minus big) and book-to-market (high minus low) factors, and the US geopolitical risk index (*GPRUS*), introduced by Caldara and Iacoviello (2022). For the estimates (α and β) the t-stats are provided in parentheses. The table reports the results of the augmented Fama and French asset pricing models, adding the *GPR* index. N.B. critical values for t-stats are 1.645 (at 10%), 1.960 (at 5%), 2.576 (at 1%)
Source(s): Table created by authors

that feature big box retailers". As highlighted by Caldara and Iacoviello (2022), a rise in the GPR index predicts lower expected GDP growth with possible impacts on households' expectations, sentiments and consumption (as suggested by the Survey of Consumers, University of Michigan [9]). On the other hand, Healthcare Reits that include senior living facilities, hospitals, medical office buildings and skilled nursing facilities, are less sensitive to geopolitical risks. This point supports Caldara and Iacoviello (2022)'s observation. They report indeed in their Appendix that Healthcare industry is indeed less sensitive to GPR indices than Real estate industry (as a whole). These results are confirmed with Carhart (1997)'s model (See Table A2 in the Appendix).

4.2 Economic policy uncertainty and Nareit indices returns

In this section, we follow Korogolos (2022) suggestion, and analyze the impact of economic policy uncertainty, *EPU*, on the dynamics of U.S. Nareit returns. As reported by Baker *et al.* (2016), "policy uncertainty is associated with greater stock price volatility and reduced investment and employment in positive-sensitive sectors". As introduced by Baker *et al.* (2016), we consider two metrics for the *EPU* index in the U.S.A.: the "Three component index", *EPU*1, and the "News based policy uncertainty index", *EPU*2. The detailed results are reported in Table 5. First, we focus on *EPU*1, in the top part of the table. For all Nareit indices, the *EPU* factor is statistically significant at 10% (for 6 indices at 5%: Apartments, Health Care, Office, Residential, Retail and Shopping Centers), except Lodging. The coefficients rank (when significant) from 0.040 for Diversified (*t*-stat: 1.72) to 0.106 for Health Care (*t*-stat: 3.33), followed by Shopping Centers (0.067, *t*-stat: 2.43), and Retail (0.059, *t*-stat: 2.32), with an average coefficient of 0.058. This result is consistent with Baker *et al.* (2016) who highlight the impact of policy uncertainty on policy-sensitive sectors like defense, health care, finance, and infrastructure. Second, we consider, as robustness check, *EPU*2 that is statistically significant at 10% for eight Nareit indices. As previously observed, the coefficient is not statistically significant at 10% for Lodging, and now Diversified. The estimates rank from 0.026 for Office (*t*-stat: 1.65), followed by Regional Malls (0.031, *t*-stat: 1.65) to 0.075 for Health Care (*t*-stat: 3.59), followed by Shopping Centers (0.053, *t*-stat: 2.89).Very interestingly, these results shed light on the policy-sensitivity differences among U.S. REITs sectors. Health Care Reits are indeed the most sensitive Reits to economic policy uncertainty, confirming Baker *et al.* (2016)'s results, who report that the volatility for firms in the health care sector significantly increases with the EPU index. Besides, Lodging REITs including different classes of hotels based on features such as the hotels' level of service and amenities, are not sensitive to EPU indices. This point could be seriously considered by investors, banking and insurance sectors, policy makers and other stakeholders in the real estate industry [10].

4.3 Geopolitical risk and economic policy uncertainty

As reported by Caldara and Iacoviello (2022), economic policy uncertainty and geopolitical risks are two different phenomena and induce different shocks. Focusing on Table 2, we note indeed that the correlation coefficients between *EPU* indices and *GPR* index are practically zero (0.008 and −0.002). In this case, it would be relevant to consider simultaneously in a parsimonious asset pricing model their relative contribution on the analysis of U.S. Nareit indices returns since the "new REITs era". We report the results of this valuation in Table 6 for the *GPR* index and for the *EPU* indices. As expected, the geopolitical risk factor is still highly significant at 1% for all Nareit indices. All *t*-stats are higher than 3, the critical value introduced by Harvey *et al.* (2016). The coefficient estimates rank from 0.021 for Lodging (*t*-stat: 3.32) to 0.048 for Shopping Centers (*t*-stat: 6.48) with an average of 0.0356. We observe the same trend in the second panel. *EPU*

Economic policy uncertainty index 1: January 1994–December 2023

	J_{T_1}	J_{T_2}	J_{T_3}	J_{T_4}	J_{T_5}	J_{T_6}	J_{T_7}	J_{T_8}	J_{T_9}	$J_{T_{10}}$
	4.32	3.10	4.36	2.10	1.67	3.01	3.70	4.92	4.27	5.31
	(0.37)	(0.54)	(0.36)	(0.72)	(0.80)	(0.56)	(0.45)	(0.30)	(0.37)	(0.26)
	α_1	α_2	α_3	α_4	α_5	α_6	α_7	α_8	α_9	α_{10}
	0.158	−0.346	0.216	0.399	−0.698	−0.138	−0.216	0.234	−0.217	−0.363
	(0.62)	(1.55)	(0.84)	(1.16)	(2.92)	(0.58)	(0.63)	(0.96)	(0.81)	(1.31)
	$\beta_{k,1}$	$\beta_{k,2}$	$\beta_{k,3}$	$\beta_{k,4}$	$\beta_{k,5}$	$\beta_{k,6}$	$\beta_{k,7}$	$\beta_{k,8}$	$\beta_{k,9}$	$\beta_{k,10}$
MKT	0.846	1.019	0.828	0.939	1.317	1.067	1.403	0.789	1.198	1.245
	(8.22)	(10.75)	(11.71)	(3.35)	(11.05)	(7.83)	(7.53)	(7.66)	(8.80)	(8.25)
SMB	0.261	0.381	0.084	0.021	0.394	0.244	0.424	0.228	0.272	0.228
	(4.62)	(4.94)	(0.76)	(0.17)	(6.00)	(3.90)	(3.49)	(3.96)	(2.82)	(2.41)
HML	0.685	0.904	0.547	0.312	1.041	0.739	1.034	0.628	0.821	0.856
	(6.04)	(6.58)	(2.92)	(1.21)	(9.81)	(6.38)	(4.12)	(5.47)	(4.48)	(5.06)
*EPU*1	0.054	0.040	0.106	0.046	−0.019	0.049	0.048	0.053	0.059	0.067
	(2.38)	(1.72)	(3.33)	(1.85)	(0.51)	(2.10)	(1.66)	(2.36)	(2.32)	(2.43)

Economic Policy Uncertainty Index 2: January 1994 to December 2023

	J_{T_1}	J_{T_2}	J_{T_3}	J_{T_4}	J_{T_5}	J_{T_6}	J_{T_7}	J_{T_8}	J_{T_9}	$J_{T_{10}}$
	4.02	2.80	4.10	1.42	1.50	2.67	3.49	4.57	3.86	4.81
	(0.41)	(0.59)	(0.40)	(0.84)	(0.83)	(0.61)	(0.48)	(0.33)	(0.43)	(0.31)
	α_1	α_2	α_3	α_4	α_5	α_6	α_7	α_8	α_9	α_{10}
	0.151	−0.339	0.213	0.403	−0.702	−0.136	−0.216	0.223	−0.204	−0.334
	(0.59)	(1.52)	(0.83)	(1.18)	(2.94)	(0.57)	(0.63)	(0.91)	(0.75)	(1.20)
	$\beta_{k,1}$	$\beta_{k,2}$	$\beta_{k,3}$	$\beta_{k,4}$	$\beta_{k,5}$	$\beta_{k,6}$	$\beta_{k,7}$	$\beta_{k,8}$	$\beta_{k,9}$	$\beta_{k,10}$
MKT	0.854	1.014	0.836	0.958	1.325	1.058	1.401	0.802	1.192	1.243
	(8.37)	(11.08)	(11.51)	(3.41)	(11.37)	(7.82)	(7.69)	(7.81)	(8.96)	(8.32)
SMB	0.259	0.372	0.100	0.020	0.402	0.233	0.421	0.228	0.268	0.225
	(4.96)	(4.91)	(0.91)	(0.16)	(6.45)	(3.81)	(3.52)	(4.25)	(2.82)	(2.40)
HML	0.683	0.890	0.576	0.306	1.048	0.725	1.027	0.628	0.807	0.839
	(6.41)	(6.69)	(3.11)	(1.17)	(10.44)	(6.37)	(4.16)	(5.80)	(4.52)	(5.10)
*EPU*2	0.038	0.024	0.075	0.032	−0.011	0.026	0.031	0.037	0.042	0.053
	(2.50)	(1.57)	(3.59)	(1.81)	(0.44)	(1.65)	(1.65)	(2.52)	(2.54)	(2.89)

Note(s): This table reports the average pricing errors (α_i), coefficients of $\beta_{k,i}$ and goodness-of-fit statistics obtained from the GMM estimation of system (1) using monthly data from January 1994 to December 2023. We use the FTSE Nareit U.S. REIT indices for 10 real estate sectors. p1: Apartment; *p*2: Diversified; *p*3: Healthcare; *p*4: Industrial; *p*5: Lodging Resorts; *p*6: Office; *p*7: Regional Malls; *p*8: Residential; *p*9: Retail; *p*10: Shopping Centers. J_T is Hansen's statistic (to test the model's over-identifying restrictions) and *p*-values are provided in parentheses

The model is the four-factor APM. The factors are the market excess return (*MKT*), *SMB* and *HML* the Fama and French size (small minus big) and book-to-market (high minus low) factors, and the U.S. Economic Policy Uncertainty indices (*EPU*1 and *EPU*2), introduced by Baker *et al.* (2016). *EPU*1 is the "Three Components Index". *EPU*2 is the "News Based Policy Uncertainty Index". For the estimates (α and β) the *t*-stats are provided in parentheses. The table reports the results of the augmented Fama and French asset pricing models, adding the *EPU*1 and *EPU*2 indices. N.B. critical values for *t*-stats are 1.645 (at 10%), 1.960 (at 5%), 2.576 (at 1%)

Source(s): Table created by authors

Table 5.
Fama-French asset pricing model and *EPU*

indices are statistically significant at 10% for 9 U.S. Nareit indices (except Lodging in the first panel). Thus, we note that Nareit indices are sensitive to both geopolitical risk and economic policy uncertainty. Nevertheless, they are more sensitive to geopolitical risks. These results should shed new light for investment, financing and insurance in the real estate sector.

Geopolitical Risk and Political Uncertainty: January 1994–December 2023										
	J_{T_1}	J_{T_2}	J_{T_3}	J_{T_4}	J_{T_5}	J_{T_6}	J_{T_7}	J_{T_8}	J_{T_9}	$J_{T_{10}}$
	4.61	3.52	4.66	1.89	1.85	3.88	3.55	4.76	4.11	5.32
	(0.46)	(0.62)	(0.46)	(0.87)	(0.87)	(0.57)	(0.62)	(0.45)	(0.53)	(0.38)
	α_1	α_2	α_3	α_4	α_5	α_6	α_7	α_8	α_9	α_{10}
	0.159	−0.340	0.199	0.409	−0.691	−0.136	−0.224	0.238	−0.241	−0.401
	(0.62)	(1.49)	(0.77)	(1.20)	(2.86)	(0.56)	(0.65)	(0.97)	(0.89)	(1.44)
	$\beta_{k,1}$	$\beta_{k,2}$	$\beta_{k,3}$	$\beta_{k,4}$	$\beta_{k,5}$	$\beta_{k,6}$	$\beta_{k,7}$	$\beta_{k,8}$	$\beta_{k,9}$	$\beta_{k,10}$
MKT	0.857	1.040	0.833	0.924	1.322	1.069	1.390	0.787	1.199	1.259
	(8.21)	(10.55)	(10.89)	(3.32)	(10.59)	(7.41)	(7.43)	(7.57)	(8.60)	(7.96)
SMB	0.256	0.400	0.114	0.026	0.395	0.235	0.467	0.229	0.310	0.260
	(4.84)	(5.51)	(1.10)	(0.21)	(6.15)	(3.59)	(3.98)	(4.22)	(3.42)	(2.86)
HML	0.633	0.913	0.552	0.263	1.010	0.660	1.060	0.586	0.831	0.846
	(5.66)	(6.59)	(3.07)	(1.00)	(9.08)	(5.43)	(4.21)	(5.16)	(4.94)	(4.79)
GPR	0.034	0.024	0.031	0.034	0.021	0.043	0.046	0.032	0.043	0.048
	(5.07)	(3.97)	(5.82)	(3.21)	(3.32)	(5.34)	(6.38)	(4.96)	(6.85)	(6.48)
*EPU*1	0.051	0.038	0.104	0.041	−0.018	0.045	0.046	0.049	0.058	0.067
	(2.25)	(1.70)	(3.33)	(1.69)	(0.5)	(1.90)	(1.65)	(2.21)	(2.35)	(2.49)

Geopolitical Risk and Political Uncertainty: January 1994–December 2023										
	J_{T_1}	J_{T_2}	J_{T_3}	J_{T_4}	J_{T_5}	J_{T_6}	J_{T_7}	J_{T_8}	J_{T_9}	$J_{T_{10}}$
	4.46	3.36	4.37	1.45	1.62	3.56	3.43	4.51	3.87	5.04
	(0.49)	(0.65)	(0.50)	(0.92)	(0.90)	(0.62)	(0.64)	(0.48)	(0.57)	(0.41)
	α_1	α_2	α_3	α_4	α_5	α_6	α_7	α_8	α_9	α_{10}
	0.157	−0.331	0.194	0.413	−0.697	−0.137	−0.224	0.230	−0.226	−0.369
	(0.62)	(1.46)	(0.75)	(1.22)	(2.87)	(0.56)	(0.65)	(0.94)	(0.83)	(1.32)
	$\beta_{k,1}$	$\beta_{k,2}$	$\beta_{k,3}$	$\beta_{k,4}$	$\beta_{k,5}$	$\beta_{k,6}$	$\beta_{k,7}$	$\beta_{k,8}$	$\beta_{k,9}$	$\beta_{k,10}$
MKT	0.861	1.033	0.841	0.936	1.329	1.062	1.385	0.797	1.188	1.249
	(8.32)	(10.88)	(10.71)	(3.38)	(10.85)	(7.42)	(7.60)	(7.69)	(8.76)	(8.00)
SMB	0.254	0.390	0.128	0.023	0.404	0.226	0.465	0.227	0.304	0.256
	(5.18)	(5.45)	(1.24)	(0.19)	(6.64)	(3.51)	(4.03)	(4.52)	(3.42)	(2.83)
HML	0.629	0.897	0.579	0.254	1.016	0.648	1.056	0.585	0.814	0.823
	(5.92)	(6.63)	(3.25)	(0.96)	(9.56)	(5.41)	(4.27)	(5.39)	(4.50)	(4.77)
GPR	0.034	0.023	0.030	0.034	0.022	0.042	0.045	0.031	0.043	0.048
	(4.95)	(3.92)	(5.61)	(3.15)	(3.57)	(5.29)	(6.50)	(4.89)	(6.90)	(6.39)
*EPU*2	0.037	0.024	0.075	0.029	−0.010	0.025	0.030	0.035	0.041	0.054
	(2.40)	(1.57)	(3.59)	(1.62)	(0.42)	(1.58)	(1.67)	(2.38)	(2.57)	(2.91)

Note(s): This table reports the average pricing errors (α_i), coefficients of $\beta_{k,i}$ and goodness-of-fit statistics obtained from the GMM estimation of system (1) using monthly data from January 1994 to December 2023. We use the FTSE Nareit U.S. REIT indices for 10 real estate sectors. *p*1: Apartment; *p*2: Diversified; *p*3: Healthcare; *p*4: Industrial; *p*5: Lodging Resorts; *p*6: Office; *p*7: Regional Malls; *p*8: Residential; *p*9: Retail; *p*10: Shopping Centers. J_T is Hansen's statistic (to test the model's over-identifying restrictions) and *p*-values are provided in parentheses
The model is the five-factor APM. The factors are the market excess return (*MKT*), *SMB* and *HML* the Fama and French size (small minus big) and book-to-market (high minus low) factors, the geopolitical risk index (*GPR*), introduced by Caldara and Iacoviello (2022) and the economic policy uncertainty indices (*EPU*1, *EPU*2), introduced by Baker *et al.* (2016). *EPU*1 is the "Three Components Index". *EPU*2 is the "News Based Policy Uncertainty Index". For the estimates (α and β) the *t*-stats are provided in parentheses. The table reports the results of the augmented Fama and French asset pricing models, adding the *GPR* index. N.B. critical values for *t*-stats are 1.645 (at 10%), 1.960 (at 5%), 2.576 (at 1%)
Source(s): Table created by authors

Table 6. Fama-French asset pricing model *GPR* and *EPU*

5. Conclusion

This article analyzes the role of geopolitical risk and economic policy uncertainty as potential risk factors in U.S. Nareit indice returns since the "new REITs era" (from January 1994 to December 2023). Using standard Fama and French (1993) asset pricing models including a geopolitical risk factor, *GPR*, as recently introduced by Caldara and Iacoviello (2022), we report that this factor is priced in all U.S. Nareit sectors. The coefficients estimates are low compared to Fama-French risk factors with an average of 0.0312. They are higher for Shopping Centers, Retail and Regional Malls and lower for Health Care and Lodging.

Economic policy uncertainty indices, introduced by Baker *et al.* (2016), are also priced, but are less statistically significant. Health Care sector, followed by Shopping Centers and Retail are the most policy-sensitive sectors. The coefficient estimated may be compared to the coefficient estimates of the *GPR* factor, with an average for *EPU*1 of 0.0554 (when both risks are priced).

These results shed a new light on the relative importance of geopolitical risk and economic policy uncertainty in the real estate sector. They suggest possible implications for investors, insurers, bankers, policy makers and other stakeholders in a context marked by higher uncertainty shocks and geopolitical risks. It could be interesting to analyze the diffusion channels (interest rates, building material prices . . .) at a REIT level. We leave this promising point for future research.

Notes

1. See for example Caldara *et al.* (2016), Cai *et al.* (2022) and Choi (2022) among others.
2. "2023–24 Top Ten Issues Affecting Real Estate®", The Counselors of Real Estate®. https://cre.org/external-affairs/2023-24-top-ten-issues-affecting-real-estate/
3. This econometric method has already been used in financial economics by Erickson and Whited (2000), Coën and Racicot (2007), Carmichael and Coën (2008), Erickson and Whited (2012) among others.
4. To detect the presence of EIV, we can also proceed in two steps using artificial regression as proposed by Davidson and MacKinnon (2004). First, we compute estimates of EIV, $\widehat{W}$, as the residuals of k OLS regressions with observed variables, X as dependent variables and the instruments as regressors (higher moments of X such as $X - \widehat{X} = \widehat{W}$, with $\widehat{X}$, estimates of the true variables. Second, we add estimates of EIV as additional regressors (see the Appendix of Carmichael and Coën (2008) for more details).
5. https://www.reit.com/data-research/reit-indexes/monthly-property-index-values-returns
6. https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html. From this website, we use also the momentum factor (UMD).
7. https://www.matteoiacoviello.com/gpr.htm
8. https://www.policyuncertainty.com/us_monthly.html
9. https://data.sca.isr.umich.edu/
10. As reported by Table A2, in the Appendix, these results are confirmed with Carhart (1997)'s asset pricing model including GPR or EPU indices.

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Appendices

Geopolitical threats GPT: January 1994–December 2023										
	J_{T_1}	J_{T_2}	J_{T_3}	J_{T_4}	J_{T_5}	J_{T_6}	J_{T_7}	J_{T_8}	J_{T_9}	$J_{T_{10}}$
	3.00	2.20	3.04	1.09	1.32	1.97	2.75	3.43	2.71	2.67
	(0.56)	(0.70)	(0.55)	(0.90)	(0.86)	(0.74)	(0.60)	(0.49)	(0.61)	(0.61)
	α_1	α_2	α_3	α_4	α_5	α_6	α_7	α_8	α_9	α_{10}
	0.200	−0.326	0.254	0.409	−0.712	−0.133	−0.215	0.275	−0.170	−0.298
	(0.79)	(1.43)	(0.97)	(1.20)	(2.97)	(0.55)	(0.62)	(1.13)	(0.62)	(1.05)
	$\beta_{k,1}$	$\beta_{k,2}$	$\beta_{k,3}$	$\beta_{k,4}$	$\beta_{k,5}$	$\beta_{k,6}$	$\beta_{k,7}$	$\beta_{k,8}$	$\beta_{k,9}$	$\beta_{k,10}$
MKT	0.788	1.000	0.767	0.947	1.353	1.030	1.383	0.730	1.163	1.218
	(7.67)	(10.55)	(11.25)	(3.47)	(12.65)	(7.34)	(7.34)	(7.15)	(8.53)	(8.01)
SMB	0.217	0.349	0.027	0.005	0.406	0.196	0.390	0.188	0.242	0.214
	(4.33)	(4.44)	(0.27)	(0.04)	(6.45)	(3.03)	(3.17)	(3.61)	(2.44)	(2.21)
HML	0.631	0.878	0.524	0.300	1.023	0.667	0.989	0.581	0.801	0.887
	(5.96)	(6.18)	(3.12)	(1.05)	(10.27)	(5.42)	(3.76)	(5.35)	(4.09)	(4.95)
GPT	0.016	0.012	0.015	0.016	0.020	0.021	0.037	0.017	0.028	0.023
	(0.76)	(0.70)	(0.78)	(0.72)	(2.09)	(1.06)	(2.70)	(0.83)	(1.61)	(1.27)
Geopolitical Acts GPA: January 1994–December 2023										
	J_{T_1}	J_{T_2}	J_{T_3}	J_{T_4}	J_{T_5}	J_{T_6}	J_{T_7}	J_{T_8}	J_{T_9}	$J_{T_{10}}$
	3.03	3.71	2.40	3.25	0.87	1.50	2.45	3.87	3.08	3.53
	(0.55)	(0.45)	(0.66)	(0.52)	(0.93)	(0.83)	(0.65)	(0.42)	(0.54)	(0.47)
	α_1	α_2	α_3	α_4	α_5	α_6	α_7	α_8	α_9	α_{10}
	0.173	−0.258	−0.336	0.245	0.324	−0.702	−0.119	−0.259	0.244	−0.201
	(0.67)	(0.95)	(1.48)	(0.94)	(0.98)	(3.01)	(0.50)	(0.74)	(0.99)	(0.73)
	$\beta_{k,1}$	$\beta_{k,2}$	$\beta_{k,3}$	$\beta_{k,4}$	$\beta_{k,5}$	$\beta_{k,6}$	$\beta_{k,7}$	$\beta_{k,8}$	$\beta_{k,9}$	$\beta_{k,10}$
MKT	0.821	1.204	0.996	0.775	1.029	1.333	1.032	1.425	0.758	1.202
	(7.27)	(7.91)	(10.02)	(10.22)	(4.16)	(12.16)	(7.10)	(7.51)	(6.99)	(8.29)
SMB	0.244	0.234	0.369	0.049	0.034	0.429	0.231	0.427	0.216	0.282
	(5.49)	(2.71)	(5.17)	(0.53)	(0.27)	(6.99)	(3.77)	(3.57)	(4.73)	(3.04)
HML	0.631	0.843	0.882	0.525	0.297	1.035	0.658	0.969	0.589	0.800
	(6.47)	(5.18)	(6.59)	(3.30)	(1.04)	(10.11)	(5.13)	(3.83)	(5.89)	(4.37)
GPA	0.021	0.032	0.012	0.017	0.025	0.018	0.025	0.036	0.020	0.030
	(2.62)	(3.37)	(1.27)	(3.30)	(2.93)	(1.65)	(2.46)	(3.65)	(2.96)	(3.64)

Note(s): This table reports the average pricing errors (α_i), coefficients of $\beta_{k,i}$ and goodness-of-fit statistics obtained from the GMM estimation of system (1) using monthly data from January 1994 to December 2023. We use the FTSE Nareit U.S. REIT indices for 10 real estate sectors. *p*1: Apartment; *p*2: Diversified; *p*3: Healthcare; *p*4: Industrial; *p*5: Lodging Resorts; *p*6: Office; *p*7: Regional Malls; *p*8: Residential; *p*9: Retail; *p*10: Shopping Centers. J_T is Hansen's statistic (to test the model's over-identifying restrictions) and *p*-values are provided in parentheses

The model is the four-factor APM. The factors are the market excess return (*MKT*), *SMB* and *HML* the Fama and French size (small minus big) and book-to-market (high minus low) factors, and the geopolitical risk indices (*GPT*, geopolitical threats, and *GPA*, geopolitical acts), introduced by Caldara and Iacoviello (2022). For the estimates (α and β) the *t*-stats are provided in parentheses. The table reports the results of the augmented Fama and French asset pricing models, adding the *GPT* and *GPA* indices. N.B. critical values for *t*-stats are 1.645 (at 10%), 1.960 (at 5%), 2.576 (at 1%)

Source(s): Table created by authors

Table A1. Fama-French asset pricing model and *GPT*

Carhart APM and geopolitical risk: January 1994–December 2023

	J_{T_1}	J_{T_2}	J_{T_3}	J_{T_4}	J_{T_5}	J_{T_6}	J_{T_7}	J_{T_8}	J_{T_9}	$J_{T_{10}}$
	4.61	3.52	4.66	1.89	1.85	3.88	3.55	4.76	4.11	5.32
	(0.46)	(0.62)	(0.46)	(0.87)	(0.87)	(0.57)	(0.62)	(0.45)	(0.53)	(0.38)
	α_1	α_2	α_3	α_4	α_5	α_6	α_7	α_8	α_9	α_{10}
	0.202	−0.031	0.310	0.541	−0.053	−0.047	0.241	0.305	0.176	−0.100
	(0.75)	(0.12)	(1.22)	(1.40)	(0.19)	(0.17)	(0.61)	(1.18)	(0.58)	(0.34)
	$\beta_{k,1}$	$\beta_{k,2}$	$\beta_{k,3}$	$\beta_{k,4}$	$\beta_{k,5}$	$\beta_{k,6}$	$\beta_{k,7}$	$\beta_{k,8}$	$\beta_{k,9}$	$\beta_{k,10}$
MKT	0.774	0.765	0.681	0.833	1.002	0.930	1.050	0.699	0.888	1.071
	(7.47)	(7.68)	(8.87)	(2.56)	(7.86)	(5.71)	(5.38)	(6.80)	(5.46)	(6.05)
SMB	0.215	0.562	0.203	0.166	0.843	0.298	0.719	0.199	0.486	0.425
	(2.97)	(7.13)	(2.38)	(1.30)	(6.63)	(2.81)	(4.97)	(2.80)	(4.43)	(4.44)
HML	0.593	0.856	0.585	0.275	0.922	0.640	0.964	0.553	0.771	0.872
	(5.77)	(5.99)	(3.61)	(0.94)	(7.17)	(4.80)	(3.73)	(5.23)	(3.90)	(4.72)
UMD	−0.013	−0.343	−0.163	−0.255	−0.821	−0.116	−0.493	−0.028	−0.376	−0.312
	(0.13)	(2.38)	(3.60)	(1.49)	(3.94)	(0.79)	(2.60)	(0.29)	(2.35)	(2.16)
GPR	0.028	0.017	0.020	0.032	0.027	0.036	0.042	0.026	0.036	0.040
	(4.38)	(3.28)	(3.90)	(3.18)	(3.99)	(5.04)	(6.61)	(4.31)	(6.47)	(6.26)

Carhart APM and Political Uncertainty: January 1994 to December 2023

	J_{T_1}	J_{T_2}	J_{T_3}	J_{T_4}	J_{T_5}	J_{T_6}	J_{T_7}	J_{T_8}	J_{T_9}	$J_{T_{10}}$
	5.53	3.81	7.08	2.45	2.03	4.84	6.18	6.16	5.99	5.68
	(0.35)	(0.58)	(0.22)	(0.78)	(0.85)	(0.44)	(0.29)	(0.29)	(0.31)	(0.34)
	α_1	α_2	α_3	α_4	α_5	α_6	α_7	α_8	α_9	α_{10}
	0.224	−0.024	0.332	0.583	−0.060	−0.019	0.420	0.320	0.274	−0.033
	(0.84)	(0.10)	(1.33)	(1.54)	(0.21)	(0.07)	(1.09)	(1.24)	(0.91)	(0.11)
	$\beta_{k,1}$	$\beta_{k,2}$	$\beta_{k,3}$	$\beta_{k,4}$	$\beta_{k,5}$	$\beta_{k,6}$	$\beta_{k,7}$	$\beta_{k,8}$	$\beta_{k,9}$	$\beta_{k,10}$
MKT	0.791	0.774	0.702	0.803	0.989	0.963	0.991	0.728	0.857	1.017
	(8.20)	(7.81)	(8.95)	(2.46)	(7.83)	(6.38)	(5.11)	(7.28)	(5.24)	(5.90)
SMB	0.264	0.578	0.253	0.200	0.850	0.325	0.726	0.246	0.485	0.436
	(3.51)	(6.88)	(2.65)	(1.56)	(6.79)	(3.20)	(4.60)	(3.28)	(4.16)	(4.26)
HML	0.650	0.859	0.582	0.285	0.954	0.718	0.884	0.595	0.704	0.807
	(5.76)	(5.89)	(3.12)	(1.07)	(7.45)	(5.70)	(3.34)	(5.22)	(3.60)	(4.42)
UMD	−0.038	−0.343	−0.198	−0.296	−0.842	−0.127	−0.574	−0.053	−0.426	−0.365
	(0.39)	(2.34)	(3.92)	(1.77)	(4.19)	(0.91)	(2.95)	(0.55)	(2.60)	(2.46)
*EPU*1	0.055	0.043	0.109	0.051	−0.003	0.050	0.058	0.054	0.062	0.063
	(2.32)	(1.74)	(3.25)	(2.03)	(0.10)	(2.04)	(1.86)	(2.31)	(2.28)	(2.27)

Note(s): This table reports the average pricing errors (α_i), coefficients of $\beta_{k,i}$ and goodness-of-fit statistics obtained from the GMM estimation of system (1) using monthly data from January 1994 to December 2023. We use the FTSE Nareit U.S. REIT indices for 10 real estate sectors. *p*1: Apartment; *p*2: Diversified; *p*3: Healthcare; *p*4: Industrial; *p*5: Lodging Resorts; *p*6: Office; *p*7: Regional Malls; *p*8: Residential; *p*9: Retail; *p*10: Shopping Centers. J_T is Hansen's statistic (to test the model's over-identifying restrictions) and *p*-values are provided in parentheses

The model is the five-factor APM. The factors are the market excess return (*MKT*), *SMB* and *HML* the Fama and French size (small minus big) and book-to-market (high minus low) factors, the momentum factor, *UMD* (up minus down) introduced by Carhart, the geopolitical risk index (*GPR*), introduced by Caldara and Iacoviello (2022) and the economic policy uncertainty indices (*EPU*1, *EPU*2), introduced by Baker *et al.* (2016). *EPU*1 is the "Three Components Index". *EPU*2 is the "News Based Policy Uncertainty Index". For the estimates (α and β) the *t*-stats are provided in parentheses. The table reports the results of the augmented Fama and French asset pricing models, adding the *GPR* index or the *EPU*1 index. N.B. critical values for *t*-stats are 1.645 (at 10%), 1.960 (at 5%), 2.576 (at 1%)

Source(s): Table created by authors

Table A2.
Carhart asset pricing model *GPR* / *EPU*