

Evidence of Geopolitical Risk and Economic Policy Uncertainty on Equity Prices in Emerging Markets

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ABSTRACT

This paper presents evidence of the impact of changes in downside risk(ΔVaR_t), economic policy uncertainty (ΔEPU_t), the geopolitical risk (ΔGPR_t) in six Asian equity markets while controlling for COVID-19. Applying the month data for the period of 1990.01– 2021.12 to Asian markets, evidence shows that national stock returns are negatively correlated with ΔVaR_t , ΔEPU_t , ΔGPR_t and ΔGPR_t^2 , suggesting that these risk/uncertainty factors harmfully affect stock markets. Evidence shows that a rise in U.S. geopolitical risk adversely spillovers to Asia stock markets. Spreads of COVID-19 damage local stock returns via interacting with changes in EPU and GPR. **Purpose:** Present evidence of COVID-19 and the impact of changes in downside risk(ΔVaR_t), economic policy uncertainty (ΔEPU_t), the geopolitical risk (ΔGPR_t) with different forms of nonlinear specifications in six Asian equity markets. **Design/methodology/approach:** The rolling regression method is used to derive time-varying coefficients of investors' response to changes of policy uncertainty, which is sensitive to react to other uncertainty variables. **Findings:** Evidence shows that national stock returns are negatively correlated with ΔVaR_t , ΔEPU_t and ΔGPR_t^2 , suggesting that these risk/uncertainty factors adversely affect local stock markets. In addition, the evidence shows that a rise in U.S. geopolitical risk ($\Delta GPR_t^{2,US}$) can adversely spillover to domestic stock markets. A spillover effect is found from COVID_19 development. **Research limitations/implications:** The findings are based on data from six Asian markets. More data may be collected, which would expand the analysis to a broader coverage of the global market. **Practical implications:** Evidence suggests that in addition to the risk from financial markets, the geopolitical risk (GPR) and COVID-19 are important factors in determining whether a risk premium should be received. From a policymaker's point of view, geopolitical stability is the foundation for maintaining financial market stability. **Originality/value:** This paper presents evidence on the time-varying behavior of investors' response to ΔEPU_t . In addition to ΔEPU_t and the ΔGPR_t , the nonlinear components of ΔGPR_t^2 , U.S. $\Delta GPR_t^{2,US}$ and interaction to COVID-19 have a harmful effect on national stock prices in Asian markets.

Keywords: Downside risk, Economic policy uncertainty, Geopolitical risk, Safe haven, Asset pricing, Asian markets, JEL Classification: G10, G11, G14, G15

INTRODUCTION

The mean-variance approach has been one of most crucial relations in analyzing capital investments. The attractiveness of this model lies in its simplicity in focusing on two key parameters: return and variance (risk). An advance of this approach is due to Merton's (1973,1980) Intertemporal Capital Asset Pricing model (ICAPM), which implies a positive risk-return tradeoff relation in stock markets. Studies from French, Schwert, and Stambaugh (1987), Ghysels, Santa-Clara and Valkanov (2005), Kinnunen (2014), and Cederburg and O'Doherty (2019) provide supporting evidence on the positive tradeoff hypothesis. However, an extensive literature review shows that the conditional volatility and conditional mean move in an opposite direction as reported in the publications of Glosten, Jagannathan and Runkle (1993), Lettau and Ludvigson (2001) and Brandt and Kang (2004). Therefore, the evidence on the issue of risk-return relation displays mixed signs.

As noted by Guo and Whitelaw (2006), the conventional approach in conducting empirical analysis is likely to miss a component for the changes in investment opportunities that are expounded in Merton's (1973) model. It follows that some of the model specifications are likely to commit an omitted variable problem. The researchers thus have reoriented their direction by focusing on the impact of economic policy uncertainty (EPU) on stock prices. Bloom (2009, 2014) and Baker, Bloom and Davis (2016) and Chiang (2019a) demonstrate that heightened EPU will impede economic activity and delay business investment decision, which would produce a harmful impact on stock prices. The studies by Caggiano, Castelnuevo and Groshenny (2014), Li (2017), Christou, Cunado, Gupta and Hassapis (2017) and Chiang (2020) provide supporting evidence for the impact of EPU on the stock returns.

Despite the researchers' positive contributions, their attention is placed on the risk associated with financial sources. However, it is well recognized that geopolitical stability is the foundation for maintaining financial market stability. Investors tend to pay attention to information that is revealed in the daily news associated with nuclear tensions, war threats, terrorist threats, etc. All of these activities and their related uncertainties no doubt have a profoundly disturbing investors' psychology and, hence, have significant impact on investors' behavior, which would affect their judgment in making portfolio decisions. Along this line, Pástor and Veronesi (2013) suggest that political uncertainty commands a risk premium. In their recent study of U.S. political policy risk on world asset prices, Brogaard, Dai, Ngo, and Zhang et al. (2020) state that: "political uncertainty can spillover from one country and influence the financial outcomes in other countries". Caldara and Iacoviello (2022) provide various components of measuring geopolitical risk and conflict of related tensions.

The outbreak of COVID-19 has threatened human health and impeded economic activities since the spring of 2020. Its ensuing damages can be seen in the significant financial losses suffered by many investors in a short period of time (Zhang et al., 2020). In response, governments have provided assistance, by using fiscal programs and easing monetary supplies. These government interventions, however, can induce further policy uncertainty that interacts with the often rising and erratic spread of coronavirus infections. Thus, an investigation of stock returns and policy uncertainty needs to factor into the interacting effects of EPU and GPR with changes in COVID-19 infections.

This paper expands on the empirical studies of stock return behavior in several ways. First, instead of using conditional volatility to model financial risk as a way of explaining stock market variations, this study employs VaR as a measure of risk because of its information content, which covers the variance and higher stock return moments in describing asset pricing. Second, this study employs a news-based EPU index to describe stock market performance. Third, this paper uses a news-based GPR index to capture the impact arising from military-tensions, nuclear threats, or changes of governments that cause a harmful effect on stock prices. Fourth, to factor in the global influence, this study also includes U.S. GPR in the test equation. This study also incorporates the interacting effects of EPU and GPR with changes in COVID-19 infections. Lagged dividend yield and time series patterns are used as control variables. Thus, the model in this study is more inclusive because the arguments are not restricted to a single measure of risk variable, an approach that is typically used in conventional studies.

The remainder of this paper is organized as follows. Section 2 provides a brief literature review that leads to the specification of an econometric model for testing stock returns. Section 3 presents the testable hypothesis. Section 4 describes the data and variable definitions in the empirical analysis. Section 5 presents empirical evidence for the test equation and extends the analysis by applying rolling regression estimations. Section 6 tests the impact of uncertainty by incorporating the COVID-19 effect on stock returns. Section 7 concludes the empirical findings.

LITERATURE REVIEW

Empirical analysis of risk-return relation usually employs a regression model by relating stock return to a measure of risk. French et al. (1987) pioneers this research and demonstrate the (excess) stock return is positively correlated with the conditional variance or standard deviation. Tests of the null hypothesis performed by Ghysels et al. (2005), (2010), Bali and Engle (2010) and Chiang, Li and Zheng (2015) that relate the conditional mean of stock returns to the conditional variance and find evidence of a positive and statistically significant relation. However, Nelson (1991), Glosten et al. (1993), Brandt and Kang (2004) and Ang, Hodrick, Xing and Zhang (2006) test the same hypothesis and fail to find supporting evidence.

The cause of these mixed signs stems from a number of reasons, but most noticeable are the measure of risk variable and a possible missing variable. Focusing on the characteristic that conditional variance models fail to deal with the extreme tail risk has prompted researchers to shift their attention and consider downside risk as measured by using Value-at-Risk (VaR) in their approach. Bali, Demirtas and Levy (2009) report that downside risk can significantly predict stock returns in the U.S. market; *Chen, Chiang, and Härdle (2018)* document that stock returns are positively correlated with the lagged downside risk in G7 markets, and Chiang (2019b) uncovers evidence that lagged downside risk presents a significant predictive power in Chinese stocks.

A shortcoming of using historical information to construct a risk variable is based on a premise of parametric stability, which usually fails to capture updated information. A news-based index such as an EPU index, however, appears to more effectively reveal on-going disruptive events that could affect decision-making. Following the studies by Bloom (2009, 2014), Baker et al. (2016), we employ a news-based EPU index that highlights three words: {Economic, Policy,

Uncertainty}¹. By construction, the term EPU captures not only uncertainty but also encompasses economic factors as well as policy innovations, which reflect economic fundamentals and policy impact.

By applying the EPU index to examine the asset pricing model, Antonakakis, Chatziantoniou and Filis (2013), Brogaard and Detzel (2015), Arouri, Estay, Rault and Roubaud (2016), Li, Balcilar, Gupta and Chang (2015), Liu and Zhang (2015), Christou et al. (2017), Chen, Jiang and Tong (2017) and Chiang (2019a, 2019b) find supporting evidence that heightened EPU causes a damaging effect on stock prices.² The publications in the above mentioned literatures can be summarized in the following equation:

$$R_t = \alpha + \beta \cdot Risk_t + \gamma \cdot \Delta Economic Policy Uncertainty_t + \delta \cdot DY_{t-1} + u_t \quad (1)$$

where R_t is the expected (excess) market return at time t. Equation (1) specifies that a stock return is a linear function of risk, changes (Δ) in EPU, lagged dividend yields plus an error term.

Several measures have been used as proxies for financial market risk, including realized volatility (Andersen, Bollerslev, Diebold and Labys, 2003), an absolute value of stock return, return squared (Ding, Granger and Engle, 1993), conditional variance (French et al., 1987; Engle, 2009; Bollerslev, 2010; Bali and Engle, 2010), the standard deviation of the stock return (French et al., 1987), downside risk as measured by VaR (Bali et al., 2009; Chen and Chiang, 2016).³ In this study, VaR is a proxy for financial market risk because VaR possesses information that captures investors' risk-averse behavior during an extremely volatile environment. Moreover, Bali et al. (2009) and Chen et al. (2018) demonstrate that the VaR can grasp information of higher moments of stock returns via the Cornish-Fisher expansion (Cornish and Fisher, 1937).

With respect to the EPU, we prefer to use ΔEPU in this paper because of its compatibility with the notion of EPU and at the same time its ability to reduce the impact of non-stationarity. Since a rise in a ΔEPU would delay business investments and decrease household consumption that, in turn, impedes economic activity and hence stock prices, the coefficient γ in equation (1) is expected to be negative.

Empirical literature suggests the need to include dividend yields, which serve as an economic fundamental (Pettenuzzo and Timmermann, 2011; Koski and Scruggs, 1998). This assertion can

¹ Knight (1921) distinguishes risk from uncertainty on the basis of measurability. Knight (1921) argues that only quantifiable uncertainty is considered as a risk. The availability of the EPU index constructed by Baker et al., (2016) helps to implement empirical studies by separating risk and uncertainty as presented in equation (1).

² In addition, Drobetz, El Ghouli, Guedhami and Janzen (2018) report that EPU and earnings management is negatively correlated. Berger, Guedhami, Kim and Li (2018) test the EPU effect on the real economy through its influence over bank liquidity hoarding. Goodell, Goyal and Urquhart (2021) find when there is greater volatility of economic uncertainty, firms hold more cash. Chiang (2021) further finds that a rise in the U.S. EPU causes not only a decline in U.S. stock return, but also a negative spillover effect on global markets.

³ In addition to the risk component, Guo and Whitelaw (2006) find a component of hedge changes when investment opportunities are significant. Guo (2006) reports that the consumption-wealth ratio is helpful in predicting variations in international stocks.

be made by using the valuation model of future cash flows, which states that a stock price is the present value of the expected cash flows. As noted by Campbell, Lo and MacKinlay (1997), a rise in the dividend yield predicts a higher stock price. Thus, the coefficient δ is anticipated to be positive.

The information included in equation (1) obviously excludes the argument of GPR, which is the main concern of this study. Incorporating a ΔGPR_t into equation (1) yields the expression given by equation (2):

$$R_t = \alpha + \beta \Delta VaR_t + \gamma \Delta EPU_t + \psi \Delta GPR_t + \delta DY_{t-1} + \varepsilon_t \quad (2)$$

Equation (2) follows the restrictions $\beta < 0$, $\gamma < 0$, $\psi < 0$ and $\delta > 0$; VaR_t , EPU_t , GPR_t and DY_{t-1} are expressed in natural logarithm. If the estimated parameters β , γ and ψ are negative and statistically significant, then the estimated coefficients are considered to be risk-averse parameters, suggesting that investors who are exposed to downside risk, EPU or GPR would be expected to be compensated by risk/uncertainty premiums. By comparing equations (1) and (2), it is clear that $u_t = \psi \Delta GPR_t + \varepsilon_t$. The missing variable of ΔGPR_t can be detected by regressing u_t , the error term in equation (1) on the ΔGPR_t by applying an omitted variable test or conducting an orthogonality test for examining the significance of $\psi = 0$.

To complete the model, the conditional variance σ_t^2 is assumed to follow a GARCH (1,1) process as popularized by Bollerslev, Chou and Kroner (1992).⁴ That is,

$$\sigma_t^2 = \omega + b_1 \varepsilon_{t-1}^2 + b_2 \sigma_{t-1}^2, \quad (3)$$

Following Nelson (1991) and Li, Yang, Hsiao, and Chang (2005), we apply the GED distribution to model stock return error series because of the GED distribution is capable of modeling the fat-tail. The error series is assumed to be distributed as:

$$\varepsilon_t | I_{t-1} \sim \text{GED}(0, \sigma_{t-1}^2, \nu) \quad (4)$$

The system of equations (1) through (4) will be used in our empirical estimation. This model represents a general approach for estimating a stock return model that connects to existing literature in a number of different ways. First, both financial risk and EPU are simultaneously incorporated into a unified model, which avoids the omitted variable problem (Kennedy, 2008), which allows only ΔVaR_t or ΔEPU_t in the test equation in existing literature. Second, in addition to the economic factor, ΔGPR_t is also incorporated into the model, which now contains a broader coverage of the nature of risk. Third, the DY_{t-1} captures the economic fundamental implied in the valuation model based on a dividend stream. It posits that a rise in dividend yields indicates improving performance in stock prices (Campbell et al., 1997). Fourth, the GED-

⁴ Alternatively, a model is known as the exponential GARCH model by Nelson (1991), and the GPR specification (Glosten et al., 1993) is considered in the experimental stage. However, no significant evidence is showed on the asymmetric coefficient since the effect is already embedded in the measure of a downside risk. Bollerslev (2010) provides a good survey on various specifications of GARCH-type models.

GARCH model specification helps to deal with the fat-tail distribution and the volatility clustering phenomenon.

The outbreak of the COVID-19 pandemic elevated the fears of market participants whose normal daily activities were interrupted by measures to prevent the spread of the virus. These interruptions caused uneven economic activities, production delays, profit declines, and increases in government regulation. The destructive impacts of these changes typically have been expressed in financial losses and a plunge in share prices. The negative effect of COVID-19 on stock returns has been documented by a number of studies in recent literature (Baker et al., 2020). For instance, Zhang et al. (2020) find that the impact of COVID-19 has caused investors to suffer big losses in a short period of time due to heightened risk. Chatjuthamard et al. (2021) test the global market and find that an increase in the growth rate of the number of confirmed cases of COVID-19 increases volatility while reducing return. They further find that the risk from COVID-19 has fueled the sources of economic and political risk in recent years. Khatatbeh et al. (2021) reveal that the announcement of the first confirmed COVID-19 case had a significant negative impact on stock returns. Harjoto et al. (2020) examine the reaction of emerging markets' investors to COVID-19 cases and mortality rates and find results that differ from those in the developed markets across two different periods of COVID-19 infection. Chiang (2022b) tests global markets and finds not only a direct damaging effect of COVID-19 on global stock returns but also an indirect effect via its influence on stock market volatility. In the robustness test, this paper extends the literature by examining the impact on Asia countries and incorporating the effect of an interaction from a change of GPR and a change in the rate of COVID-19 infections

TESTABLE HYPOTHESES

To test equation (2) and its variants, it is convenient to summarize our notions in the following hypotheses.

Hypothesis I: *Conditional downside risk premium hypothesis*: This hypothesis reveals that investors place a high priority avoiding a big loss in managing their investments as noted by Bali et al. (2009), Chen and Chiang, (2016a) and Chen et al. (2018). This safety-first principle becomes more apparent when investors face a dramatic economic downturn. This principle implies that the estimated coefficient of the ΔVaR_t is expected to be negative, since $-\beta \Delta VaR_t = -\beta VaR_t + \beta VaR_{t-1}$. Thus, investors who buy stocks at time t-1 would expect to be rewarded by a downside risk premium at time t.

Hypothesis II: *Economic policy uncertainty hypothesis*: This hypothesis is motivated by the literature that a heightened level of EPU tends to impede economic activities, delaying business investment, and in turn worsening the expected future cash flows and stock returns (Bloom, 2009; Leduc and Liu, 2016). Thus, it is anticipated that stock returns are negatively correlated with the ΔEPU (Chen et al., 2017; Chiang, 2019a), that is, $\gamma < 0$. The negative sign of the estimated coefficient is consistent with the notion that rational traders will be rewarded by an uncertainty premium, since $-\gamma \Delta EPU_t = -\gamma EPU_t + \gamma EPU_{t-1}$. This relationship suggests that rational traders who buy shares at time t-1 when uncertainty is high will see price discounts as prevailing prices are declining. However, the traders will receive a reward as prices rebound at

a later point of time, as reflected in $\gamma > 0$ for EPU_{t-1} in the subsequent period. This increase in price is the uncertainty premium rewarded to rational traders.

Hypothesis III: *Geopolitical risk premium hypothesis*: This hypothesis is tied closely to geopolitical risk (GPR) that goes beyond economic events (Klößner and Sekkel, 2014). It has been seen that the news of an increase in uncertainty from military tensions, military-related tensions, war threats, terrorist threats, etc. (Chan, Saffarand and Wei, 2019) are factors in determining economic uncertainty. ΔGPR could lead investors to take a more prudent approach and postpone their decision-making. As such, we expect that stock returns are inversely related to ΔGPR_t . That is, $\psi < 0$.

Hypothesis IV: *Nonlinear geopolitical risk hypothesis*: This is an extension of Hypothesis III, which captures a market phenomenon that uncertainty has an emotional dimension that takes shape as fear, pessimism and other negative reactions that tend to cause investors to react intensively to political events that can have an impact on the economy. The hypothesis focuses not only on investors' informational but also non-informational responses aimed at coping with uncertainty (Freeston, Rheaume, Letarte, Dugas and Ladouceur, 1994; Hillen, Gutheil, Strout, Smets and Han, 2017). This emotional reaction is reflected in nonlinear terms such as $\Delta EPU_t \cdot \Delta GPR_t$, ΔGPR_t^2 , $|\Delta GPR_t|$ or other nonlinear terms in this study.

Hypothesis V: *International geopolitical risk hypothesis*: This is analogous to international financial contagion hypothesis. Uncertainty in one country, especially if the event occurs in a major country, is transmitted to another country without a change in economic fundamentals (Chiang, Jeon and Li, 2007; Forbes, 2012; Chiang, 2021). This phenomenon is even more evident in a high-tech environment, since investors can access information via mass media, digital devices and trade connections that link financial channels, enabling local investors to reassess their portfolio positions as ΔGPR rises in the financial center (Wall Street) and political center (Main Street). In this study, the variance of the U.S. ΔGPR and $\Delta GPR_t^{2,US}$ will be employed to test the international ΔGPR effect.

DATA

The data in this study cover the markets including China (CN), Hong Kong (HK), India (IN), South Korea (KO), Malaysia (MA) and Thailand (TH) for the period of 1990.01 – 2021.12. The selection of these markets is mainly due to the fact that regional war, power conflict and terrorist threat are frequently observed and the data constrained by the availability of the economic policy uncertainty indices provided by Davis (2020) and the geopolitical indices by Caldara and Iacoviello (2022). In addition, this group of Asia markets is more vulnerable and sensitive to external shocks; yet these markets have great potential to grow.

The total stock return (RI in *Datastream*) is defined as the total price index adjusted by the dividend yield. Specifically, $RI_t = RI_{t-1} \cdot [(PI_t + D_t)/PI_{t-1}]$ as defined by the *Datastream*, where PI_t is the stock price index, and D_t is the dividend. The returns are calculated by taking the natural log-difference of RI times 100. The daily stock index is used to calculate the downside risk, which is the minimum of daily returns of the past 21 trading days (Bali et al., 2009). The original VaR_t is multiplied by -1 before running regressions. The monthly data are measured at the end of the month in the regression analysis. The dividend yield (*DY*) is calculated at the

end of the month. Following Bekaert and Harvey (1995), the stock indices are measured using U.S. dollars, which allow cross-market comparisons to be made and remove the exchange rate influence.

The EPU is based on the criterion established by Baker et al. (2016) for three words, E, P, U: Economic, Policy, Uncertainty and their variants, which are extracted from daily, local, and major newspapers available at to EPU. Davis (2020) and his associates construct a scaled frequency count of articles related to own-country newspaper articles that discuss EPU during the month. Davis (2020) also constructs a Global Economic Policy Uncertainty (GEPU) Index, which is a balanced panel of monthly EPU index values for 21 countries from January 1997 to the present. The computed GEPU Index value for each month is the GDP-weighted average of the 21 national EPU index values, using GDP data from the IMF's World Economic Outlook Database (https://www.policyuncertainty.com/global_monthly.html). On the EPU website, Baker et al. (2019) also construct a newspaper-based equity market volatility measure calibrated by a COVID-19 pandemic index as denoted $\Delta V_{D,t}$. This index is obtained by the counts of newspaper articles that contain at least one term in E(economic), M (stock market), V (volatility), and ID (disease) and their variants across approximately 3,000 U.S. newspapers.

Caldara and Iacoviello (2022) construct a monthly index of Geopolitical Risk (GPR Index) by counting the occurrence of words related to geopolitical tensions in 11 leading international newspapers. Caldara and Iacoviello (2022) derive the Geopolitical Risk index by search and identifies articles containing references to the following words: {military-related tensions, nuclear tensions, war threats, terrorist threats, terrorist acts, or the beginning of a war}. The GPR indices were downloaded from Caldara and Iacoviello (2022) and were updated in February 2022 (See https://www.matteoiacoviello.com/gpr_country_files/gprc_as.htm#tab-2786-2).

EMPIRICAL EVIDENCE

Time Series Paths of Stock Indices

Figure 1 depicts the time series plots of various stock indices (for China, Hong Kong, India, South Korea, Malaysia, and Thailand) that measure the total market of stock indices on the vertical axis and time on the horizontal axis. The stock indices display some degree of comovements as exhibited by some major turning points, which reflect the influence of some common events or external shocks. In reviewing these results, the Hong Kong market performance is notably more apparent because of its relatively greater efficiency and the role it plays in bridging Asian markets and advanced markets. The figures also show several market dips and major turning points: the Asian financial crisis in October 1997; the 911 terrorist attack in 2001 and later the SARs outbreak; the U.S. subprime crisis and bankruptcy of Lehman Brothers in October 2008; Brexit in June 2016. These events more or less spilled over to other Asian markets under investigation. Of course, each individual market has its individual own shocks. For instance, in early 2015, Chinese stock markets were driven by an easing monetary policy, which prompted an expansion by enthusiastic individual investors in speculative investments. The market then crashed in May 2015. Since 2018, China has been experiencing a series of trade negotiations with the U.S. and the Trump administration, which have caused volatile movements in the stock markets. Korea markets have suffered from Daewoo Motors bankruptcy in November 2000 and the Korea parliament impeachment of President Park

during the period from February 2016 through March 2017. Since January 2015, the India stock market (BSE Sensex) crashed, a downturn that extended to 2016 due to fears of the country's potential weakening global position, especially with respect to China's growth. Starting in March 2019, India's stocks experienced a continual decline as WHO declared the Coronavirus outbreak a "pandemic" phenomenon.

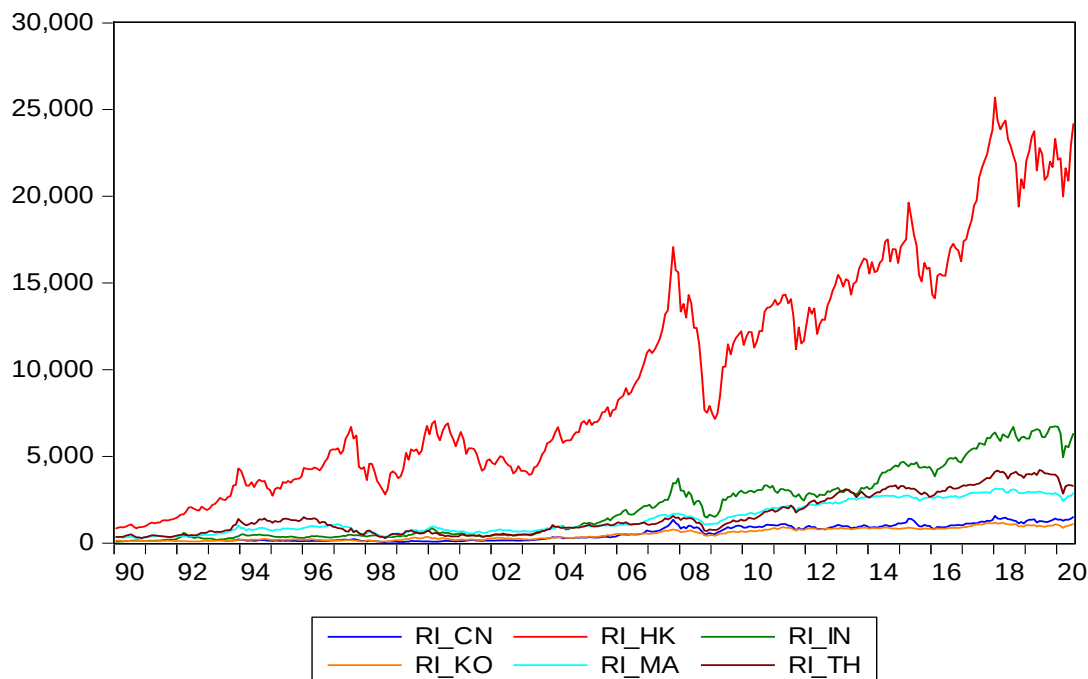


Figure 1: Time series plots of total return series for various stock market indices

Table 1 provides summary statistics of monthly stock market returns for each market for the period of January 2000 through July 2020. The mean values in Table 1 indicate that the highest market performance occurred in India and was followed by Hong Kong, while S. Korean stocks underperform all other markets. With respect to the standard deviation, China has the highest value, whereas the Malaysia market has the lowest. Pooling mean-variance information, the Hong Kong market appears most impressive, with relatively high returns and low risk.

Table 1: Summary statistics of monthly stock market returns: 1990.01 – 2020.02

Statistics	$R_{CN,t}$	$R_{HK,t}$	$R_{IN,t}$	$R_{KO,t}$	$R_{MA,t}$	$R_{TH,t}$
Mean	0.6962	0.6134	1.1629	0.2422	0.6192	0.6548
Median	0.9875	1.0422	1.1781	0.5104	0.9049	0.7149
Maximum	64.1834	26.4523	53.7902	20.7196	33.5029	47.4158
Minimum	-29.0974	-34.8235	-41.4871	-23.5822	-39.1017	-31.5856
Std. Dev.	9.2450	6.9807	9.0230	6.2090	6.6209	8.9106
Skewness	0.8094	-0.3008	0.1768	-0.1131	-0.4192	0.2134
Kurtosis	10.4926	5.6716	7.8511	4.6087	10.3411	6.7083
Jarque-Bera	754.07	113.12	356.84	39.81	823.46	210.16

Empirical Evidence

Equations (1) and (2) are estimated by using GED-GARCH procedure, the results are reported in Tables 2 and 3, respectively. Since equation (1) is nested in equation (2) and estimated statistics are comparable, our interpretations focus on the latter.

Table 2: Estimates of downside risk, economic policy uncertainty and lagged dividend yield on market stock returns

Market return	C	ΔVaR_t	ΔEPU_t	DY_{t-1}	AR(1)	AR(12)	AR(13)	ω	ε_{t-1}^2	σ_{t-1}^2	$\bar{R}^2$
$R_{CN,t}$	0.403	-0.039	-0.007	0.234		-0.017		168.247	4.539	0.399	0.06
	2.62	-48.07	-54.89	1.73		-2.99		0.68	0.84	0.79	
$R_{HK,t}$	-5.522	-0.039	-0.056	6.207			-0.086	2.198	0.126	0.815	0.20
	-3.14	-8.43	-4.02	3.67			-1.80	1.16	1.47	7.36	
$R_{IN,t}$	-0.973	-0.035	-0.024	5.013	0.044			20.271	1.057	0.704	0.19
	-7.14	-47.99	-18.93	17.44	2.80			0.60	0.82	2.16	
$R_{KO,t}$	-1.063	-0.037	-0.022	0.921	0.035			12.764	1.175	0.694	0.10
	-5.07	-63.13	-14.65	7.73	2.59			0.76	1.13	3.17	
$R_{MA,t}$	-0.251	-0.031	-0.006	0.904	-0.015			2.863	1.182	0.783	0.11
	-1.78	-203.70	-46.88	7.19	-2.57			0.55	1.12	4.80	
$R_{TH,t}$	-1.374	-0.084	-0.036	0.670			0.018	32.664	1.587	0.665	0.12
	-21.64	-19.94	-81.72	28.43			6.88	0.66	0.77	2.08	

Notes: This table presents evidence of stock returns, R_t on ΔVaR_t , ΔEPU_t and DY_{t-1} using a GED-GARCH (1,1) procedure. The stock returns include total market indices from China (CN), Hong Kong (HK), India (IN), South Korea (KO), Malaysia (MA) and Thailand (TH). The independent variables are changes in downside risk (ΔVaR_t), economic policy uncertainty (ΔEPU_t) and lagged dividend yield (DY_{t-1}). AR(p) denotes autocorrelation with p^{th} orders. The statistics of ω , ε_{t-1}^2 and σ_{t-1}^2 in the variance equation are constant parameters. For each model, the first row reports the estimated coefficients, the second row contains the estimated z-statistics. The critical values of t-distribution at the 1%, 5%, and 10% levels of significance are 2.63, 1.98, and 1.66, respectively. $\bar{R}^2$ is the adjusted R-squared for the coefficient of determination.

Table 3: Estimates of downside risk, economic policy uncertainty, ΔGPR and lagged dividend yield on market stock returns

Market return	C	ΔVaR_t	ΔEPU_t	ΔGPR_t	DY_{t-1}	AR(1)	AR(12)	AR(13)	ω	ε_{t-1}^2	σ_{t-1}^2	$\bar{R}^2$
$R_{CN,t}$	0.130	-0.039	-0.008	-0.011	0.359		-0.045		52.131	1.724	0.498	0.06
	0.59	-37.31	-6.01	-3.44	1.98		-2.96		0.81	1.02	1.40	
$R_{HK,t}$	-5.797	-0.038	-0.048	-0.024	6.406			-0.100	2.184	0.149	0.790	0.20
	-3.18	-8.11	-3.32	-2.55	3.67			-2.06	1.24	1.72	7.29	
$R_{IN,t}$	-1.290	-0.032	-0.032	-0.022	5.609	0.107			23.931	1.003	0.692	0.20
	-18.02	-32.04	-38.66	-11.01	35.84	21.36			0.59	0.78	1.95	
$R_{KO,t}$	0.285	-0.032	-0.028	-0.014	0.912	0.016			1.117	0.457	0.889	0.09
	2.97	-41.68	-23.22	-13.27	4.93	3.43			0.34	1.08	9.75	
$R_{MA,t}$	-3.748	-0.025	-0.017	-0.002	3.809	-0.029			7.285	2.065	0.657	0.10
	-29.63	-149.61	-11.60	-4.63	33.62	-3.70			0.67	0.86	2.19	
$R_{TH,t}$	-0.757	-0.037	-0.055	-0.002	1.349			0.028	23.945	0.965	0.751	0.11
	-7.82	-297.98	-46.37	7.09	17.22			12.18	0.64	0.70	2.72	

Notes: This table presents evidence of stock returns, R_t on ΔVaR_t , ΔEPU_t , ΔGPR_t , and DY_{t-1} using a GED-GARCH (1,1) procedure. The stock returns include total market indices from China (CN), Hong Kong (HK), India (IN), South Korea (KO), Malaysia (MA) and Thailand (TH). The independent variables are changes in downside risk (ΔVaR_t), economic policy uncertainty (ΔEPU_t), geopolitical risk (ΔGPR_t) and lagged dividend yield (DY_{t-1}). AR(p) denotes autocorrelation with p^{th} orders. The statistics of ω , ε_{t-1}^2 and σ_{t-1}^2 in the variance equation are constant parameters. For each model, the first row reports the estimated coefficients, the second row contains the estimated z-statistics. The critical values of t-distribution at the 1%, 5%, and 10% levels of significance are 2.63, 1.98, and 1.66, respectively. $\bar{R}^2$ is the adjusted R-squared for the coefficient of determination.

As shown in Table 3, the coefficients on ΔVaR_t and ΔEPU_t are negative and statistically significant. The results are consistent with our perception that a rise in downside risk or heightened EPU can impede economic activity, causing a potential deterioration in future cash flows that depress stock prices. The results are consistent with the findings reported by Bali et al. (2009), Chen et al. (2018) for the effect of downside risk documented by Christou et al. (2017), Chen, et al. (2017) and Chiang (2019a) for a change of EPU. Therefore, the preliminary evidence supports both Hypothesis I and Hypothesis II – *The risk/uncertainty premium hypothesis*.

Evidence also shows that the stock returns are negatively correlated with the ΔGPR_t and statistically significant. This result is consistent with the phenomenon that a rise in GPR would lead to market instability and cause delays in business investment decisions, which in turn would depress stock market returns (Chiang, 2021; Caldara and Iacoviello, 2022). The evidence is consistent with Hypothesis III – *Geopolitical risk premium hypothesis*.

Dynamic Investor Behavior and Policy Innovations

The Lucas (1976) critique suggests that when a policy shock hits the system, the market participants will adapt their behavior to the new anticipated market condition. As a result, the parameters that are used to describe market behavior in response to policy uncertainty cannot be held constant. In response to the Lucas critique, we re-estimate equation (1) by applying rolling regressions with a fixed window of 48 observations. The estimated coefficients of ΔEPU_t , $\hat{\gamma}_t$, for different markets are depicted in Figure 2. The estimated coefficients are obviously time-varying, especially in the earlier period when the Asian crisis hit this region. The volatility is more pronounced in the Thailand and Hong Kong markets, which are considered to be the center of the disaster area during the crisis. On the other hand, the China and India markets are relatively stable due to the fact that they were less open at that time.

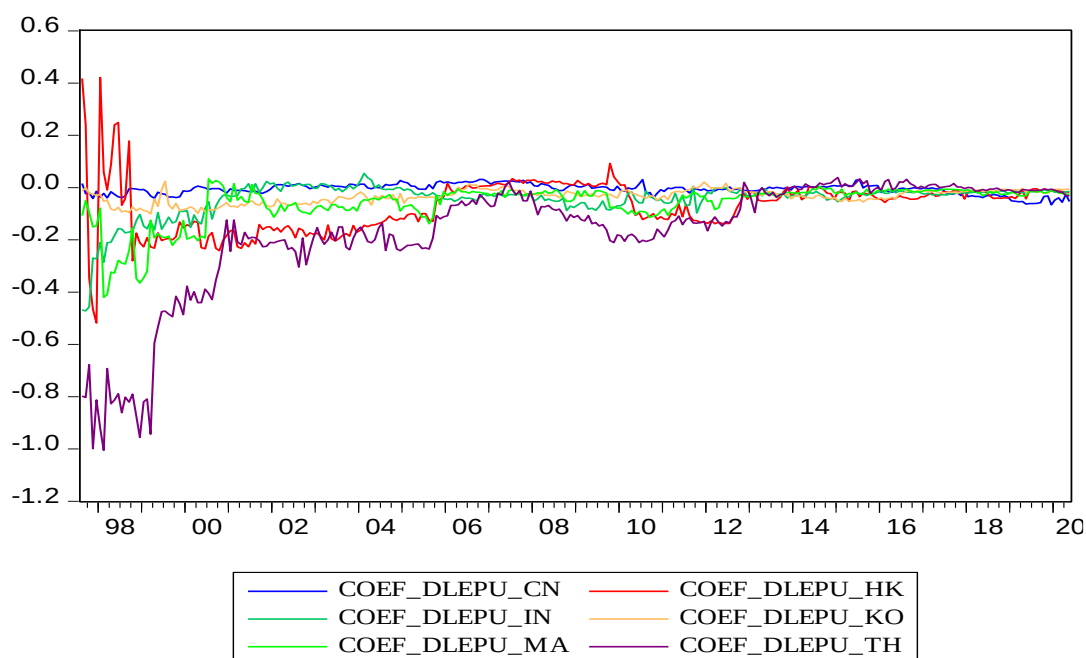


Figure 2: Time-varying coefficients of change in economic policy uncertainty derived from rolling regressions with a window of 48 fixed observations

To describe the nature of this behavioral change, we fit the time-varying $\hat{\gamma}_t$ series as follows:

$$(1 - \phi_p L^p) \hat{\gamma}_t = b_0 + b_1 \Delta GPR_t + b_2 \Delta GPR_t^2 + \varepsilon_t \quad (5)$$

where $\hat{\gamma}_t$ is the estimated coefficient of ΔEPU_t for the rolling regression for each market based on equation (1). $\hat{\gamma}_t$ is assumed to be related to a change in GPR and its variance as measured by either by ΔGPR_t^2 or $|\Delta GPR_t|$ (Ding, et al., 1993). L^p is lagged operator with p period lags. The regression estimates of equation (5) are reported in Tables 4 and 5. These tables convey the following information.

Table 4: Estimates of coefficient of change in economic policy uncertainty to change in geopolitical risk and its variability

Coefficient	C	ΔGPR_t	ΔGPR_t^2	$AR(1)$	$AR(2)$	ω	ε_{t-1}^2	σ_{t-1}^2	$\chi^2(2)$	$\bar{R}^2$
$\hat{\gamma}_{CN,t}$	0.002	0.00002	-0.0000007	0.924	0.069	0.000	1.216	0.329	293.50	0.72
	0.22	16.71	-4.87	223.76	14.70	1.29	1.26	0.94	[0.00]	
$\hat{\gamma}_{HK,t}$	-0.048	-0.00002	0.0000011	0.752	0.198	0.000	1.492	0.599	105.78	0.31
	-26.94	-4.11	9.93	70.90	20.52	1.11	1.31	3.88	[0.00]	
$\hat{\gamma}_{IN,t}$	-0.031	-0.00003	-0.0000003	0.432	0.188	0.000	0.556	0.894	1792.70	0.82
	-77.57	-6.52	-4.63	31.90	12.99	0.42	0.79	9.47	[0.00]	
$\hat{\gamma}_{KO,t}$	-0.004	0.00001	-0.0000003	0.728	0.231	0.000	0.458	0.801	1859.73	0.72
	-1.04	9.23	-15.93	83.79	26.33	0.73	1.54	7.97	[0.00]	
$\hat{\gamma}_{MA,t}$	-0.021	-0.00001	0.0000001	0.871	0.069	0.000	0.231	0.836	29.35	0.78
	-10.07	-4.39	2.38	45.28	3.76	0.99	1.65	13.42	[0.00]	
$\hat{\gamma}_{TH,t}$	-0.036	-0.00007	0.000001	0.542	0.437	0.000	0.488	0.884	210.94	0.95
	-2.68	-12.24	8.79	40.36	32.12	0.42	0.93	9.99	[0.00]	

Notes: This table presents evidence of $\hat{\gamma}_{i,t}$ on ΔGPR_t and ΔGPR_t^2 using a GED-GARCCCH (1,1) procedure. The of $\hat{\gamma}_{i,t}$ is the time-varying coefficients of ΔEPU_t from China (CN), Hong Kong (HK), India (IN), South Korea (KO), Malaysia (MA) and Thailand (TH). The independent variables are changes in geopolitical risk (ΔGPR_t) and nonlinear GPR (ΔGPR_t^2) and autocorrelations with two lags. The statistics of ω , ε_{t-1}^2 and σ_{t-1}^2 in the variance equation are constant parameters. For each model, the first row reports the estimated coefficients, the second row contains the estimated z-statistics. $\chi^2(2)$ is the Chi-square statistics with two restrictions on the coefficients of ΔGPR_t and ΔGPR_t^2 to be zero. The critical values of t-distribution at the 1%, 5%, and 10% levels of significance are 2.63, 1.98, and 1.66, respectively. Values in the bracket are P-values. $\bar{R}^2$ is the adjusted R-squared for the coefficient of determination.

Table 5: Estimates of coefficient of change in economic policy uncertainty to change in geopolitical risk and its variability

Coefficient	C	ΔGPR_t	$ \Delta GPR_t $	$AR(1)$	$AR(2)$	ω	ε_{t-1}^2	σ_{t-1}^2	$\chi^2(2)$	$\bar{R}^2$
$\hat{\gamma}_{CN,t}$	-0.008	0.00002	-0.00001	0.884	0.050	0.001	0.517	0.724	79.50	0.73
	-9.34	7.17	-3.99	129.46	10.43	0.95	1.31	4.40	[0.00]	
$\hat{\gamma}_{HK,t}$	-0.049	-0.00001	0.00006	0.945	-0.025	0.001	1.068	0.696	1041.23	0.31
	-54.95	-5.54	24.66	93.18	-2.96	1.06	1.31	6.06	[0.00]	
$\hat{\gamma}_{IN,t}$	-0.034	-0.00002	-0.00001	0.566	0.257	0.001	0.469	853	3649.61	0.88
	-83.49	-13.34	-2.31	46.63	20.88	0.56	1.07	8.49	[0.00]	
$\hat{\gamma}_{KO,t}$	-0.014	0.000005	-0.00002	0.789	0.150	0.000	0.694	0.679	56.11	0.72
	-6.98	2.29	-7.14	67.56	11.12	0.94	1.50	4.15	[0.00]	
$\hat{\gamma}_{MA,t}$	-0.031	-0.00001	0.00002	0.652	0.221	0.000	0.262	0.892	47.47	0.78
	-45.89	-4.87	6.11	102.22	28.92	0.62	1.09	14.02	[0.00]	
$\hat{\gamma}_{TH,t}$	-0.094	-0.00001	-0.00005	0.592	0.375	0.000	1.401	0.592	256.22	0.95

	-37.29	-2.81	-14.78	71.99	45.15	0.69	1.45	3.03	[0.00]	
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Notes: This table presents evidence of $\hat{\gamma}_{i,t}$ on ΔGPR_t and $|\Delta GPR_t|$ using a GED-GARCH (1,1) procedure. The $\hat{\gamma}_{i,t}$ is the time-varying coefficients of ΔEPU_t from China (CN), Hong Kong (HK), India (IN), South Korea (KO), Malaysia (MA) and Thailand (TH). The independent variables are the changes in geopolitical risk (ΔGPR_t) and absolute level of change in geopolitical risk ($|\Delta GPR_t|$) and autocorrelations with two lags. The statistics of ω , ε_{t-1}^2 and σ_{t-1}^2 in the variance equation are constant parameters. For each model, the first row reports the estimated coefficients, the second row contains the estimated z-statistics. $\chi^2(2)$ is the Chi-square statistics with two restrictions on the coefficients of ΔGPR_t and $|\Delta GPR_t|$ to be zero. The critical values of t-distribution at the 1%, 5%, and 10% levels of significance are 2.63, 1.98, and 1.66, respectively. Values in the bracket are *P*-values. $\bar{R}^2$ is the adjusted R-squared for the coefficient of determination.

First, investor behavior, as revealed in the estimated coefficient, $\hat{\gamma}_t$, responds to policy innovations not only in a linear form but also nonlinear fashion. This result is verified by the t-statistics, which are significant. In addition, a joint test based on the Chi-square statistics, which produces high *P*-value (shown in the brackets), also leads to a rejection of the null. The evidence implies that the linear model provided by equation (2), which only includes a ΔGPR_t term, may be insufficient to capture the behavioral response of investors. (See Table 3 for results of equation (2)). However, the results are consistent with the Lucas critique (1976). Further, the AR terms are significant although they vary among the different markets. The results may be partially attributable to the construction of rolling regressions. However, the time series pattern for each market also reflects their systematic responses to policy innovations.

NONLINEAR IMPACT

Evidence of Domestic Market

Evidence from a previous section signifies that investor behavior displays some sort of nonlinear phenomena. Since many different forms of nonlinearity can be specified, we now focus on the specifications using $\Delta EPU_t \times \Delta GPR_t$, ΔGPR_t^2 and $|\Delta GPR_t|$ to re-estimate equation (2). The results, which are reported in Tables 6, 7, and 8, respectively, are summarized as follows. First, coefficients of ΔVaR_t for different markets exhibit negative signs, and the t-statistics are significant at the 1% level. The evidence strongly supports the *downside risk premium hypothesis*, which is consistent with results documented by Bali et al. (2009) for the U.S. market and Chen and Chiang (2016a) for the G7 markets.

Second, the estimated results show that stock returns and ΔEPU_t are negatively correlated and the estimated t-statistics are highly significant. The evidence indicates that a rise in ΔEPU_t produces a harmful effect on stock markets. This negative relation confirms with the *economic policy uncertainty premium hypothesis*. The results are consistent with the findings reported by Bloom (2009, 2014) Baker et al. (2016) Brogaard and Detzel (2015), Li, Balcilar, Gupta and Chang (2015), Liu and Zhang (2015), Christou et al. (2017) and Chiang (2019a, 2019b).

Third, the coefficients for ΔGPR_t display negative signs and are statistically significant. The evidence suggests that investors are also risk averse to ΔGPR arising from uncertainty related to activities of social movements, military threats, terrorist attacks, changes in government regime or the upcoming election among other events. The damaging impact on stock prices is consistent with the findings reported by Pástor and Veronesi (2013), Chiang and Chen (2021), Chiang (2021), and Caldara and Iacoviello (2022).

Fourth, the estimated results indicate that the nonlinear terms are highly significant. The product terms of $\Delta EPU_t \times \Delta GPR_t$ in Table 6 show mixed signs, which could be the result from a situation in which two elements reinforce or offsetting each other. However, the nonlinear terms of ΔGPR_t^2 in Table 7 and $|\Delta GPR_t|$ in Table 8 consistently display negative signs and are statistically significant. The negative sign is consistent with the phenomenon that when the economy is under stress or faces political turbulence, investors tend to delay their investment decisions (Wade, 2019) and even sell off stocks, causing a negative correlation between stock returns and ΔGPR . This is consistent with the evidence provided by Caldara and Iacoviello (2022) and Balciar, Bonato, Demirer and Gupta (2018). It is conceivable that risk averse investors are inclined to move funds from stocks to bonds or gold with an escalation in political risk variability (Chiang, 2021, 2022a). This movement signals a flight-to-safe haven phenomenon (Baur and Lucey, 2010; Baur and Mcdermott, 2010).

Table 6: Estimates of downside risk, economic policy uncertainty, ΔGPR and lagged dividend yield on market stock returns

Return	C	ΔVaR_t	ΔEPU_t	ΔGPR_t	$\Delta EPU_t \times \Delta GPR_t$	DY_{t-1}	AR(1)	AR(12)	AR(13)	ω	ε_{t-1}^2	σ_{t-1}^2	Q(24)	$\bar{R}^2$
$R_{CN,t}$	-0.322	-0.037	-0.008	-0.012	-0.0001	0.567		-0.063		42.529	1.479	0.478	23.05	0.05
	-1.25	-27.12	-11.38	-3.40	-2.70	2.99		-6.96		0.88	1.19	1.54	[0.46]	
$R_{HK,t}$	-4.282	-0.035	-0.036	-0.007	5.329	-0.0005				5.231	0.395	0.787	27.34	0.19
	-6.65	-27.97	-11.22	-2.75	9.05	-11.67				0.63	0.96	3.74	[0.29]	
$R_{IN,t}$	-1.332	-0.033	-0.030	-0.017	-0.0003	5.565	0.083			3.824	0.443	0.891	13.69	0.20
	-9.38	-58.74	-25.49	-11.41	-4.03	19.51	10.12			0.44	0.88	7.71	[0.94]	
$R_{KO,t}$	0.032	-0.032	-0.026	-0.016	0.0002	1.047				34.991	1.229	0.508	19.74	0.09
	0.45	-45.19	-23.87	-22.51	5.57	9.54				1.12	1.12	1.62	[0.71]	
$R_{MA,t}$	-3.948	-0.023	-0.010	-0.002	0.0002	3.973	0.047			23.497	5.370	0.443	20.87	0.10
	-42.08	-102.02	-11.90	-8.29	13.09	54.39	7.03			0.77	0.87	1.16	[0.23]	
$R_{TH,t}$	-0.320	-0.037	-0.055	-0.007	-0.0003	1.045			0.027	27.018	1.950	0.615	26.94	0.11
	-3.50	-131.85	-20.03	-8.58	-5.33	13.25			14.90	0.73	0.93	2.15	[0.26]	

Notes: This table presents evidence of stock returns, R_t on ΔVaR_t , ΔEPU_t , ΔGPR_t , $\Delta EPU_t \times \Delta GPR_t$, and DY_{t-1} using a GED-GARCC (1,1) procedure. The stock returns include total market indices from China (CN), Hong Kong (HK), India (IN), South Korea (KO), Malaysia (MA) and Thailand (TH). The independent variables are the changes in downside risk (ΔVaR_t), economic policy uncertainty (ΔEPU_t), geopolitical risk (ΔGPR_t), the interaction term of economic policy uncertainty and geopolitical risk ($\Delta EPU_t \times \Delta GPR_t$), and lagged dividend yield (DY_{t-1}). AR(p) denotes autocorrelation with p^{th} orders. The statistics of ω , ε_{t-1}^2 and σ_{t-1}^2 in the variance equation are constant parameters. For each model, the first row reports the estimated coefficients, the second row contains the estimated z-statistics. The critical values of t-distribution at the 1%, 5%, and 10% levels of significance are 2.63, 1.98, and 1.66, respectively. $\chi^2(2)$ is the Chi-squared statistics for testing the joint significance of coefficients of $\Delta GPR_t = 0$ & $\Delta EPU_t \times \Delta GPR_t = 0$. Q(24) is the Ljung-Box statistics with 24 order lags. Values in the bracket are P-values. $\bar{R}^2$ is the adjusted R-squared for the coefficient of determination.

Table 7: Estimates of downside risk, economic policy uncertainty, ΔGPR , nonlinear ΔGPR and lagged dividend yield on market stock returns

Return	C	ΔVaR_t	ΔEPU_t	ΔGPR_t	ΔGPR_t^2	DY_{t-1}	AR(1)	AR(12)	AR(13)	ω	ε_{t-1}^2	σ_{t-1}^2	$\chi^2(2)$	Q(24)	$\bar{R}^2$
$R_{CN,t}$	0.367	-0.038	-0.006	-0.005	-0.0004	0.253		-0.091		83.522	2.434	0.583	858.5	23.780	0.06
	8.05	-115.46	-15.71	-38.55	-9.55	5.96		-17.15		0.64	0.83	1.49	[0.00]	[0.14]	
$R_{HK,t}$	-5.232	-0.034	-0.041	-0.019	-0.0005	6.230				-0.096	2.340	0.178	5.16	24.88	0.20
	-2.90	-7.34	-2.88	-1.95	-2.13	3.59				-2.00	1.31	1.77	[0.01]	[0.36]	
$R_{IN,t}$	-0.970	-0.030	-0.028	-0.010	-0.0007	5.955	0.134			16.217	0.571	0.790	218.00	19.13	0.20
	-17.18	-53.01	-48.46	-7.31	-88.20	45.25	20.64			0.56	0.71	2.92	[0.00]	[0.69]	
$R_{KO,t}$	0.244	-0.032	-0.028	-0.013	-0.0001	1.104	0.029			29.588	1.079	0.565	152.2	18.84	0.09
	2.25	-31.10	-33.89	-7.63	-2.90	6.80	9.25			0.99	1.06	1.80	[0.00]	[0.71]	
$R_{MA,t}$	-3.264	-0.021	-0.017	-0.005	-0.0002	3.651	-0.039			12.574	4.043	0.474	79.27	19.53	0.10
	-18.37	-45.02	-13.88	-9.37	-9.93	21.76	-7.00			0.79	1.02	1.50	[0.00]	[0.38]	
$R_{TH,t}$	-0.938	-0.035	-0.075	-0.001	-0.0001	1.797			0.021	34.664	1.065	0.750	25.67	24.03	0.13
	-14.62	-168.29	-26.83	-3.01	-5.88	53.39			2.82	0.56	0.61	2.30	[0.00]	[0.40]	

Notes: This table presents evidence of stock returns, R_t on ΔVaR_t , ΔEPU_t , ΔGPR_t , ΔGPR_t^2 and DY_{t-1} using a GED-GARCH (1,1) procedure. The stock returns include total market indices from China (CN), Hong Kong (HK), India (IN), South Korea (KO), Malaysia (MA) and Thailand (TH). The independent variables are the changes in downside risk (ΔVaR_t), economic policy uncertainty (ΔEPU_t), geopolitical risk (ΔGPR_t), GPR squared (ΔGPR_t^2) and lagged dividend yield (DY_{t-1}). AR(p) denotes autocorrelation with p^{th} orders. The statistics of ω , ε_{t-1}^2 and σ_{t-1}^2 in the variance equation are constant parameters. For each model, the first row reports the estimated coefficients, the second row contains the estimated z-statistics. The critical values of t-distribution at the 1%, 5%, and 10% levels of significance are 2.63, 1.98, and 1.66, respectively. $\chi^2(2)$ is the Chi-squared statistics for testing the joint significance of coefficients of $\Delta GPR_t = 0$ & $\Delta GPR_t^2 = 0$. Q (24) is the Ljung-Box statistics with 24 order lags. Values in the bracket are P-values. $\bar{R}^2$ is the adjusted R-squared for the coefficient of determination.

Table 8: Estimates of changes in downside risk, economic policy uncertainty, ΔGPR , absolute value of ΔGPR and lagged dividend yield on market stock returns

Return	C	ΔVaR_t	ΔEPU_t	ΔGPR_t	$ \Delta GPR_t $	DY_{t-1}	AR(1)	AR(12)	AR(13)	ω	ε_{t-1}^2	σ_{t-1}^2	$\chi^2(2)$	Q(24)	$\bar{R}^2$
$R_{CN,t}$	0.412	-0.030	-0.002	-0.010	-0.037	0.490		-0.163		18.93	0.692	0.584	171.07	25.46	0.06
	1.15	-17.96	-0.69	-2.01	-4.07	1.78		-9.84		0.98	1.40	2.54	[0.00]	[0.25]	
$R_{HK,t}$	-3.865	-0.033	-0.058	-0.022	-0.039	5.044			-0.076	3.316	0.240	0.780	10.32	23.30	0.22
	-3.55	-11.08	-5.69	-3.77	-4.07	4.78			-2.65	0.77	1.11	4.29	[0.00]	[0.44]	
$R_{IN,t}$	-0.175	-0.030	-0.037	-0.023	-0.050	5.277	0.048			19.70	0.812	0.730	437.98	17.53	0.21
	-0.99	-32.08	-26.27	-18.22	-25.40	16.27	3.84			0.58	0.77	2.42	[0.00]	[0.78]	
$R_{KO,t}$	0.359	-0.034	-0.028	-0.011	-0.005	1.020	0.032			0.902	0.379	0.901	47.07	19.44	0.09
	7.23	-41.67	-30.81	-23.84	-4.15	6.63	8.43			0.32	1.11	11.15	[0.00]	[0.68]	
$R_{MA,t}$	-3.746	-0.022	-0.018	-0.005	-0.021	4.558	0.002			3.772	1.486	0.768	158.54	20.56	0.11
	-27.25	-36.93	-21.09	-11.30	-28.95	36.18	0.19			0.51	0.87	3.44	[0.00]	[0.33]	
$R_{TH,t}$	-1.243	-0.033	-0.037	-0.005	-0.007	2.157			0.027	-	-	-	51.33	23.56	0.10
	-2.85	-24.46	-7.37	-2.45	-2.58	6.29			2.45	0.63	1.05	9.55	[0.00]	[0.43]	

Notes: This table presents evidence of stock returns, R_t on ΔVaR_t , ΔEPU_t , ΔGPR_t , $|\Delta GPR_t|$ and DY_{t-1} using a GED-GARCH (1,1) procedure. The stock returns include total market indices from China (CN), Hong Kong (HK), India (IN), South Korea (KO), Malaysia (MA) and Thailand (TH). The independent variables are the changes in downside risk (ΔVaR_t), economic policy uncertainty (ΔEPU_t), geopolitical risk (ΔGPR_t), absolute value of geopolitical risk ($|\Delta GPR_t|$) and lagged dividend yield (DY_{t-1}). AR(p) denotes autocorrelation with p^{th} orders. The statistics of ω , ε_t^2 and σ_t^2 in the variance equation are constant parameters. For each model, the first row reports the estimated coefficients, the second row contains the estimated z-statistics. The critical values of t-distribution at the 1%, 5%, and 10% levels of significance are 2.63, 1.98, and 1.66, respectively. $\chi^2(2)$ is the Chi-squared statistics for testing the joint significance of coefficients of $\Delta GPR_t = 0$ & $|\Delta GPR_t| = 0$. Q (24) is the Ljung-Box statistic with 24 order lags. Values in the bracket are P-values. $\bar{R}^2$ is the adjusted R-squared for the coefficient of determination.

Evidence of U.S. GPR

In a globally integrated financial system, it is impossible to insulate each national stock market from external disturbances. With the tremendous military power of the U.S. and its political influence in the world order, it is necessary to include the potential impact of U.S. influence on the Asian market. For this reason, we incorporate the U.S. element into the test equation by adding the term $\Delta GPR_t^{2,US}$ to Table 7. Estimated results are reported in Table 9. By comparing the estimated statistics, Table 9 yields comparable qualitative results, except for ΔGPR_t^2 in Korea market. However, the coefficients of the incremental variable, $\Delta GPR_t^{2,US}$, for all of markets are negative and statistically significant. Further testing for the joint hypothesis of the coefficients that $\Delta GPR_t = \Delta GPR_t^2 = \Delta GPR_t^{2,US} = 0$ reveals a rejection of the null as shown in the $\chi^2(3)$ statistics. Therefore, the evidence concludes that the U.S. geopolitical risk squared in tandem with domestic ΔGPR factors can have a significant damaging effect on stock prices as $\Delta GPR_t^{2,US}$, originating from the U.S., escalates. This transmission of the U.S. ΔGPR is analogous to the financial contagion, since an upward shift of $\Delta GPR_t^{2,US}$ can give rise to volatility (Balcilar

et al., 2018), creating fear that upends investors' psychological balance and disrupts the stock market stability and prices (Brogaard et al 2020; Caldara and Iacoviello, 2022).

Table 9: Estimates of stock returns respond to changes in downside risk, economic policy uncertainty and geopolitical risk, nonlinear geopolitical risk in domestic and U.S. sources, and lagged dividend yield (1993M2-2020M2)

Return	C	ΔVaR_t	ΔEPU_t	ΔGPR_t	ΔGPR_t^2	$\Delta GPR_t^{2,US}$	DY_{t-1}	AR(1)	AR(12)	AR(13)	ω	ε_{t-1}^2	σ_{t-1}^2	$\chi^2(3)$	$\bar{R}^2$
$R_{CN,t}$	0.138	-0.031	-0.004	-0.009	-0.001	-0.0001	0.429		-0.141		43.305	1.662	0.509	167.68	0.06
	0.77	-31.77	-5.02	-2.44	-8.43	-2.11	2.60		-13.54		0.81	1.21	1.70	[0.00]	
$R_{HK,t}$	-4.793	-0.024	-0.014	-0.009	-0.0003	-0.00006	5.508				25.622	1.029	0.669	834.49	0.14
	-27.57	-21.21	-13.64	-6.38	-8.03	-26.14	32.49				0.67	0.83	1.90	[0.01]	
$R_{IN,t}$	-0.940	-0.031	-0.036	-0.016	-0.001	-0.00003	6.147	0.114			26.843	0.742	0.736	259.12	0.21
	-9.68	-57.03	-46.37	-6.76	-39.84	-2.10	31.71	18.61			0.57	0.68	2.10	[0.00]	
$R_{KO,t}$	0.147	-0.032	-0.026	-0.012	0.00002	-0.0002	1.423				35.969	0.767	0.377	102.78	0.10
	0.78	-13.06	-16.00	-3.49	0.39	-4.40	4.42				1.68	1.33	1.47	[0.00]	
$R_{MA,t}$	-4.001	-0.022	-0.011	-0.004	-0.0001	-0.0001	4.300	-0.012			7.461	2.481	0.673	376.59	0.10
	-30.13	-58.99	-12.87	-18.68	-23.13	-28.34	40.00	-2.16			0.58	0.87	2.28	[0.00]	
$R_{TH,t}$	0.220	-0.035	-0.025	-0.002	-0.0001	-0.0003	0.961			-0.063	34.469	0.731	0.619	561.39	0.12
	1.86	-65.61	-9.08	-2.20	-4.09	-22.53	11.58			-7.55	0.86	0.74	1.70	[0.00]	

Notes: This table presents evidence of stock returns, R_t on ΔVaR_t , ΔEPU_t , ΔGPR_t , ΔGPR_t^2 , $\Delta GPR_t^{2,US}$ and DY_{t-1} using a GED-GARCCCH (1,1) procedure. The stock returns include total market indices from China (CN), Hong Kong (HK), India (IN), South Korea (KO), Malaysia (MA) and Thailand (TH). The independent variables are changes in downside risk (ΔVaR_t), economic policy uncertainty (ΔEPU_t), geopolitical risk (ΔGPR_t), GPR squared (ΔGPR_t^2), U.S. geopolitical risk square ($\Delta GPR_t^{2,US}$) and lagged dividend yield (DY_{t-1}). AR(p) denotes autocorrelation with p^{th} orders. The statistics of ω , ε_{t-1}^2 and σ_{t-1}^2 in the variance equation are constant parameters. For each model, the first row reports the estimated coefficients, the second row contains the estimated z-statistics. The critical values of t-distribution at the 1%, 5%, and 10% levels of significance are 2.63, 1.98, and 1.66, respectively. The $\chi^2(3)$ is the Chi-squared distribution for testing the joint significance of coefficients of $\Delta GPR_t = \Delta GPR_t^2 = \Delta GPR_t^{2,US} = 0$. Q (24) is the Ljung-Box statistic with 24 order lags. Values in the bracket are P-values. $\bar{R}^2$ is the adjusted R-squared for the coefficient of determination.

Sensibility of Recent Data

The COVID-19 pandemic has had an enormous impact on social routines and has increased costs of health system not only in terms of current patient treatments but also in terms of the measures that will likely be needed in the future to prevent and control the disease. The coronavirus is also likely to push up economic costs as businesses struggle to implement policies for social distancing and testing among other control measures. The actions have and are likely to continue to interrupt business operations, disrupt production output and supply chains, possibly leading to business closures and heightened unemployment. To alleviate disruptions, many governments have initiated rescue programs and measures to inject liquidity, but the timing of these programs and continued assistance in the future only adds to uncertainty over fiscal and monetary policies (Davis et al. 2021). To identify and better understand these economic impacts and possible changes in investors' behavior, we conduct sensitivity tests by extending the data to the end of 2021. The estimated results, which are reported in Table 10, are mainly comparable for the markets of China, Hong Kong, S. Korea and India. This is evidenced by coefficients of $\{\Delta EMV_t, \Delta EPU_t, \Delta GPR_t, \Delta GPR_t^2$ and $\Delta GPR_t^{2,US}\}$ that are negative and statistically significant; the coefficients for Malaysia and Thailand, however, do not perform similarly, reflecting different investor behavior toward ΔGPR_t with the development of the COVID-19 pandemic. In addition, the evidence shows that the time series correlation changes as reflected in pattern changes. This also confirms that stock returns are sensitive to outliers or new information.

Table 10: Estimates of stock returns respond to changes in U.S. equity market volatility, economic policy uncertainty and geopolitical risk, nonlinear geopolitical risk in domestic and U.S. sources, and lagged dividend yield (1993M2-2021M12)

Return	C	ΔEMV_t	ΔEPU_t	ΔGPR_t	ΔGPR_t^2	$\Delta GPR_t^{2,US}$	DY_{t-1}	AR(1)	AR(12)	ω	ε_{t-1}^2	σ_{t-1}^2	$\chi^2(3)$	R^2
$R_{CN,t}$	0.526	-0.066	-0.004	-0.006	-0.0005	-0.0005	0.342			58.855	2.805	0.728	1753.76	0.02
	9.44	-95.10	-3.79	-4.26	-10.65	-9.23	4.91			0.42	0.84	2.51	[0.00]	
$R_{HK,t}$	-4.225	-0.048	-0.017	-0.074	-0.0004	-0.0001	5.133			3.492	3.492	0.632	5117.99	0.11
	-15.38	-26.71	-11.56	-4.50	-14.74	-2.80	18.61			0.79	0.79	1.64	[0.01]	
$R_{IN,t}$	-0.756	-0.055	-0.029	-0.026	-0.0005	-0.0001	5.749			29.335	0.245	0.809	4100.80	0.17
	-6.66	-13.83	-20.64	-9.13	-21.16	-17.40	26.18			0.45	0.39	2.10	[0.00]	
$R_{KO,t}$	-0.633	-0.049	-0.033	-0.009	0.0001	-0.0003	3.181		-0.038	31.607	0.985	0.405	1210.31	0.07
	-3.78	-15.44	-15.93	-5.34	2.83	-34.79	10.75		-3.06	1.46	1.42	1.58	[0.00]	
$R_{MA,t}$	5.522	-0.003	-0.037	0.007	-0.0002	0.0001	-4.226		-0.034	14.564	1.286	0.581	195.96	0.01
	28.89	-5.12	-39.12	9.36	-9.59	1.92	-23.76		-3.01	0.87	0.84	1.61	[0.00]	
$R_{TH,t}$	-1.106	0.010	-0.011	-0.008	0.0001	0.0003	1.438	0.064	-0.091	1.547	0.350	0.873	76.22	0.01
	-3.59	7.85	-4.46	-5.61	8.37	4.26	5.51	11.74	-10.29	0.46	1.23	10.55	[0.00]	

Notes: This table presents evidence of stock returns, R_t on ΔEMV_t , ΔEPU_t , ΔGPR_t , ΔGPR_t^2 , $\Delta GPR_t^{2,US}$ and DY_{t-1} using a GED-GARCCH (1,1) procedure. The stock returns include total market indices from China (CN), Hong Kong (HK), India (IN), South Korea (KO), Malaysia (MA) and Thailand (TH). The independent variables are changes in U.S. equity market volatility (ΔEMV_t), economic policy uncertainty (ΔEPU_t), geopolitical risk (ΔGPR_t), GPR squared (ΔGPR_t^2), U.S. geopolitical risk square ($\Delta GPR_t^{2,US}$) and lagged dividend yield (DY_{t-1}). AR(p) denotes autocorrelation with p^{th} orders. The statistics of ω , ε_{t-1}^2 and σ_{t-1}^2 in the variance equation are constant parameters. For each model, the first row reports the estimated coefficients, the second row contains the estimated z-statistics. The critical values of t-distribution at the 1%, 5%, and 10% levels of significance are 2.63, 1.98, and 1.66, respectively. The $\chi^2(3)$ is the Chi-squared distribution for testing the joint significance of coefficients of $\Delta GPR_t = \Delta GPR_t^2 = \Delta GPR_t^{2,US} = 0$. Q (24) is the Ljung-Box statistic with 24 order lags. Values in the bracket are P-values. $\bar{R}^2$ is the adjusted R-squared for the coefficient of determination.

Impact of COVID-19 and Variants

Following outbreaks of COVID-19 in February 2020, governments initiated various rescue plans, providing coronavirus relief for health care; unemployment compensation; and assistance to families, communities and businesses. It also provided liquidity by cutting interest rates and purchasing Treasury and agency securities as needed. All these measures were helpful in the short run.⁵ The large amounts of funding through government programs helped to bolster a stock market recovery. In the long run, however, the fiscal stimulus and easy monetary policy have created inflation, leading to policy uncertainty. To address this issue, this section conducts tests, which include a measure of worldwide equity market volatility as proxied by U.S. volatility. In addition, the test equation includes product terms that reflect the reaction of ΔEPU_t and ΔGPR_t to the lagged COVID-19 pandemic change, $\Delta V_{D,t-1}$. The test results are reported in Table 11.

The estimated results indicate stock returns are negatively correlated with heightened equity market volatility, which is statistically significant and reflected in a negative slope. The evidence is consistent with the findings in the literature. Turning to $\{\Delta EPU_t, \Delta GPR_t$ and $\Delta EPU_t \cdot \Delta V_{D,t-1}\}$, the coefficients show negative signs and are statistically significant except for the $\Delta EPU_t \cdot \Delta V_{D,t-1}$ term in Hong Kong market. The evidence for $\{\Delta EPU_t$ and $\Delta EPU_t \cdot \Delta V_{D,t-1}\}$ is consistent with Chiang (2022b), who finds similar result in the global markets. Similarly, the result is in

⁵ Here we use the case of the U.S. policies to illustrate the economic changes, other countries follow a similar approach. International Monetary Fund (2021) provides a good summary of the programs related to fiscal policy and monetary policy in different countries.

line with Dai et al (2021), who used the daily skewness as a proxy for market crash and documented that EPU is negatively correlated with stock market crash risk.

For the $\Delta GPR_t \cdot \Delta V_{D,t-1}$ term, the results are diverse. The reasons for this result are complex. They may stem from the different speeds at which market participants react to shocks (Greer et al. 2020), different country residents' response to different government regulations (Davis et al., 2021) or varying responses of investors to uncertainty separate and apart from their reactions to COVID-19 crisis (Fernandez-Perez et al., 2021).

To examine the result further, we conduct $\chi^2(2)$ test, which is the Chi-squared statistics for testing the joint significance of coefficients of $\Delta EPU_t \cdot \Delta V_{D,t-1} = \Delta GPR_t \cdot \Delta V_{D,t-1} = 0$. The test statistics with 2 degrees of freedom indicate the results are highly significant as shown by the P-values in the brackets. The results uniformly reject the null and confirm the significance of policy uncertainties that interact with the lagged infectious disease. The result supports a nonlinear specification.

Table 11: Estimates of stock returns respond to changes in equity market volatility, economic policy uncertainty, geopolitical risk and interacting to infectious disease and dividend yield for six Asia markets (1993M2-2021M12)

Return	C	ΔEMV_t	ΔEPU_t	ΔGPR_t	$\Delta EPU_t \cdot \Delta V_{D,t-1}$	$\Delta GPR_t \cdot \Delta V_{D,t-1}$	DY_{t-1}	AR(1)	ω	ε_{t-1}^2	σ_{t-1}^2	$\chi^2(2)$	$\bar{R}^2$
$R_{CN,t}$	-0.019	-0.067	-0.003	-0.025	-0.004	0.017	0.620		72.716	14.511	0.578	144.25.	0.02
	-0.11	-21.71	-3.03	-7.15	-10.66	9.79	4.33		0.29	0.96	1.74	[0.00]	
$R_{HK,t}$	-4.330	-0.056	-0.016	-0.022	0.004	-0.003	4.851		54.309	2.534	0.539	1884.4	0.11
	-7.18	-37.75	-14.43	-13.82	14.48	-11.64	8.56		0.54	0.68	0.94	[0.00]	
$R_{IN,t}$	-1.036	-0.038	-0.040	-0.001	-0.001	-0.002	6.362		25.939	0.348	0.869	374.75	0.18
	-19.75	-25.64	-20.48	-0.33	-7.60	-18.31	28.34		0.41	0.41	3.38	[0.00]	
$R_{KO,t}$	-0.262	-0.048	-0.026	-0.009	-0.003	0.002	2.487		1.243	0.298	0.861	128.04	0.06
	-1.27	-27.25	-16.26	-3.92	-14.06	14.83	7.02		0.57	1.32	9.17	[0.00]	
$R_{MA,t}$	-3.580	-0.018	-0.037	-0.008	-0.003	0.005	3.694	-0.017	1.152	2.592	0.824	2239.42	0.06
	-14.97	-8.16	-24.26	-6.38	-5.85	18.94	16.90	-3.12	0.11	0.86	4.53	[0.00]	
$R_{TH,t}$	-0.805	-0.019	-0.059	-0.022	-0.005	0.003	1.597		14.77	0.642	0.754	1431.11	0.05
	-4.71	-22.81	-16.64	-28.82	-63.58	92.93	11.66		0.68	0.79	2.99	[0.00]	

Notes: This table presents evidence of stock returns, R_t on ΔVaR_t , ΔEPU_t , ΔGPR_t , $\Delta EPU_t \cdot \Delta V_{D,t-1}$, $\Delta GPR_t \cdot \Delta V_{D,t-1}$ and $\log(DY_{t-1})$ using a GED-GARCH (1,1) procedure. The stock returns include total market indices from China (CN), Hong Kong (HK), India (IN), South Korea (KO), Malaysia (MA) and Thailand (TH). The independent variables are the changes in U.S. equity market volatility (ΔEMV_t), economic policy uncertainty (ΔEPU_t), geopolitical risk (ΔGPR_t), equity market volatility due to change in infectious disease ($\Delta V_{D,t}$) and lagged dividend yield (DY_{t-1}). AR(p) denotes autocorrelation with p^{th} orders. The statistics of ω , ε_{t-1}^2 and σ_{t-1}^2 in the variance equation are constant parameters. For each model, the first row reports the estimated coefficients, the second row contains the estimated z-statistics. The critical values of t-distribution at the 1%, 5%, and 10% levels of significance are 2.63, 1.98, and 1.66, respectively. $\chi^2(2)$ is the Chi-squared statistics for testing the joint significance of coefficients of $\Delta EPU_t \cdot \Delta V_{D,t-1} = \Delta GPR_t \cdot \Delta V_{D,t-1} = 0$. The test statistics are highly significant as shown by the P-values in the brackets. $\bar{R}^2$ is the adjusted R-squared for the coefficient of determination.

CONCLUSIONS

Risk and uncertainty have long been considered as key factors that govern investors' portfolio decisions. This study separates the role of uncertainty from risk and estimates the respective effects that move stock returns. Special attention is given to highlighting the impacts of ΔEPU , ΔGPR and ΔGPR_t^2 or $|\Delta GPR_t|$. Further, this study also investigates the effect of ΔEPU (and ΔGPR) interacting with the COVID-19 change in Asian stock markets. This study achieves several empirical findings. First, evidence indicates that stock returns for Asian markets are negatively correlated with ΔEPU_t , which implies that stock returns are positively correlated

with EPU_{t-1} . These results are consistent with uncertainty premium hypothesis as reported by Bali et al. (2009) in the U.S. and those results by Chen et al. (2018) for the G7 markets.

Second, in line with findings in recent studies of the ΔEPU_t on stock markets (Brogaard and Detzel, 2015; Christou et al., 2017; Chiang, 2019b), the evidence from the Asian markets also exhibits a negative correlation between stock returns and ΔEPU_t , which supports the uncertainty premium hypothesis. One implication is that the harmful effect of ΔEPU_t on stock markets can become a more widespread phenomenon.

Third, in addition to the traditional measure of risk, this study finds that ΔGPR_t has a significantly negative effect on the stock returns. The evidence is consistent with the result reported by Caldara and Iacoviello (2022). Moreover, the evidence derived from the rolling regression suggests that ΔGPR_t also has an impact on the behavior of investors who react to a change of EPU_t , which implies a nonlinear effect of ΔEPU_t on stock returns.

Fourth, this study finds direct evidence that stock returns respond to ΔGPR_t in a nonlinear fashion as shown in the negative coefficients on ΔGPR_t^2 or $|\Delta GPR_t|$. The evidence implies that investors tend to selloff stocks as an increase in ΔGPR_t or ΔGPR_t^2 occurs, leading to a flight-to-safe haven phenomenon (Baur and Lucey, 2010; Baur and Mcdermott, 2010). If capital moves to gold or a foreign country, the flight could trigger political turmoil and economic instability (Chiang, 2022a).

Fifth, the evidence finds that all stock returns are negatively correlated with U.S. GRP change. This would mean that the damaging effect from a rise in $\Delta GPR_t^{2,US}$ will directly spillover to domestic stock prices. The evidence is in agreement with the finding documented by Brogaard et al. (2020). However, the latter only tests the GPR_t , excluding a domestic ΔGPR_t^2 element and controlling variables in the current model.

Sixth, this study finds that the product terms, $\Delta EPU_t \cdot \Delta V_{D,t-1}$ and $\Delta GPR_t \cdot \Delta V_{D,t-1}$, have significant effects on the stock return equation. The exclusion of these nonlinear terms will commit misspecification of the test equation.

An important implication of this study is that the nonlinear specification is crucial. Ignoring the impacts from $\Delta GPR_t^{2,US}$ and the effects of changes in policy uncertainties as ΔEPU_t and ΔGPR_t react to lagged $\Delta V_{D,t}$, respective, could produce biased estimators and lead to a miscalculation in the risk premium as it pertains to uncertainties. Beside this, there are other forms of nonlinearity for financial variables reacting to COVID-19 (Dai et al., 2021), effects of costs of capital, pension planning and the future of government policies, among others, are the agendas for future research (Goodell, 2020).

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