

The impact of geopolitical risk on the stock market and stock bubbles in Vietnam: A mediation model

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Abstract

This paper aims to examine the indirect impact of geopolitical risk on the Vietnamese stock market and stock bubbles (VSB) through its impact on macro factors and commodity prices. Firstly, before testing the influence of geopolitical risk on stock bubbles, a stock bubble existence test using SADF (sup augmented Dickey-Fuller test) and GSADF (generalized sup Augmented Dickey-Fuller) is done. The tests show that stock bubbles appeared on the Vietnamese stock market in 3 periods: September 2014 to November 2014, June 2017 to May 2018 and March 2021 to March 2022. Secondly, the test on indirect relationship between geopolitical risk and Vietnam's stock market and stock bubbles reveals that geopolitical risk has a significant indirect relationship with the stock market through intermediary factors including macroeconomic factors and natural gas prices, while it has a significant indirect relationship with stock bubbles through the mediation role of oil prices and natural gas prices. More specifically, the indirect relationships are weak but positive, which means that increasing geopolitical tension may cause the VNIndex (representing Vietnam's stock market) to increase and may further exacerbate stock bubbles on the market. Finally, the indirect correlation between geopolitical risk and Vietnam's stock bubble is discussed and a crucial finding is concluded that major geopolitical events often occurred just before and during the stock bubble formation.

1. Introduction

Geopolitical events and geopolitical risks are the focus of research on many scientific topics in many fields, including economics and finance. Caldara and Iacoviello (2022) identified geopolitical risk (GPR) as the threats, realisation and escalation of events related to war, terrorism and any tensions between nation-states that affect peace in international

relations. To measure GPR, they have compiled a geopolitical risk index that quantifies things that seem difficult to measure. The GPR index is calculated monthly by dividing the number of articles that mention escalating geopolitical tensions, or geopolitics in general, by the total number of articles written that month. That way, the GPR index is generated based on an automatic search algorithm on the archives of 10 international newspapers. The historical GPR

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dates back to 1900 and the more recent GPR index goes back to 1985.

The impacts of geopolitical risks on all aspects of our lives are immense. In addition to the obvious effects on the lives and properties of the unfortunate people located in the countries directly affected, geopolitical events and risks also affect the economic factors of many other countries. Recently, the war in Ukraine has shown the strong influence of geopolitical risks on the world's economy. Acre et al. (2023) pointed out that the war caused a great shock to the global economy, especially to the energy and food markets, by tightening supply and pushing prices to unprecedented levels.

As an important part of every economy, the stock market can also be influenced by geopolitical factors. Hoque and Zaidi (2020) demonstrated that GPR can impact the stock market in both positive and negative ways depending on lag time, volatility mode, and market stock. GPR is proven to have a two-way effect on the stock market.

In this paper, the influence of geopolitical risks on Vietnam's stock bubble is also examined. Previous studies have shown that despite being established for only 23 years, the Vietnamese stock market has witnessed waves of bubble formation and bursting. Reza (2010) explains that price bubble is often used to describe a situation in which the market is constantly in a state of overvaluing assets relative to their intrinsic value. Jones (2014) states that an asset price bubble can form as the market continues to appreciate an asset despite of a prior appreciation. When trading, investors believe that since the value of an asset has increased previously, the price will increase further in a short period of time. Therefore, the investor decides to buy the asset at a higher price than before. The further rise in price then exacerbates the bubble and increases the risk of a bubble burst along with the risk of a market crash when the asset's price returns to its pre-bubble level.

To test the presence of bubbles on the Vietnamese stock market in the period from 2006 to 2019, numerous research has applied the statistical right-side stationarity test (SADF) and

the general right-side stationarity test (GSADF). Chau and Tran (2020) showed the presence of VSB in the periods of 2006-2012 and 2013-2019. More specifically, Vietnam's stock market appeared to have a stock bubble during 3 periods: from the end of 2006 to May 2007, from January 2007 to March 2007, and from June 2017 to May 2018. In addition, the Vietnamese stock market has recently witnessed the formation of a stock bubble from the beginning of 2021 to the second half of 2022. It is worth noting that in most of the periods when VSB occur, the GPR index is also in higher-than-normal levels. During the stock bubble of 2017-2018, the GPR index had several periods of highs (above 100). Two major geopolitical events: the U.S.-China Trade War and the geopolitical crisis on the Korean Peninsula took place during that period. In the most recent stock bubble (2020-2022), the GPR index also increased dramatically, especially in the late 2021 and early 2022 periods. The GPR index's fluctuations coincided with the escalating tensions between Russia and Ukraine at the end of 2021, culminating in the official outbreak of conflict between the two countries in February 2022. Through that correlation, the relationship between geopolitical risks and stock bubbles deserves a closer look. In the context of current geopolitical uncertainties around the world, studies into the impacts of geopolitical risk on asset markets are increasingly needed and have great practicalities. Therefore, this study adds into and helps contribute to further research this rapidly developing field of study. The scope of this paper is the impact of geopolitics on the Vietnamese stock market and VSB. Since Vietnam is situated in an important geostrategic crossroad between world powers and is therefore affected by major geopolitical events, the country is an ideal location to examine this relationship. Furthermore, through research into the Vietnamese stock market, this paper also aims to contribute to the research archives about the influence of geopolitics on the Vietnamese stock market, since previous research on this topic is scarce. Moreover, the paper is also intended to help investors, individuals or organisations anticipate the influence

of regional and international geopolitics on the Vietnamese stock market to derive suitable investment strategies.

This paper examines the indirect effects of geopolitical risk on the stock market and stock bubbles through the mediation impact of macroeconomic factors and commodity prices.

Mediation occurs when the effect of the independent variable A on the outcome variable C occurs through the intermediate variable B. In this case, the geopolitical risk factor plays the role of an independent variable, acting through the intermediate variables that are macroeconomic factors such as inflation, FDI inflow, and other macro factors to influence the dependent variable, which is the stock bubble in Vietnam. In addition to the above factors, oil and natural gas prices are also added to the intermediate variables due to the strong impact of these variables on the stock market. The macroeconomic factors used in this study are intentional due to: First, their influence on the Vietnamese stock markets; Second, their susceptibility to geopolitical events; Third, the availability of their data.

2. Literature review and research hypotheses

The impact of geopolitical risk on the economy in general, and asset and stock prices in particular, has attracted much research. This part of the article summarises and analyses prior research on two areas: (1) Research on the impact of macro factors on asset prices and asset bubbles, (2) Research on the impact of GPR on intermediate factors, and studies on the impact of GPR on the stock market, especially the Vietnamese stock market.

2.1. Research on the impact of macroeconomic factors on asset prices and asset bubbles

Many studies showed the impact of macro factors on asset prices in general, and the stock market in particular. Hussainey and Le (2009) showed that the industrial production index had a positive impact on the Vietnamese stock market. However, short-term interest rates and long-term interest rates were demonstrated to have oppo-

site effects on the stock market. More specifically, short-term interest rates had a negative effect on the market and long-term interest rates had a positive effect. Regarding the impact of monetary policy on the stock market, Vo (2018) proved that monetary policy had a correlation with the movements of the stock market. However, this relationship did not have a big impact on Vietnam's stock market in the studied time frame.

Moreover, the effects of geopolitical risk on asset prices and on the formation of asset bubbles also received the attention of many studies. Su et al. (2023) demonstrated that geopolitical factors as well as related natural factors increased the likelihood of natural gas bubbles forming in Europe. Their research results showed that out of ten observed natural gas bubbles, five were formed under the influence of geopolitical factors. In which, the war between Russia and Ukraine was the factor that led to the formation of the latest natural gas bubble from March to April 2022. More specifically, the sanctions and embargoes of Western countries on Russian gas exports caused natural gas prices to climb to record levels. Umar et al. (2022) showed that natural gas has provided a significant abnormal return since February 24, 2022. Thereby, the price of natural gas was proven to depend directly on GPR. In addition, the influence of GPR on precious metal prices was also examined. According to Baur and Smales (2020), in the weeks following the 2001 terrorist attacks in the U.S., the price of gold futures contracts increased by 6.2%. They showed that the return of precious metals was positively related to changes in geopolitical risks. Thereby, precious metals, more specifically gold were considered to be a safe haven against those risks.

Le et al. (2020) examined the impact of monetary policy on the real estate bubble in Hanoi, Vietnam. Their results showed that real estate bubbles reacted quickly to shocks from monetary policies and demonstrated that monetary policy was not only the cause of the real estate bubbles, but also the solution to them. Le (2014) proved that real estate bubbles in Ho Chi Minh City, Vietnam depended on shocks from

economic growth variables, real estate credit balance and foreign investment in real estate. Le et al. (2019) showed that, in the long term, the VNI stock price index was affected by the oil price, money supply, interest rate, SJC gold price, and exchange rate. In the short term, the stock price index had a causal relationship with oil prices, interest rates, and the M2 money supply. The results were supported with further research (Dao et al., 2022; Pham & Ngo, 2019). Furthermore, research by Su et al. (2017) also demonstrated that foreign direct investment (FDI) had a significant impact on the VN Index. Thus, we argued that macroeconomic variables had a significant impact on asset prices in general, and on the stock market indices (including the VN Index) in particular.

From the above literature review, the following hypotheses are proposed:

H₁: Macroeconomics variables (namely inflation rate, FDI inflow, Industrial production index) have positive impact on VN Index.

H₂: Oil and natural gas prices have positive impact on Vietnam's stock market and VSB.

2.2. Research on the impact of GPR on intermediate factors

Khan et al. (2020) pointed out that oil prices were affected by risks, geopolitical uncertainties, and GPR influences oil prices in the medium term. Using wavelet analysis for the period of 1985-2016, Li et al. (2020) investigated the time and frequency change co-movement and the causal relationship between crude oil price and GPR. A strong level of co-synergy between GPR and oil prices was detected at very high frequency (for short duration) over the whole sampling period. However, such correlation was not seen at low frequency (for long duration) almost during the sampling period. Li et al. (2020) examined the correlation between GPR and crude oil prices based on data from June 1987 to February 2020. By using the time-varying copula method, the relation between GPR and oil price was shown to be strong during political tension. Furthermore, the correlation between GPR and crude

oil prices fluctuated strongly during periods of political stress. Furthermore, Abbel-Latif et al. (2020) showed that a positive shock to geopolitical risk resulted in higher oil prices. They also found that the low oil prices perpetual cycle (e.g. the late 1980s one) resulted in a geopolitical fight (the 1st Iraq War), which later, in turn, led to higher oil prices. Further research by Noguera-Santaella (2016), Minesso et al. (2024), Wang et al. (2023) all demonstrated that geopolitical risks had some discernible impacts on oil prices.

By applying the SUR (seemingly unrelated regression) estimation model, Nguyen et al. (2022) pointed out the negative influence of GPR on FDI inflows. In addition, Kim et al. (2019) argued that investors were discouraged from investing in developing countries when the regional GPR increased, as asymmetric information during uncertain times created a disadvantage for foreign investors (compared to domestic) in the region. Nguyen and Lee (2021) showed that countries with ambiguous economic policies received lower FDI. They also pointed out the safe-haven effect, in which foreign investors moved FDI from risky places to perceived safer locations. Bilgin et al. (2020) made an interesting observation that GPR caused government spending to increase, mitigating consequences of geopolitical risks. Regarding the effect of GPR on inflation, Caldara et al. (2023) argued through the structural autoregression (SVAR) model that high GPR caused inflation to increase. An escalation of geopolitical tensions was demonstrated to have the same negative effect as a supply shock. With a one-standard deviation shock to GPR, inflation increased by about 2 percentage points. In addition, high inflation and declining economic activity were usually accompanied by expansionary fiscal policies. Looking at the impact of geopolitical events on the United States, they found that the impact of GPR shocks corresponds to that of expenditure shocks. More specifically, a spike in geopolitical risk raised inflation by a little more than 1 percentage point and caused GDP levels to rise at nearly 2 percents above trend before starting to fall. They

also showed that high GPR was accompanied by news about future increased in military spending, which could materialise within the next 3 to 5 years, leading to an increase in public debt. Through the above research, GPR is shown to directly affect macroeconomic variables, natural gas, and oil prices. The effects of GPR on those variables are complex and vary through different time periods. Thus, the following hypotheses have been formulated:

- H₃:** Geopolitical factors directly affect macroeconomic variables.
- H₄:** Geopolitical factors directly affect oil and natural gas prices.

2.3. Research on the impact of GPR on the stock market

Many studies have covered the effects of GPR on the stock market. By examining the influence of GPR on four emerging stock markets, Hoque and Zaidi (2020) drew the conclusion that GPR impacts each country differently. For the Indian stock market, they showed that GPR had a positive effect on the Indian market returns at a low level with moderate volatility and had a negative effect in high volatility regimes. For the Indonesian stock market, GPR was shown to have a positive effect on the market in low volatility mode, and a simultaneous negative effect with moderate volatility. The effects suggested that the relationship could be different over time, depending on changes of market conditions and structure. Bouri et al. (2023) examined the impact of oil price volatility and GPR on Gulf countries' internal stock markets (GCC) under different conditions. They demonstrated that while the impact of oil price volatility on GCC stock markets was larger than that of GPR, both had a positive effect on the return and volatility of the stock market under bullish cases. Specifically, oil price shocks led to increased returns in GCC stock markets under bullish conditions, and depressed returns when the market was going down. Lee and Chen (2020) examined whether U.S. and home country geopolitical risks (GPRs) and disasters affected the rate of returns from ETFs by applying a quantile regression method.

It was found that US disasters impact more than home country disasters on ETF returns. Furthermore, U.S. and home country GPRs and disasters also had influence on rate of returns. Zhang et al. (2023) found that GPR had a significant positive effect on stock market volatility, and the effect of GPR on stock market volatility was more significant for emerging economies, crude oil exporters, and countries at peace. Feng et al. (2023) pointed out that the impact of GPR on market volatility increases when there were large shocks to the markets such as war, financial crisis and COVID-19. In addition, the impact of GPR on the total volatility spillover index was shown to be negative in the early and late time periods, and positive in the middle periods. Pan et al. (2023), concentrating on China's stock market, showed that global geopolitical risk presents non-linear causality effects on both the overall volatility connectedness among industry sectors in the stock market and the net volatility connectedness across different sectors. Based on the findings above, GPR has shown to have some impacts on stock markets around the world, especially regions prone to geopolitical events. Previous research also showed that GPR had an indirect impact on stock markets through mediation variables, such as oil price. Thus, GPR has proven to have both direct impacts and indirect impacts on stock markets through mediation variables. Therefore, GPR also affects the Vietnamese stock market to some extent. The following research hypothesis is put forward:

- H₅:** Geopolitics, through macroeconomic variables and oil and gas prices, have an impact on Vietnam's stock market and VSB.

2.4. Research on the impact of geopolitical factors on Vietnam's stock market

Among the countries in the world, Vietnam's geographical location is quite unique. According to Vuving (2023), Vietnam not only played the role of a gateway to the sea for two neighbouring countries: Laos and Cambodia but was also an important link in the strategic playing field of major powers such as China, the United States, Japan, and India. Thus, Vietnam's stock mar-

ket was vulnerable to geopolitical events in the region and in the world. Regarding the impact of geopolitics on the Vietnamese stock market, Le et al. (2018) examined the impact of the Hai Duong 981 (HD-981) rig incident on the Vietnamese stock market and found that the incident had a negative impact on the Vietnamese market. More specifically, immediately after Vietnamese media reported on the HD-981 incident, stock markets in both Ho Chi Minh City and Hanoi witnessed the deepest plunge since 2001. On May 8, 2014, the VN-Index lost 32.88 points, while the HNX-Index lost 6.4 points. It was worth noting while most industries that were dependent on the China economy were negatively affected, the impact of the event on some industries was ignorable. Nguyen et al. (2023) used the Time-Varying Parameter Vector Autoregression (TVP-VAR) to explore the relationship between the geopolitical risk index and Vietnamese stock market returns. Their results showed that geopolitical risk had a heterogeneous effect on the return of financial assets, and the market did not respond to geopolitical tensions in a uniform manner.

In general, articles on the link between geopolitical risks and Vietnam's stock market are few. Previous studies on the matter have discussed thoroughly about the impacts of specific geopolitical events on the stock market, or about geopolitical risk on the stock market as a whole. However, studies about the impacts of geopolitical risk and the Vietnamese stock bubbles specifically are lacking. Thereby, this paper aims to fill that research gap and contributes to promoting more studies on this topic.

3. Data and research method

3.1. Data

Secondary data is taken in the form of monthly time series data from January 2009 to February 2023. In addition, daily data of the variables are also obtained to test the periods of stock bubble formation. Microsoft Excel is used to synthesised the data and Stata is used to perform descriptive statistics of the variables.

The variables used in the model are listed in detail as follows:

VN Index: taken through investing.com website. VN Index represents Vietnam's stock market, representing all stocks listed and traded on HoSE. This index is calculated using the market value weighting method, based on the weight of each stock used. The impact of intermediate variables on the increase or decrease of the index is taken as evidence for the impact of the variables on the increase or decrease of the stock market. From there, the impact of those variables on the stock bubble in Vietnam is evaluated.

Geopolitical Risk Index: obtained through the websites of Caldara and Iacoviello (2022), this set of indexes serves as a summary of geopolitical events and geopolitical risks in general around the world. The GPR variable used here is the global GPR index, representing global geopolitical instability.

Oil prices and natural gas prices: Brent crude oil prices are taken from Investing.com website and natural gas prices for the Japan and Korean markets are extracted from the website of the Federal Reserve Bank of America in St. Louis. These two variables are chosen as intermediate variables because not only are they strongly influenced by geopolitics, but they also have an impact on the stock market in Vietnam.

Macro factors: inflation rate, FDI inflow, Industrial production index, are all compiled from the data of the General Statistics Office. In addition, data on short-term interest rates and long-term interest rates are obtained from the database of the State Bank of Vietnam (SBV).

3.2. Testing the formation of a stock bubble

Prior research has shown that the SADF and GSADF methods are most suitable to test for the existence of asset bubbles. Baur and Glover (2012), Bialkowski et al. (2015), Çelik et al. (2019), and Korkmaz (2018) used those methods to test for bubbles in gold markets. In the currency market, Maldonado et al. (2019), and Pavlidis et al. (2017) also applied the methods to test for bubbles. To test for stock bubbles in the Vietnamese stock market, Vu et al. (2022)

and Chau and Tran (2019) used the Augmented Dickey Fuller (ADF) test. Because of the proven application of the SADF and GSADF methods in detecting asset bubbles, the two methods are therefore chosen in this paper. In order to adopt these methods into Stata and re-test the formation of VSB, the Recursive Augmented Dickey-Fuller (RADF) test method is used. The method is complied by Baum and Otero (2020), based on the right-tail augmented Dickey and Fuller (1979) unit root test, and its subsequent developments by Phillips et al. (2011) (PWY), Phillips et al.(2015) (PSY) based on upper bound statistics derived from ADF-type regression estimated using recursive windows (PWY) and recursive flexible windows (PSY).

Based on PSY, RADF calculates three tests based on ADF regression:

$$\Delta y_t = \alpha_{r_1, r_2} + \beta_{r_1, r_2} y_{t-1} + \sum_{i=1}^k \delta_{r_1, r_2}^i \Delta y_{t-i} + \varepsilon_t$$

In which Δ is the first difference operator, y_t is the time series of interest at time t, k is the number of lags of the dependent variable, and r_1 and r_2 represent the start and end points used for the estimation. T is the total number of time periods in the sample, r_1 and r_2 are expressed as fractions of T such that $r_2 = r_1 + r_w$, where r_w is the window size of the regression, also expressed as a fraction of T. The number of observations to estimate (1) is $T_w = [Tr_w]$, where $[.]$ is the floor function which gives the integer part of the argument. The error term is ε_t . This model aims to test two hypotheses:

$$H_0 : \beta_{r_1, r_2} = 0 \text{ (unit roots)}$$

$$H_1 : \beta_{r_1, r_2} > 0 \text{ (explosive behavior)}$$

If the hypothesis H_0 in this test is rejected, it means that there is evidence for an explosive behaviour in price. The evidence for bubbles can be reinforced when the explosive behaviour persists for a certain amount of time. The ADF t-statistics test for testing H_0 in (1) is $ADF_{r_1}^{r_2}$ denoted . The radf method computes two statistics studied by PWY: The right-tail ADF statistic based on the full range of observations, $r_1 = 0$ and $r_2 = 1$ ($r_w = 1$), is ADF_0^1 ;

The second statistic is based on the up-bound T statistic and is the result of forward recursive estimation of (1):

$$SADF(r_0) = \sup_{r_2 \in [r_0, 1]} ADF_0^{r_2} \quad (2)$$

However, Phillips, Shin and Yu (2015) showed that, for periods where there are many bubbles, the recursive approach provides consistent estimates of the first bubble's start and end dates, but not for the next bubble. To deal with this problem, PSY devised the Generalized supremum ADF (GSADF) test, which is also the third statistic produced by RADF. The GSADF test involves a much broader set of regressions, where the first observation is used to estimate the change from 0 to $r_2 - r_0$, while the last observation varies from r_0 to 1:

$$GSADF(r_0) = \sup_{\substack{r_1 \in [0, r_2 - r_0] \\ r_2 \in [r_0, 1]}} ADF_{r_1}^{r_2} \quad (3)$$

By testing for a recursive/recursive flexible window estimate of (1), it is possible to determine the specific times or periods of explosive behaviour.

Suppose one is interested in evaluating whether any particular observation, say r_2 , belongs to a period of explosive behavior. PSY recommends performing the supADF test on a sample sequence where the endpoint is fixed at r_2 and extends backwards to the starting point, r_1 , varying between 0 and $(r_2 - r_0)$. The inverse SADF statistic is defined as:

$$BSADF_{r_2}(r_0) = \sup_{r_1 \in [0, r_2 - r_0]} ADF_{r_1}^{r_2} \quad (4)$$

PSY shows that this identification procedure is more general than that proposed earlier in PWY when setting $r_1 = 0$ in (4), and is, therefore, more efficient in determining the periods of occurrence of many bubbles together.

3.3. Mediation effect model

The mediation effect model used is Hayes Process Macro Model 4, which was developed by Hayes (2012) and Preacher and Hayes (2008) and deals with indirect relationships between

variables. The model allows for mediation analysis with multiple mediating variables. The following research model is proposed (Figure 1) with the following components:

Independent variables: the world GPR index
Dependent variables: the VN-Index and VSB. In which, the data for VSB was obtained by taking the VN-Index score during the periods in presence of those bubbles. Those bubble periods were determined through our own testing results for stock bubbles the Vietnam market (see part 4.2.).
Mediating variables: The mediating variables are divided into two groups - macroeconomic variables (short term and long-term interest rates, the Vietnamese Industrial production index, Vietnamese inflation rate, and the amount of FDI inflow into Vietnam) and commodities prices (natural gas and brent crude oil prices).

4. Research results and discussion

4.1. Empirical test result for the stationarity of data

After performing the stationarity test, the results are shown in Table 2. Before taking the first order difference of the variables, the variables VNI (representing the VNIndex), STR, LTR (short-term and long-term interest rate variables) are not stationary. However, after taking the first order difference, all variables showed stationarity at the confidence level of 5%, permitting further tests.

4.2. Empirical Test Result for stock bubbles in the Vietnamese stock market

Results of the bubble test in the period from 2009 to 2019 are similar to the test results of Chau and Tran (2019), confirming that the Vietnamese stock market had a stock bubble in 2 periods: September 2014 to November 2014 and June 2017 to May 2018.

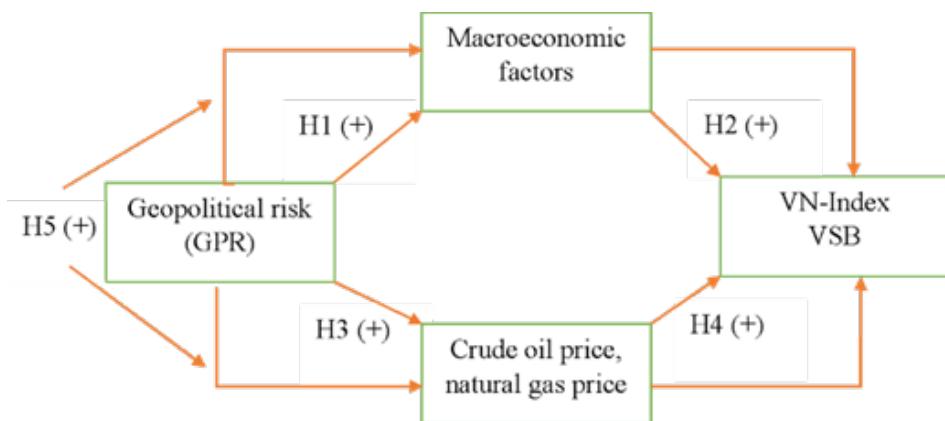
In addition, an additional test is conducted in the period from 2021 to February 2023 and shows that a stock bubble existed from March 2021 to March 2022.

In total, there are 3 major bubbles in the Vietnamese stock market in the periods: September 2014 to November 2014, June 2017 to May 2018, March 2021 to March 2022. In which, the longest bubble lasted from early March 2021 to early March 2022 – about 1 year. The VN-Index during this time increased sharply (Figure 2,3,4,5), from 1,191 points in March 2021 to about 1,492 points in early March 2022 before the bubble busted.

4.3. Hypothesis testing results

The indirect effects of GPR through mediators were tested on the broad Vietnamese stock index (VNI) and VSB in the market. The test results (Table 3 and Table 4) show the impact of geopolitical risk on VNI and VSB through several mediating factors.

The relationship between geopolitical risk and



Sources: Summarized by the authors

Figure 1. Research model

Table 1. Descriptive statistics of the variables

Variables	Number of observations	Average	Standard Deviation	Skewness	Kurtosis	Minimum	Maximum
GPR	170	96.33	29.27	3.68	25.57	60.60	325.40
VNIIndex (VNI)	170	736.90	308.20	0.76	2.60	245.70	1,498.00
CPI (%change)	170	0.38	0.60	1.40	7.15	-1.54	3.32
Short term rates (%) -STR	170	5.04	3.48	0.74	2.70	0.27	13.83
Long term rate (%) - LTR	170	6.70	3.12	0.27	1.87	2.08	12.38
LNG Price (USD/MMBTU) - LNGPrice	170	13.07	8.40	1.81	7.53	2.03	54.16
Crude oil price (USD/barrel) - Crude	170	76.99	24.90	0.17	1.85	26.35	125.90
Industrial Production Index - IIP	170	153.84	31.15	1.47	6.12	89.0	267.16
FDI Registered (Inflow) - Register	170	2.01	1.53	1.83	8.60	0.02	10.43

Sources: Summarized by the authors with the support of Stata 16

the stock index and VSB was tested through 2 groups of mediators: natural gas and crude oil prices, and macroeconomic factors (Short term and long-term interest rates, the Industrial production index, FDI inflow, and inflation rates). First, the results revealed that GPR has a significant indirect effect on the index through natural gas prices ($\beta = 2.0011$, $t = 4.0078$) and has significant indirect effects on VSB through both natural gas prices ($\beta = 2.0287$, $t = 4.5002$) and crude oil prices ($\beta = -1.2463$, $t = -2.4577$), partly confirming H_4 and H_2 .

Second, the results show that with regards to macroeconomic factors, GPR has a significant indirect effect on VNI through long term interest rates ($\beta = 2.2148$, $t = 2.9393$) and the industrial production index ($\beta = 1.0583$, $t = 2.5762$), supporting H_3 and H_1 .

However, the effect of GPR on VSB through macroeconomic variables were insignificant. The direct effects of GPR on VNI and VSB in presence of the mediators were also tested. GPR has significant direct effects on VNI in the case of natural gas and oil prices ($\beta = 2.5422$, $p = 0.0009$) and in the case of macroeconomic variables ($\beta = 1.3170$, $p = 0.0001$). The direct effects of VNI on VSB in presence of mediators were not significant. All mediation results were obtained using the bootstrapping method with bias-corrected confidence estimates. In this study, the 95% confidence interval of the indirect effects was obtained with 5,000 bootstrap resamples.

4.4. Discussion and theoretical implications

The results of the test show that overall, the indirect impact of geopolitics on VNI and VSB through natural gas price, short-term interest rates and foreign investment is positive. However, it is noted that the impacts of GPR on VNI and VSB are small in magnitude and thus don't affect the entire market substantially. With regards to stock bubbles, the results imply that geopolitical events and risks exacerbate the presence of stock bubbles in the market through mediators. In order to verify whether the results are consistent with reality, each stock bubble

Table 2. Dickey-Fuller test results

Variables	Initial results		After first order difference		Variable after difference
	DF	P-Value	DF	P-value	
GPR	-5.167	0.0000	-15.069	0.000	DGPR
VNI	-1.308	0.6255	-11.828	0.000	DVNI
CPIchange	-6.541	0.0000	-17.598	0.000	DCPIchange
LNGPrice	-2.983	0.0016	-11.624	0.000	DLNGPrice
IIP	-3.824	0.0027	-13.489	0.000	DIIP
STR	-1.042	0.7377	-10.334	0.000	DSTR
LTR	-0.766	0.8288	-13.289	0.000	DLTR
Register	-11.432	0.0000	-21.717	0.000	Dregister
Crude	-2.154	0.0163	-10.876	0.000	DCrude

Source: Summarized by the authors with the support of Stata 16

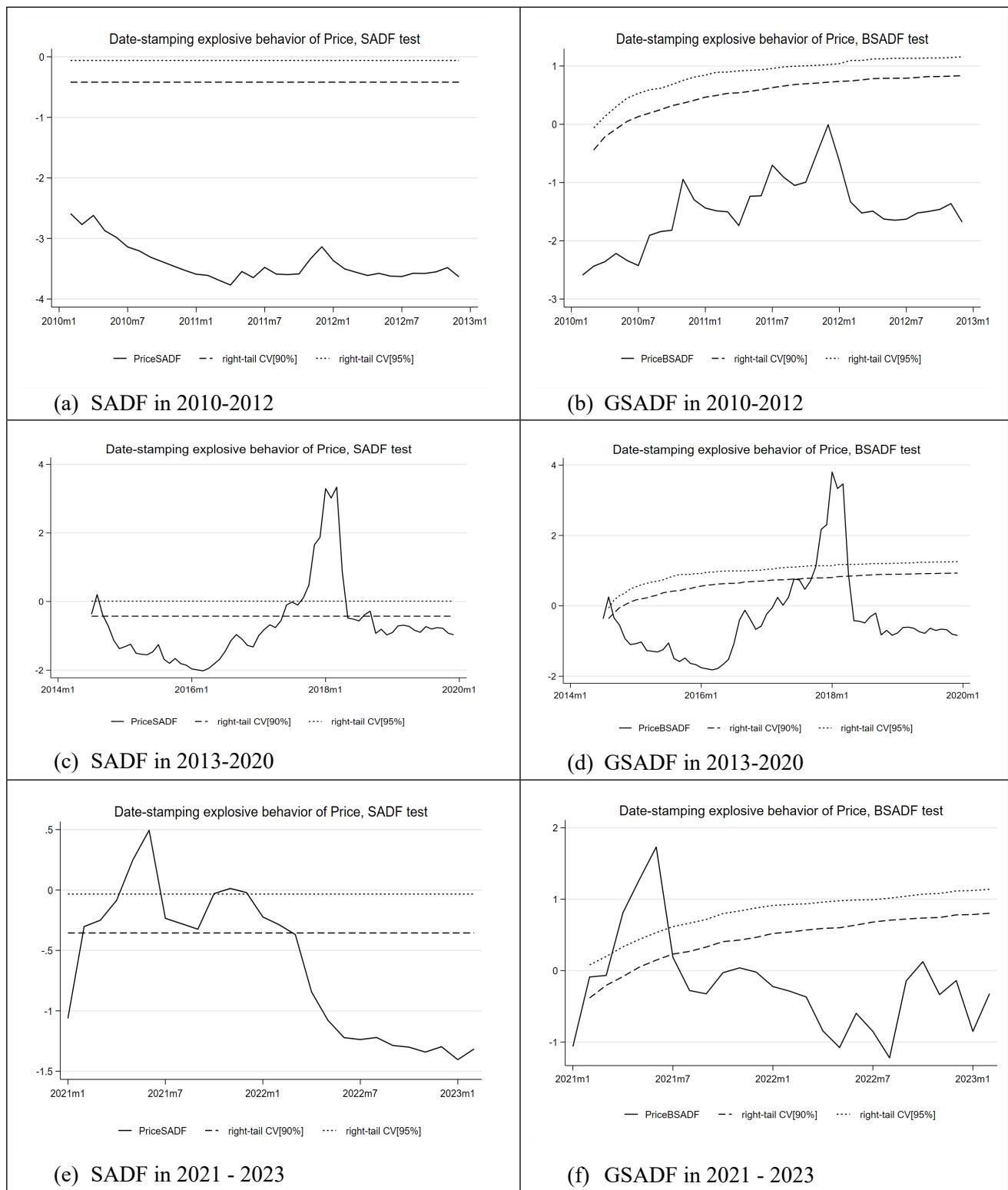
period is then examined.

Table 3 shows that the indirect link between geopolitical political risk and the general stock market through the variable short-term interest rates is positive: GPR reduces interest rates, causing the VN Index to increase. This is shown to be consistent in reality, as the HD-981 event took place from early May to mid-July 2014 coincided with the period when the State Bank of Vietnam (SBV) lowered its operating interest rates continuously to record lows compared to the previous period. That implies this geopolitical event had some impact on lower interest rates, and might be the result of monetary policies aimed to stimulate consumption. The same happened during or after events such as the Crimea crisis in 2014, the Qatar diplomatic crisis in 2017, the crisis on the Korean peninsula and the U.S.-China trade war in 2018. Thereby, GPR plays a part in affecting the interest rate policy of the SBV. Moreover, the VN Index in all 4 cases rose to high levels following the interest rate cuts. In 2 events: the HD-981 incident and the U.S.-China trade war, the index increased strongly, and bubbles formed in the market. This can be partly explained by the increasing cash flow into the market due to the decrease in interest rates, making bank deposits less attractive. Therefore, an indirect relationship exists between geopolitical risk and VN Index through the short-term interest rate variable.

The positive impact of geopolitics on Vietnam's stock market through natural gas price can be partly explained by the 2014 Crimea crisis. From the beginning of the crisis on February 2014 and after Western sanctions were imposed on Russia until the end of August, according to Su et al. (2023), LNG price has always remained high. During the same period, Vietnam's stock market also witnessed many fluctuations, such as surpassing 600 points at the end of March 2014, due to the momentum from oil, gas and utilities companies. The stock market also witnessed many strong gains after the Russia-Ukraine war broke out in February 2022, driving natural gas price to historic highs. However, whether there is a link between natural gas price and Vietnam's stock market in these cases requires further research. Regarding the crude oil price variable, GPR has a small but positive impact on the oil price, however, the impact of a change in oil price is not significant on VN Index. This can be explained by the fact that the Vietnamese stock market has no clear relationship with crude oil prices, as Cao and Do (2017) have demonstrated.

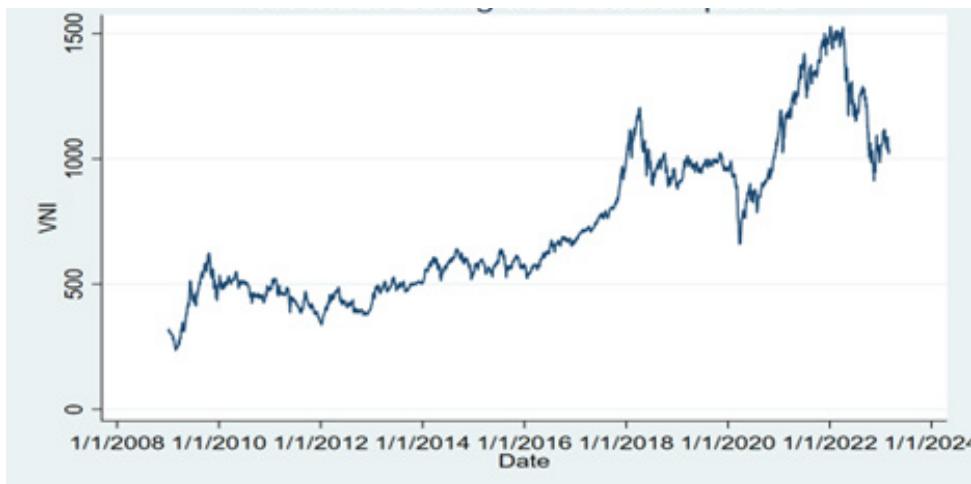
Our study has several implications. First, it has contributed significantly to the theories about the impact of geopolitical risk on the stock market. Our study suggests that geopolitical risk has both direct and indirect impacts on the stock market, confirming previous theories on

The impact of geopolitical risk on the stock market and stock bubbles in Vietnam:
A mediation model



Source: Summarized by the authors with the support of Stata16

Figure 2. Results of the SADF and GSADF hypothesis tests



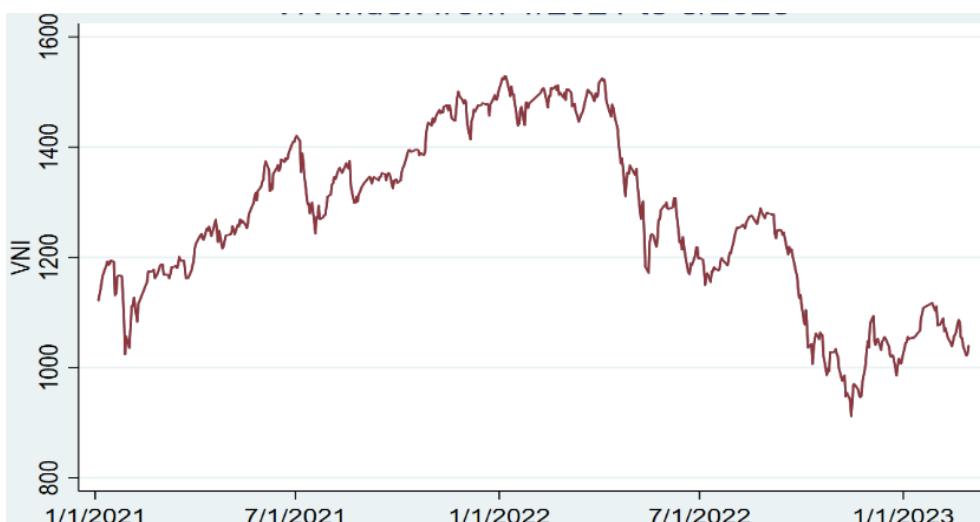
Sources: Summarized by the authors with the support of Stata16

Figure 3. VN Index in the research period

the matter. In which, the indirect effect of GPR is found to be most profound through natural gas prices and long-term interest rates. Second, the study has also examined the impact of GPR on stock bubbles, paving the way for further research into the subject. Third, the study's findings could inform policymakers and investors in Vietnam's stock market regarding the impact of GPR on country's stock market and stock bubbles. As mentioned above, the increase in GPR tends to exacerbate stock bubbles in the Vietnamese stock market. Therefore, policymakers should pay close

attention to GPR and derive certain measures should they want a more stable stock market. Additionally, investors in the Vietnam market should take note of the overall impacts of GPR, especially the indirect impacts of GPR through mediation factors. Investors should also include GPR in their risk management strategy, especially when choosing to invest in countries prone to geopolitical risks, like emerging countries such as Vietnam.

5. Conclusion



Sources: Summarized by the authors with the support of Stata16

Figure 4. VN Index from January 2021 to early March 2023

Table 3. Results from the hypothesis test (GPR and VN-Index)

	Total ef- fect (GPR ⇒ VNI)	Direct ef- fect (GPR ⇒ VNI)	Relationship	Indi- rect effect	Confidence interval		T-Sta- tistics
					Lower bound	Upper bound	
Through natural gas and oil prices	3.8416 (p=0.000)	2.5422 (p=0.0009)	GPR ⇒ LNGPrice ⇒ VNI	2.0011	0.9576	2.9868	4.0078
			GPR ⇒ WTIPRice ⇒ VNI	-0.7017	-1.4583	0.2663	-1.6731
			GPR ⇒ Short term Rates ⇒ VNI	-0.4989	-1.3309	0.2673	-1.2414
			GPR ⇒ Industrial production index ⇒ VNI	1.0583	0.4360	2.0705	2.5762
Through macroeco- nomic factors	4.0634 (p=0.000)	1.3170 (p=0.0001)	GPR ⇒ Long term rates ⇒ VNI	2.2148	1.0170	3.9691	2.9393
			GPR ⇒ FDI Inflow ⇒ VNI	0.0410	-0.1064	0.2161	0.5144
			GPR ⇒ Inflation rate ⇒ VNI	-0.0688	-0.2393	0.0534	-0.9247

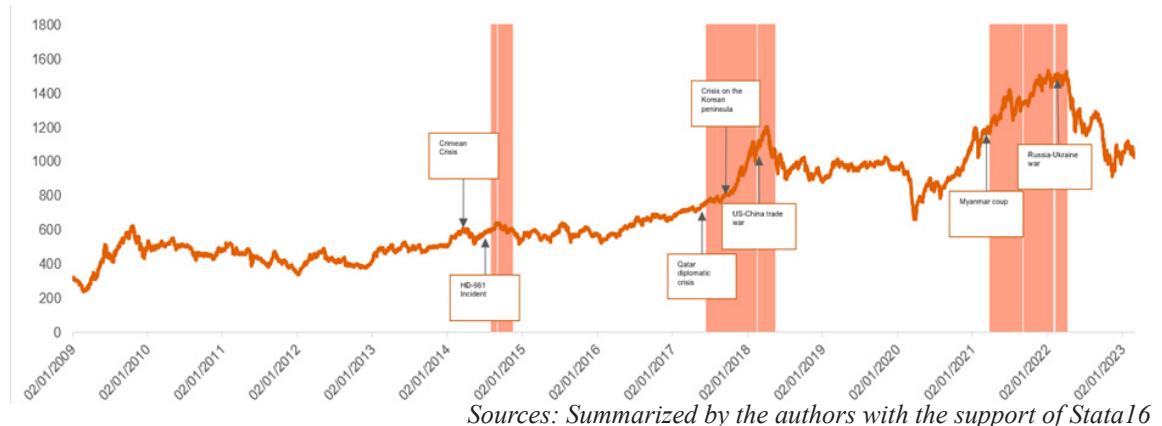
Sources: Summarized by the authors with the support of Stata16

Table 4. Results from the hypothesis test (GPR and VSB)

	Total ef- fect (GPR ⇒ VSB)	Direct ef- fect (GPR ⇒ VSB)	Relationship	Indi- rect effect	Confidence interval		T-Sta- tistics
					Lower bound	Upper bound	
Through natural gas and oil prices	2.1694 (p=0.0173)	1.3870 (p=0.1120)	GPR ⇒ LNGPrice ⇒ VSB	2.0287	1.3397	3.1443	4.5002
			GPR ⇒ WTIPRice ⇒ VSB	-1.2463	-2.5262	-0.5081	-2.4577
			GPR ⇒ Short term Rates ⇒ VSB	-0.2081	-0.8357	0.7794	-0.5222
			GPR ⇒ Industrial production index ⇒ VSB	0.0507	-0.7820	1.0858	0.1082
Through macroeco- nomic factors	2.6176 (p=0.1550)	1.1668 (p=0.1700)	GPR ⇒ Long term rates ⇒ VSB	1.6352	-0.9695	3.6570	1.4444
			GPR ⇒ FDI Inflow ⇒ VSB	0.0077	-0.1362	0.2476	0.0779
			GPR ⇒ Inflation rate ⇒ VSB	-0.0348	-0.3340	0.2442	-0.2513

Note: *p<0.01; **p<0.05; ***p<0.1

Sources: Summarized by the authors with the support of Stata16



**Figure 5. VNIndex notable geopolitical events
(shaded areas are periods when a stock bubble occurred)**

The research results show that the influence of geopolitical risk on the stock market and Vietnam's stock bubble is complex. The research model has proven that geopolitical risk has an impact on the mediators, and thereby has overall positive but small impact on the VN Index. The research results also show that the increase in geopolitical risk tends to increase the likelihoods of stock bubbles. In addition to the main objective of the study, the existence of stock bubbles on the Vietnamese stock market has been successfully re-examined, further expanding research on this topic. First, the results of the bubble test showed the appearance of a stock bubble in 3 periods: September 2014 to November 2014, June 2017 to May 2018, March 2021 to March 2022. Second, the indirect influence of geopolitical risk on the VN Index and Vietnam stock bubbles is tested through mediators according to Hayes (2012) Process 4 model, showing that (1) Geopolitical risk has a significant direct impact on the VN Index through several mediating factors. (2) Geopolitical risk has a significant indirect impact on Vietnam stock bubbles through the mediating variables.

According to the research results, individual and institutional investors in the Vietnam stock market are advised to follow major geopolitical events closely. The indirect impacts of geopolitical risks on the Vietnam stock market are complex and event-dependant. Therefore, investors should observe the impacts of each geopolitical event on factors such as: oil price,

natural gas price, and Vietnamese macroeconomic factors (long term rate, inflation rate) to devise appropriate investment strategies. However, the study still has some limitations. The first is that the research data is incomplete, as the VN Index data is only available from 2009. During the research period, there were sub periods when data was missing and affected the reliability of the variables. Second, some datasets such as the industrial production index, FDI inflow and inflation rate are only available in monthly format, leading to the research results being not as detailed as expected. Third, the GPR index, which focuses on the geopolitical risk aspect mainly from the perspective of the U.S. or Western countries, has also made it challenging to represent geopolitical risks around the world exactly. Fourth, in this paper, the variables were not analysed more clearly in each specific time in the period. Thus, the differences in how GPR affects macro factors cannot be completely clarified. Although this study has somewhat assessed the impact of geopolitics on the stock market through some intermediate factors, but when considering the remaining factors, the impact of GPR on them is insignificant.

Therefore, further studies should focus more on the relationship between regional and country-specific geopolitics with Vietnam's macro indicators; or discuss specific timelines associated with typical geopolitical events to further clarify this relationship. ■

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