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Impact of Economic Policy Uncertainty on Stock Exchanges: Evidence from a Panel Analysis for the Period 2003-2020

Impacto de la incertidumbre de política económica en los mercados bursátiles: evidencia empírica de panel para una veintena de países en el periodo 2003-2020

Mary Elena Sánchez-Gabarre
mary.e.sanchezg@udc.es
Universidade da Coruña

Pablo Castellanos-García
pablo.castellanos@udc.es
Universidade da Coruña

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Abstract

This study analyses how uncertainty affects global stock markets between 2003 and 2020, specifically through a threefold perspective: economic policy uncertainty, geopolitical risks and financial market volatility. In doing so, using a panel data approach, we assess whether such uncertainty has a homogeneous impact across different economies. In addition, both the levels and variability of uncertainty are considered and a cluster analysis and ANOVA are performed to identify patterns across a score of countries at the international level. The results of the random effects model show that economic policy uncertainty, geopolitical risk, interest rates and inflation have negative effects on stock markets, while economic growth and exchange rates have positive effects.

Keywords: Economic policy uncertainty; stock markets; panel data; cluster analysis; ANOVA.

Resumen

Este estudio analiza cómo la incertidumbre afecta a los mercados bursátiles a nivel global entre 2003 y 2020, concretamente a través de una triple perspectiva: incertidumbre de política económica, los riesgos geopolíticos y la volatilidad de los mercados financieros. Con ello, mediante un enfoque de datos de panel, se evalúa si dicha incertidumbre tiene un impacto homogéneo entre diferentes economías. Además, se consideran tanto los niveles como la variabilidad de la incertidumbre y se realiza un análisis clúster y ANOVA para identificar patrones entre una veintena de países a nivel internacional. Los resultados del modelo de efectos aleatorios muestran que la incertidumbre de política económica, el riesgo geopolítico, los tipos de interés y la inflación tienen efectos negativos sobre los mercados bursátiles, mientras que el crecimiento económico y los tipos de cambio influyen positivamente.

Palabras clave: Análisis clúster; ANOVA; incertidumbre; mercados valores; panel; política económica.

JEL Classification / Clasificación JEL: C23, G15, G18.

1. Introduction and literature review

Market uncertainty is widely considered a critical factor influencing the overall functioning of the economy. Among the primary drivers of this uncertainty, policymakers' decisions are often seen as significant in shaping stock prices (Carney, 2016). In recent decades, a pronounced global trend towards financial instability has made globalisation increasingly characterised by heightened uncertainty.

The significance of economic policy uncertainty (EPU) has been demonstrated in various studies. For instance, Wang et al. (2014) link EPU to corporate investment decisions, while Wang et al. (2015) explore its impact on commodity markets. Other studies have examined the relationship between EPU and various economic indicators, such as unemployment (Caggiano et al., 2017), co-movements in stock markets (Li and Peng, 2017; Albrecht et al., 2023), stock market volatility (Pastor and Veronesi, 2012, 2013; Liu and Zhang, 2015; Ghani and Ghani, 2024), stock market returns (Christou et al., 2017; Xu et al., 2021), and exchange rates (Bartsch, 2019).

The relationship between uncertainty and the economy is not a new topic of study. However, uncertainty has intensified in the aftermath of the global financial crisis and the crises within the Eurozone. Evidence for this can be found in research by the International Monetary Fund (IMF, 2012, 2013) and the Federal Open Market Committee (2009), which highlighted how uncertainty surrounding fiscal, regulatory, and monetary policies in the United States and Europe contributed to a sharp economic downturn during the 2008 financial crisis, followed by a slowdown in the subsequent economic recovery.

Recently, the relationship between EPU and stock markets has attracted increasing attention in the literature. However, most studies focus on the effects of policy shocks on a limited set of macroeconomic variables, typically examining individual countries or specific regions. In contrast, this study seeks to provide a comprehensive analysis of the relationship between EPU and stock markets across a broad sample of representative countries worldwide.

In the context of China, Xu et al. (2021) analyse the relationship between EPU and stock market returns using univariate and bivariate predictive regression models. They find that EPU negatively influences stock returns in the following month. Additionally, they observe that the forecasting power of EPU declines sharply when significant events lead to a substantial increase in uncertainty. Similarly, Chen et al. (2017) conduct a panel analysis and conclude that higher uncertainty is associated with lower financial market performance. Choi (2017) examines this relationship in Korea, finding an inverse correlation between EPU and the country's benchmark stock market index.

Arouri et al. (2016), using both linear and switching models, find that an increase in policy uncertainty reduces stock returns in the US markets. However, they note that the relationship between EPU and stock returns is not linear, with the effect being stronger and more persistent during periods of extreme volatility.

In a joint-country analysis, Alqahtani and Martinez (2020) examine the Gulf Cooperation Council (GCC) countries, concluding that Bahrain and Kuwait exhibit a negative relationship with US economic policy uncertainty. Similarly, Saeed (2020) analyses the impact of US uncertainty on GCC countries and finds that Bahrain's stock market returns decrease when US uncertainty rises.

Chiang (2019) conducts an analysis of five Asian stock markets, finding positive intertemporal relationships between excess stock returns and conditional volatility/downside risk. Similarly, Donadelli (2014) examines the impact of EPU and macroeconomic variables on stock market returns in 10 Asian countries using Granger causality and regression analysis. He concludes that bullish Asian stock markets can help reduce US economic policy uncertainty. Also, Chiang (2019) examines the relationship between EPU and stock market performance in the G7 countries (Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States) using the ARCH methodology. He concludes that an increase in uncertainty leads to a decline in stock market returns.

Other authors, such as Paule-Vianez et al. (2021), conduct a panel analysis of a selection of European countries to investigate the relationship between EPU and financial market returns, volatility, and liquidity. They conclude that policy uncertainty reduces returns and increases volatility in European financial markets.

Similarly, Skrinjaric and Orlovic (2019) analyse the effects of spillovers on EPU in selected Central and Eastern European markets (Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Poland, Croatia, Slovakia, and Slovenia) using VAR methodology. They find that the strongest negative relationship occurs in the Czech Republic, Lithuania, Poland, and Slovenia. Furthermore, Lam and Zhang (2014) investigate the impact of policy uncertainty on stock returns in 49 countries using panel methodology and regression analysis. They find that policy uncertainty significantly affects stock returns, though their study uses political risk ratings as a variable rather than focusing specifically on EPU.

Odionye et al. (2024) analyse the relationship between economic policy uncertainty and stock market indices in Sub-Saharan African countries, also taking into account the effect of the Covid-19 pandemic. For this purpose, they apply the novel multiple structural break test in panel (MSBP) and cross-sectional ARDL (CS-ARDL).

Finally, Wu et al. (2016) examine the relationship between EPU and stock markets in nine countries using bootstrap panel causality analysis. Their results suggest that the impact of EPU on stock prices is not consistent with previous studies, as EPU only affects stock prices in one of the seven countries under consideration – the United Kingdom. Furthermore, they find significant causality from stock prices to EPU in India, Italy, and Spain. The authors suggest that these differing patterns in the relationship between EPU and stock prices cast doubt on the theoretical view that EPU depresses stock returns through its negative impacts on industrial production, economic growth, and firm-level investment decisions.

Although the literature on the adverse impact of EPU on stock markets is expanding, to the best of our knowledge, the relationship between EPU and the behaviour of uncertainty within individual countries – and the potential for convergent groups – has not been studied in depth. This study, therefore, aims to fill this gap by applying panel methodology to a sample of approximately twenty countries, considering the three most relevant forms of uncertainty in recent years at a global level. In doing so, this study seeks to analyse the strong stock market movements in each country's relevant indices, driven by uncertainty arising from policymakers' decisions, using a representative panel of countries from across the globe.

Specifically, this paper has two main objectives: firstly, to examine the relationship between economic policy uncertainty (EPU) and the performance of stock market indices globally; and secondly, to compare the effects of EPU with those of other forms of uncertainty. To achieve this, we analyse panel data from twenty countries covering the period 2003 to 2020, a timeframe marked by diverse economic cycles and significant global events.

The literature suggests that increasing uncertainty is associated with long-term declines in stock market indices (Malkiel and Xu, 2006; Caldara and Iacoviello, 2019), indicating a negative relationship between uncertainty and stock prices. Based on this, our initial hypothesis examines the extent to which uncertainty could negatively impact stock market performance.

This paper is organized as follows. Section 2 details the data and methodology. Section 3 presents the empirical results, including the exploratory analysis of Economic Policy Uncertainty and the panel model estimation. Section 4 discusses the findings, and Section 5 concludes the study.

2. Data and methodology

2.1. Data and variables

Building on a review of the literature, this section presents the variables selected to study the relationship between stock exchanges and economic policy uncertainty. At the end of this section, a table presenting the main descriptive statistics and data sources is included.

The dependent variable is represented by the following stock exchange indices from various countries: Australia (ASX), Brazil (BOVESPA), Canada (S&P TSX), Chile (IPSA CLP), China (Shanghai SE Composite), Colombia (COLCAP), France (CAC), Germany (DAX), Greece (ATHEX), India (BSE), Ireland (ISEQ), Italy (MIB), Japan (NIKKEI), South Korea (KOSPI), Mexico (BMV IPC), Netherlands (AEX), Russia (MOEX or RTS), Singapore (STI), Spain (IBEX), Sweden (OMXS), United Kingdom (FTSE), and the United States (S&P).

Stock exchanges facilitate the transfer of resources from surplus agents, i.e., those with savings, to agents requiring resources for productive activities. In other words, the stock market enables the financing of investments by transforming savings into investment. An index is essentially a mathematical formula whose values summarise the behaviour of a group of variables over a specified period of time, with the aim of simplifying the analysis of particular phenomena. In the case of stock exchange indices, these indicators reflect the fluctuations in the prices of stock market instruments, driven by the effects of supply and demand or external market factors.

We include the following independent variables, which we discuss below: uncertainty (economic policy uncertainty, stock market volatility, and geopolitical risk), economic factors (economic growth and inflation), and monetary policy (interest rate and exchange rate).

Economic Policy Uncertainty: The main stock market indices of each country are well-known and can serve as indicators of changes in various aspects, whether economic, financial, or in response to events or policymakers' decisions.

Studies such as those by Bernanke (1983) and Scotti (2016) show how economic policy influences the broader economy. Therefore, it is reasonable to consider how actions taken by economic policymakers in each country may affect the prices of their respective stock market indices.

However, measuring uncertainty is complex, as no single indicator can uniformly capture it across all countries. Baker *et al.* (2016), in their effort to quantify this uncertainty, created the Economic Policy Uncertainty (EPU) index for a number of countries worldwide.

We chose to include the EPU index to provide a consistent indicator that measures the inverse relationship between economic policy uncertainty and stock market indices across the selected countries, chosen for their relevance in each continent.

Geopolitical risks have recently been recognised by business leaders, market participants, and central banks as critical determinants of investment decisions and stock market dynamics. Investors are particularly concerned about the economic impact of various military and diplomatic conflicts around the world, with some indicating that geopolitical risks are of greater concern than political and economic uncertainty (Wells Fargo/Gallup survey). Beyond the uncertainty dimension, geopolitical risks also encompass events that disrupt the normal, democratic, and peaceful course of relations between states, populations, and territories.

The influence of the geopolitical sphere on the economy has not been extensively studied due to the lack of a consistent indicator of geopolitical risk that aligns with the perceptions of the press, the public, investors, and policymakers. This gap was addressed by Caldara and Iacoviello (2019), who developed a geopolitical risk index starting in 1985. Their research shows that negative geopolitical shocks lead to persistent declines in investment, employment, consumer confidence, and stock market returns. In summary, geopolitical risk is crucial because it can significantly affect economic prospects, making it an important factor to be monitored by both business and political institutions.

Stock market volatility plays a central role in understanding the causes and consequences of risk and uncertainty in the behaviour of financial markets, asset pricing, and monetary policy. For decades, it has been a focal point in modern economics and finance.

Volatility is commonly regarded as a measure of price fluctuations in financial markets, reflecting the dispersion of returns on a given asset. It has long been considered an indicator of risk (Markowitz, 1952), with the general view that higher volatility corresponds to greater uncertainty about the asset's value. As such, it has become a key concept in modern financial theory.

The impact of uncertainty, as measured by volatility, on stock returns has been the subject of extensive research due to the importance of stock price variability. Numerous studies (Chen *et al.*, 2015; Agarwal *et al.*, 2017; Hollstein and Prokopczuk, 2018; Kaeck, 2018) have concluded that volatility is a significant factor in explaining and predicting asset prices.

Economic growth is one of the key variables in the process of expectation formation, as this rate is typically reliable in the market and does not exhibit significant deviations. Gross Domestic Product (GDP) is a commonly used indicator for analysing economic growth. However, the industrial production index is more frequently cited in the literature as a factor influencing stock market behaviour (Chen *et al.*, 1986; Shanken and Weinstein 1990). Nevertheless, some authors also consider GDP (Bulmash and Trivoli, 2006; Chen, 1991), as it is a macroeconomic variable that significantly affects stock market valuations. Growth in a country's domestic production leads to an increase in corporate earnings, future dividends, and, consequently, the valuation of a company's financial assets.

Inflation is considered in the literature in various ways, such as historical inflation, expected inflation, or changes in expected inflation. The relationship between inflation and asset returns is generally negative, as shown in studies, particularly the work of Geske and Roll (1983). They argue that rising inflation increases business costs, which in turn reduces profits and, consequently, the value of stocks. This topic is further explored by Kaul (1987), who found that the impact of inflation depends on the evolution of interest rates, as well as money supply and demand. This relevance is taken into account when trying to predict it, as Ertl *et al.* (2025) do for different European countries. Other studies, such as those by Lintner (1975), Bodie (1976), Fama and Schwert (1977), and

Jaffe and Mandelker (1979), also established a negative correlation between inflation and asset returns.

Finally, we include two variables to measure the size of monetary policy: the interest rate and the exchange rate. Each of these variables provides a distinct perspective, helping to measure and explain factors that may influence stock index prices.

Interest rate. We use the 12-month government bond interest rate, which has been widely adopted in the literature as a measure of the degree of investment directed towards the public or private sectors (bonds or stock market). In the event of an increase in the interest rate on a country's short-term bonds, investors are likely to favour these securities over the stock market, as the returns from bonds will be higher. Conversely, when short-term bond interest rates are very low, investors tend to direct their investments towards the stock market of that country.

Exchange rate. The exchange rate is a key factor to consider, as it represents a source of risk for companies engaged in global activities, such as exporters and importers listed on the stock exchange. These companies may be affected by fluctuations in currency exchange rates, potentially leading to reduced profits (Oritani, 2010). Therefore, it is vital to formulate policies to monitor and manage exchange rates, to mitigate exposure to exchange rate risk. Such policies are also essential for improving trade policies and ensuring economic stability (Belaire-Franch and Opong, 2005).

The countries and the analysis period were selected based on the availability of data to construct a panel with the maximum number of observations possible. After discussing all the variables included in our model, the period from March 2003 to June 2020 is covered, with the following variables: stock prices of each stock market index (INDEX), the economic policy uncertainty index (EPU), the geopolitical risk index (GPR), stock market volatility (VIX), based on the Chicago Board Options Exchange Market Volatility Index, Gross Domestic Product (GDP), measured as the percentage change in real GDP compared to the previous period, inflation (CPI), based on the Consumer Price Index, interest rate (IR), based on the 12-month fixed income bond interest rate, and exchange rate (ER), based on the Real Broad Effective Exchange Rate. The sources and main descriptive statistics are presented in Table 1.

Table 1. Sources and main descriptive statistics

Variable	Source	Obs.	Mean	SD	Min.	Max.
INDEX	Eikon	4,102	4,562.20	6745.77	0.25	43,755
EPU	Policy Uncertainty Web	4,141	139.43	101.28	8.51	1,141.80
VIX	Eikon	4,160	14.98	6.60	8.00	48.54
GPR	Matteo Iacoviello Web	4,160	102.07	59.98	40.43	545.26
GDP	Eurostat/OCDE/ Monetary Authority Singapore	4,034	0.52	1.84	-25.25	23.39

Variable	Source	Obs.	Mean	SD	Min.	Max.
CPI	Eurostat/INE Chile/ DANE Colombia/ Australian Bureau of Statistic	4,160	90.43	15.35	30.90	126.20
IR	Eikon	3,598	3.20	3.22	-0.96	15.80
ER	Eurostat/ Federal Reserve	4,160	97.10	12.00	47.15	133.93

Note: INDEX is in level points. EPU, VIX, and GPR are index values. GDP is the percentage change in real GDP. CPI is a consumer price index. IR is the 12-month government bond yield (in %). ER is the real effective exchange rate (an index).
Source: Authors' own elaboration.

2.2. Methodology

The primary objective of this study is to examine the significance of economic policy uncertainty. Additionally, the study aims to determine: (i) whether distinct groups of countries can be identified based on the levels and variability of EPU, and (ii) whether significant differences exist between major geographical regions in terms of EPU behaviour. This may provide insight into the degree of similarity between countries in terms of their economic policy uncertainty, and whether these similarities are consistent across geographical blocs, such as the Eurozone.

Studies such as that of Marfatia et al. (2020) have jointly analysed the EPU indicators for 17 different countries, using a Minimum Spanning Tree (MST) and a dependence network based on partial correlations. Their findings indicate that the U.S. and German EPUs dominate a tightly knit global policy uncertainty network, with the largest flow of information transmission in the dependency network. Conversely, Greece, Russia, and Brazil are identified as the top three recipients of information in the global EPU network. They also highlight the policy implications of these results, particularly in the context of the ongoing international debate on policy coordination.

Having developed a clearer understanding of Economic Policy Uncertainty (EPU) through the analyses conducted in the previous sections, we now proceed to estimate a random effects model. This approach appears optimal for our research purposes, as it is well-suited to panel data, addresses heterogeneity, and allows for a distinction between permanent and transitory effects within variations in the dependent variable.

Random effects models assume that the numerous factors potentially influencing the dependent variable, yet not explicitly included as independent variables, can be effectively captured by the random disturbance term. One of the key advantages of panel data is its ability to distinguish between permanent effects (n) and transient or purely random effects (v) within the disturbance term.

When numerous individual units are observed over time, it is often assumed that certain omitted variables will capture factors specific to both individual units and time periods. Some of these variables may reflect differences that consistently influence each observation in a broadly similar manner over time, while others may capture factors unique to specific time periods that affect individual units in much the same way.

A key assumption of the random effects model is that these unobserved, time-invariant country effects are uncorrelated with the model's regressors. We defend this assumption by noting that our specification includes key variables that directly capture the institutional and structural factors likely to cause such correlation. Most notably, the Economic Policy Uncertainty (EPU) index and the Geopolitical Risk (GPR) index are designed to quantify the very policy environment and political stability that define a country's institutional landscape. By incorporating these proxies, we argue that the primary source of potential correlation is accounted for within the model itself.

Statistically, this conceptual justification is validated by the Hausman (1978) test. The test's result fails to reject the null hypothesis, indicating no systematic difference between the fixed and random effects estimators. This provides formal evidence that the more efficient random effects model is consistent and appropriate for our data.

3. Results

3.1. Exploratory analysis of economic policy uncertainty

We begin our empirical analysis by examining the clustering patterns and regional differences in Economic Policy Uncertainty. Prior to conducting the cluster analysis, we examined potential outliers in both the mean and standard deviation of Economic Policy Uncertainty (EPU) across countries. As shown in Figure 1 (Box plot for average EPU), China (22) was identified as an outlier due to its exceptionally high mean EPU level. Figure 2 (Box plot for standard deviation of EPU) revealed two outliers: China (22) and the United Kingdom (5), both exhibiting unusually high EPU variability.

The decision to exclude China from subsequent cluster analysis was based on its unique status as the only country appearing as an extreme outlier in both dimensions. This dual outlier characteristic means that China would disproportionately influence the Euclidean distance calculations and potentially distort the cluster formation for the remaining countries. While the United Kingdom also showed high variability, it was retained in the analysis as it represented a more consistent high-volatility profile that could meaningfully group with other countries showing similar (though less extreme) patterns (Table 2). This conservative approach ensures the robustness and interpretability of the cluster results.

FIGURE 1. BOX PLOT FOR AVERAGE

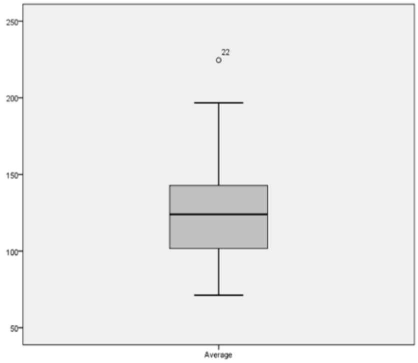
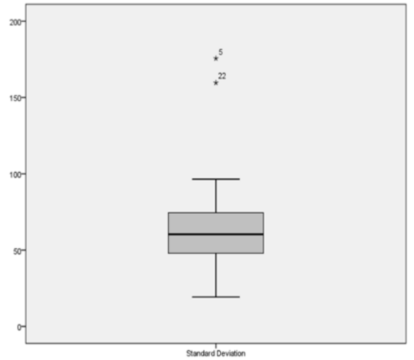


FIGURE 2. BOX PLOT FOR STANDARD DEVIATION



Source: Authors' own elaboration based on uncertainty index data.

TABLE 2. PRELIMINARY RESULTS FOR THE CLUSTER ANALYSIS: COUNTRY-LEVEL SUMMARY STATISTICS OF EPU

Country	Average	SD
Australia	105.73	61.85
Brazil	162.93	96.44
Canada	181.11	111.96
Chile	105.21	52.99
China	231.14	224.07
Colombia	100.85	37.39
France	201.25	96.76
Germany	147.73	75.83
Greece	120.76	61.89
India	93.59	50.90
Ireland	132.47	63.99
Italy	110.75	38.95
Japan	107.02	34.92
Korea, Rep.	142.37	70.17
Mexico	68.30	44.05
Russia	162.21	116.17
Singapore	133.86	68.19
Spain	112.50	55.76
United Kingdom	233.40	161.68
United States	131.30	63.12

Source: Authors' own elaboration based on uncertainty index data.

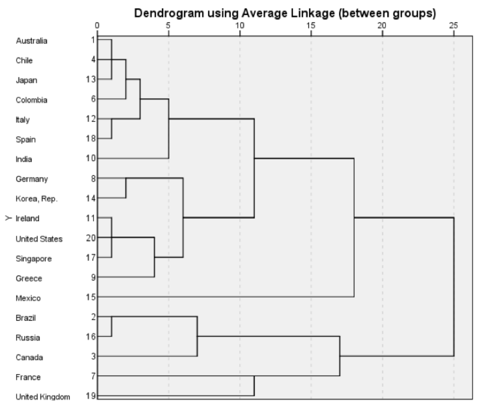
In our case, cluster analysis allows us to divide our set of countries into groups that are homogeneous within themselves and heterogeneous between groups, in order to observe the extent to which economic policy uncertainty converges through their similarities and distinctions.

We performed the cluster analysis (using Euclidean distance as the distance measure) first for all the countries, and then for the subset of European Monetary Union (EMU) countries, considering the mean, the standard deviation, and both the mean and standard deviation jointly.

The first analysis provides insight into the behaviour of the different countries at the international level, highlighting the extent to which their uncertainties are similar on a global scale. On the other hand, the separate analysis of the EMU countries seeks to determine whether the performance of the euro area is similar in terms of EPU, as it would be expected a priori that economies governed by the same economic policy should converge.

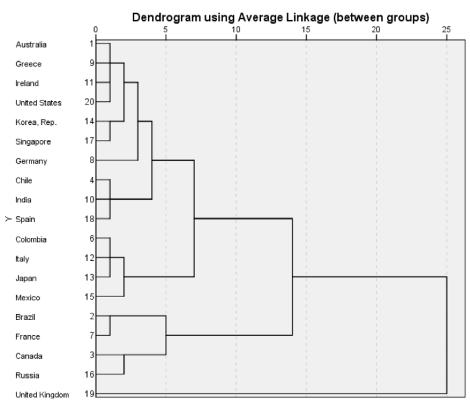
The results obtained (dendrograms) are shown in the next figures 3-8:

Figure 3. Cluster analysis: all countries (average)



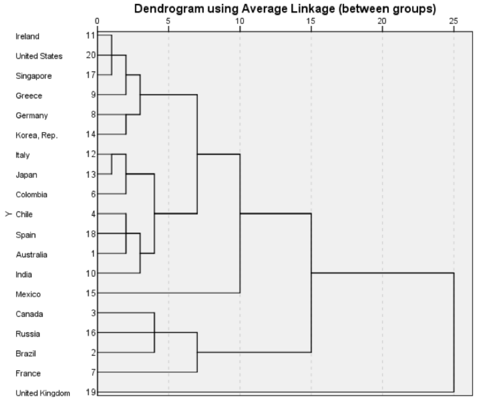
Source: Authors' own elaboration based on uncertainty index data.

Figure 4. Cluster analysis: all countries (SD)



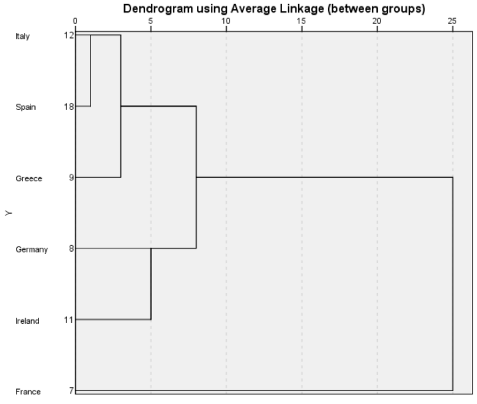
Source: Authors' own elaboration based on uncertainty index data.

Figure 5. Cluster analysis: all countries (average and standard deviation)



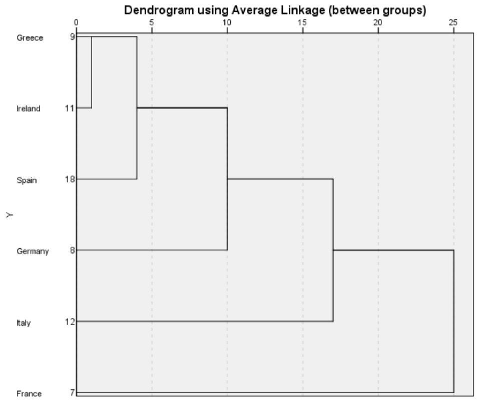
Source: Authors' own elaboration based on uncertainty index data.

Figure 6. Cluster analysis: EMU (average)



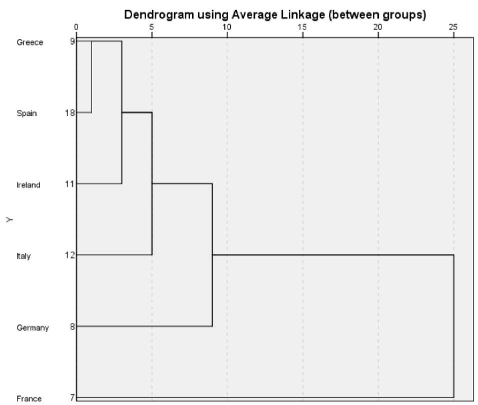
Source: Authors' own elaboration based on uncertainty index data.

Figure 7. Cluster analysis: EMU (SD)



Source: Authors' own elaboration based on uncertainty index data.

Figure 8. Cluster analysis: EMU (average and standard deviation)



Source: Authors' own elaboration based on uncertainty index data.

Looking at the dendrograms, the most notable results of the cluster analysis are as follows:

- When all countries are considered, the clusters turn out to be heterogeneous. If only the mean or standard deviation of the EPU is taken into account, there are countries (Mexico and the United Kingdom, respectively) that do not form clusters with any other.
- When only European Union countries are considered, France does not form a cluster with any other country. Homogeneity is observed only among

some of the so-called “PIIGS” countries (Greece, Italy, and Spain for the EPU mean; Greece, Ireland, and Spain in the case of the standard deviation).

The results from the hierarchical cluster analysis (Figures 3-8) are synthesized in Table 3, which provides a comprehensive overview of the identified country groupings across different clustering approaches. The key findings reveal a highly consistent core of moderate-uncertainty economies, the United Kingdom as a persistent high-volatility outlier, and France’s distinct position, often separate from other European nations.

Table 3. Summary of hierarchical cluster analysis results: EPU-based country groupings

Scope	Clustering Basis	Clusters	Composition & Patterns
All Countries	EPU Mean	4	Cluster 1: Mexico. Cluster 2: Australia, Chile, Colombia, Germany, Greece, India, Ireland, Italy, Japan, Korea Rep., Singapore, Spain & United States. Cluster 3: Brazil, Canada & Russia. Cluster 4: France & United Kingdom.
	EPU SD	3	Cluster 1: Australia, Chile, Colombia, Germany, Greece, India, Ireland, Italy, Japan, Korea Rep., Mexico, Singapore, Spain & United States. Cluster 2: Brazil, Canada, France & Russia. Cluster 3: United Kingdom.
	EPU Mean & SD	3	Cluster 1: Australia, Chile, Colombia, Germany, Greece, India, Ireland, Italy, Japan, Korea Rep., Mexico, Singapore, Spain & United States. Cluster 2: Brazil, Canada, France & Russia. Cluster 3: United Kingdom.
European Union Countries	EPU Mean	2	Cluster 1: France. Cluster 2: Germany, Greece, Ireland, Italy, Spain, Netherlands.
	EPU SD	-	The dendrogram did not yield a clear or interpretable cluster solution for variability within the EU.
	EPU Mean & SD	2	Cluster 1: France. Cluster 2: Germany, Greece, Ireland, Italy, Spain, Netherlands.

Source: Authors’ own elaboration based on uncertainty index data.

Next, we carried out an analysis of variance (ANOVA) with one factor to check whether the uncertainties among blocks of countries have the same means, i.e., to determine whether the average degree of EPU in any area is the same or differs from the mean of the rest. For this purpose, we considered the following six blocks: Asia, Central & South America, Europe_EMU, Europe_Non-EMU, North America, and Oceania.

The analysis reveals significant differences between the averages of the different blocks of countries, with the extremes being the non-EMU European countries and Oceania (maximum and minimum, respectively), as detailed in the post-hoc tests of Table 7.

Regarding the Levene’s test for homogeneity of variances (Table 4), it yields that the null hypothesis of homoscedasticity is strongly rejected (p-value <

0.0001) and, therefore, the standard *F* test cannot be applied: the Brown-Forsythe test must be used instead.

Table 4. Homogeneity of variance test

EPU			
Levene Statistic	df1	df2	Sig.
53.227	5	1242	0.0000

Source: Authors' own elaboration based on uncertainty index data.

In the case of the results of Table 5, this test clearly rejects (p-value < 0.0001) the null hypothesis of equality of means.

Table 5. Robust test of equality of means

EPU				
	Statistic	df1	df2	Sig.
Brown-Forsythe	47.011	5	768.592	0.0000

Source: Authors' own elaboration based on uncertainty index data.

Non-normality is observed in all areas except Europe_EMU countries (Table 6). However, the skewness and kurtosis statistics reveal that non-normality is not relevant, so the former result for the Brown-Forsythe test is valid.

Table 6. Normality tests

	Area	Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
EPU	Europe_EMU	0.049	208	0.2000	0.968	208	0.0001
	Europe_Non-EMU	0.107	208	0.0000	0.908	208	0.0000
	North America	0.093	208	0.0001	0.894	208	0.0000
	Central & South America	0.133	208	0.0000	0.840	208	0.0000
	Asia	0.083	208	0.0013	0.942	208	0.0000
	Oceania	0.134	208	0.0000	0.887	208	0.0000

Source: Authors' own elaboration based on uncertainty index data.

Next, we carried out post hoc tests, in order to determine in which geographical areas there are significant differences between their mean levels in the EPU variable. For these tests, we applied the Games-Howell statistic since there is heteroscedasticity (as seen above).

Table 7. Multiple comparisons

Dependent variable:		EPU				
		Games-Howell				
					95% Confidence Interval	
(I) Area	(J) Area	Mean Difference (I-J)		Sig.	Lower Bound	Upper Bound
Europe_EMU	Europe_Non-EMU	-60.2251*	8.8574	.0000	-85.6395	-34.8107
	North America	-18.6253	6.7877	.0694	-38.0776	.8270
	Central & South America	24.5767*	4.8753	.0000	10.6179	38.5355
	Asia	18.3695*	4.7483	.0018	4.7736	31.9655
	Oceania	31.8501*	5.5814	.0000	15.8672	47.8330
Europe_Non-EMU	Europe_EMU	60.2251*	8.8574	.0000	34.8107	85.6395
	North America	41.5998*	9.9588	.0005	13.0724	70.1272
	Central & South America	84.8018*	8.7677	.0000	59.6389	109.9647
	Asia	78.5946*	8.6978	.0000	53.6279	103.5614
	Oceania	92.0752*	9.1792	.0000	65.7552	118.3953
North America	Europe_EMU	18.6253	6.7877	.0694	-.8270	38.0776
	Europe_Non-EMU	-41.5998*	9.9588	.0005	-70.1272	-13.0724
	Central & South America	43.2020*	6.6702	.0000	24.0817	62.3223
	Asia	36.9948*	6.5780	.0000	18.1350	55.8546
	Oceania	50.4754*	7.2025	.0000	29.8457	71.1051
Central & South America	Europe_EMU	-24.5767*	4.8753	.0000	-38.5355	-10.6179
	Europe_Non-EMU	-84.8018*	8.7677	.0000	-109.9647	-59.6389
	North America	-43.2020*	6.6702	.0000	-62.3223	-24.0817
	Asia	-6.2072	4.5789	.7535	-19.3173	6.9030
	Oceania	7.2734	5.4381	.7639	-8.3010	22.8478
Asia	Europe_EMU	-18.3695*	4.7483	.0018	-31.9655	-4.7736
	Europe_Non-EMU	-78.5946*	8.6978	.0000	-103.5614	-53.6279
	North America	-36.9948*	6.5780	.0000	-55.8546	-18.1350
	Central & South America	6.2072	4.5789	.7535	-6.9030	19.3173
	Oceania	13.4806	5.3245	.1175	-1.7707	28.7319
Oceania	Europe_EMU	-31.8501*	5.5814	.0000	-47.8330	-15.8672
	Europe_Non-EMU	-92.0752*	9.1792	.0000	-118.3953	-65.7552
	North America	-50.4754*	7.2025	.0000	-71.1051	-29.8457
	Central & South America	-7.2734	5.4381	.7639	-22.8478	8.3010
	Asia	-13.4806	5.3245	.1175	-28.7319	1.7707

Note: *. The mean difference is significant at the .05 level.
Source: Authors' own elaboration based on uncertainty index data.

From the information gathered in Table 7, it can be said, at a 5% significance level, that:

- The Eurozone (EMU) has a significantly lower average EPU than that of non-EMU European countries. On the contrary, it is significantly higher than those of Central and South America, Asia and Oceania.

- The non-EMU European countries, on average, have a significantly higher EPU than all other areas.
- North America has a significantly higher average EPU than Central and South America, Asia and Oceania. On the other hand, it is lower than that of non-EMU European countries.

3.2. Model estimation

We began the empirical analysis by estimating a pooled model, following the standard procedure for panel data, and then a fixed effects model, and carried out a pooled *F* test of the regressors and a *F* test of existence of different intercepts by groups, reaching the conclusion that the fixed effects model was preferable to the pooled model.

Then, we estimated the random effects model and performed the joint *F* test of the regressors, the Breusch-Pagan test, and the Hausman test. We concluded that the random effects model is better than the pooled model and that the best option is the application of the random effects model rather than the fixed effects model.

Finally, we considered it convenient to carry out a two-way random effects model (i.e. including time variables as regressors) in order to observe the most relevant moments of the time series. As a complement to this model, we carried out the joint *F* test of the regressors, the joint Wald test on the time dummy variables, the Breusch-Pagan test, and the Hausman test. The results obtained show that the explanatory variables are jointly relevant, the dichotomous time variables are jointly significant, the random effects model is preferable to the pooled model, and that the best choice is the random effects model rather than the fixed effects model.

We estimate a two-way random effects model. The formal specification of our panel data model is as follows:

$$\mathbf{INDEX_{it}} = \alpha + \beta_1\mathbf{EPU_{it}} + \beta_2\mathbf{VIX_{it}} + \beta_3\mathbf{GPR_{it}} + \beta_4\mathbf{GDP_{it}} + \beta_5\mathbf{CPI_{it}} + \beta_6\mathbf{IR_{it}} + \beta_7\mathbf{ER_{it}} + \mu_i + \lambda_t + \varepsilon_{it}$$

Where $INDEX_{it}$ is the stock market index for country *i* in period *t* ; α is the common intercept; β_1 to β_7 are the parameters to be estimated for the independent variables; μ_i is the unobserved country-specific random effect, which captures time-invariant heterogeneity across countries; λ_t is the unobserved time-specific random effect, which captures common temporal shocks affecting all countries in a given period *t* and ε_{it} is the idiosyncratic error term.

The choice of a two-way specification is crucial because it allows us to control for common global shocks that simultaneously influence all stock markets in our sample. By including the time effects (λ_t), we isolate the impact of our variables of interest from these pervasive temporal events, leading to more reliable and precise estimates. Without this control, the estimated coefficients could be biased by omitting these universal trends and shocks. The estimates obtained are summarised in Table 8. All variables except the VIX were significant in the model.

Table 8. Two-way random effects model estimates

Regressor	Coefficient	*z-Statistic*	p-value
C	−2338.87	−0.4128	0.6798
EPU	−1.58965	−5.005	0.0000 ***
VIX	242.816	1.141	0.2538
GPR	−6.54635	−4.851	0.0000 ***
GDP	108.768	5.811	0.0000 ***
CPI	−17.0132	−5.642	0.0000 ***
IR	−151.580	−8.796	0.0000 ***
ER	48.6123	17.13	0.0000 ***

Note: ***, **, * indicate rejection of the null hypothesis at the 1, 5, and 10 percent levels of significance, respectively.
Source: Authors' own elaboration.

The results of the post-estimation tests, summarized in Table 9, confirm the robustness and appropriateness of our two-way random effects specification. The highly significant Breusch-Pagan test validates the use of a panel data approach over pooled OLS, while the non-significant Hausman test supports the consistency of the random effect estimators over fixed effects. Furthermore, the joint Wald test on the time dummies confirms the importance of controlling for common temporal shocks across all countries. Although the formal normality test indicates non-normal residuals, this does not invalidate our results. Following Gujarati and Porter (2010), the normality assumption is primarily required for exact inference in small samples; in our large panel dataset, the estimators retain their Best Linear Unbiased Estimators properties. Finally, the significant Pesaran CD test reflects the expected cross-sectional dependence in global financial markets, which is adequately captured by our model specification.

Table 9. Results of post-estimation tests for model selection

	Test Statistic	p-value
Normality of Residuals	5,889.3	0.000
Pesaran CD Test	10.6308	0.000
Joint F-test of Regressors	487.136	0.000
Breusch-Pagan LM Test	176,756	0.000
Hausman Test	9.59897	0.213
Joint Wald Test on Time Dummy Variables	468.668	0.000

Source: Authors' own elaboration.

The results obtained reveal that not all the uncertainty measures are relevant. First, the variable EPU used as a proxy for economic policy uncertainty is extremely significant to explain the dependent variables selected, i.e. the stock indexes.

Second, regarding the VIX, the variable to explain the global financial market volatility, is not relevant to explain the stock exchange prices.

And third, the measure of uncertainty in the geopolitical perspective, the GPR, is significant to explain the behaviour of the dependent variables. Its sign is negative, so global geopolitical threats and adverse events harm the stock markets.

With respect to the control variables, we see that all of them are significant. Gross Domestic Product (GDP) with a positive sign, as increases in a country's economy can be expected to be associated with a higher rate of investment in the stock market and hence higher stock prices. Consumer Price Index (CPI) is shown to be significant with an inverse relationship with respect to stock market indices, this could be because inflation generates more uncertainty and thus demand for minimum return will also rise which will decrease the market valuation. The Interest Rate (IR) has a negative relationship with stock prices, this is because this country's fixed income interest rate has a negative relationship with stock market investment, as investors will channel their investment to those with higher returns. The Exchange Rate (ER) is regularly incorporated as an investment asset portfolios and knowledge about the impact of exchange rate on the stock market is important for the performance of fund portfolios.

4. Discussion

In this paper, we explore the relationship between economic policy and stock exchanges for a sample of twenty countries around the world. We have offered new evidence on the effects of uncertainty.

First, we can conclude that, although there are distinguishable groups of countries in terms of economic policy uncertainty levels and variability, they are highly heterogeneous in their composition. If only European Union countries are considered, some homogeneity can only be observed among the so-called "PIIGS", when only the average EPU is considered.

Although the Eurozone exhibits a significantly lower average EPU than North America, the differences are not statistically significant compared to non-EMU European countries and Asian countries.

With regard to the specific objectives of this study, the results indicate a relatively low level of similarity among countries in terms of economic policy uncertainty. Furthermore, the Eurozone does not perform better (in terms of economic policy uncertainty) than other European countries, and notable differences exist among its member states.

Secondly, in this paper, we have explored the relationship between stock index prices and economic policy uncertainty across a sample of twenty countries worldwide, providing new evidence on the impact of three types of uncertainty on stock exchange prices over an extended period.

With regard to the control variables, we conclude that there is a positive relationship between economic growth and the benchmark stock market indices of each country. Prior studies, including those by McMillan (2005), Abugri (2008), and Bloom (2009), examined how stock prices respond to changes in economic production and found a significant positive effect of production on stock prices. The rationale is that increased economic activity generally leads to expectations of higher future cash flows, and, consequently, investors anticipate greater dividends, thereby driving demand for shares at higher prices.

In the same way, we found a positive relationship between the exchange rate and stock prices as have Hondroyiannis and Papapetrou (2001), Kyereboah-Coleman and Agyire-Tettey (2008), Hasan and Nasir (2008) and Diamandis and Drakos (2011). This positive effect can be explained by the fact that local firms become more competitive with the depreciation leading to an increase in their exports and an increase in stock prices (Muhammad and Rasheed, 2002). Other authors have not reached the same conclusion, as depending on the type of economy of the country this relationship may be different. According to Erdem *et al.* (2005), currency depreciation results in relatively decreased product prices of the country in international market, thus demand for those goods increases and there are more cash inflows into the country. At the same time currency depreciation also makes imported goods costly, thus if a country heavily depends on the imports of production inputs, currency depreciation will affect the economy negatively.

Conversely, the relationship between interest rates and stock prices has been inverse. This is because the fixed income interest rate in this country is negatively related to stock market investment, as investors tend to channel their investments towards assets with higher returns. When interest rates increase, investors prefer bonds, which causes stock prices to fall; similarly, when interest rates decrease, stock prices tend to rise. Such a negative relationship has been observed by Paul and Mallik (2003), McMillan (2005), Hasan and Nasir (2008) and Peiro (2015). Higher interest rates lead to an increased discount rate, ultimately reducing the present value of future cash flows, which is expected to negatively impact stock prices (Hasan and Nasir, 2008).

Another factor contributing to declines in stock prices is inflation, as empirical evidence suggests a negative relationship between inflation and stock prices (Istiak and Alam, 2019). This is because high and fluctuating inflation rates generate more uncertainty, leading to higher required returns and, consequently, lower market valuations, as shown by Kyereboah-Coleman and Agyire-Tettey (2008) and Leduc and Liu (2016).

Focusing on economic policy uncertainty in stock exchanges, we demonstrate how policymakers' decisions negatively influence stock market indices. Some recent studies examine the specific effects of uncertainty, especially macroeconomic and political uncertainty, on market returns. Boutchkova *et al.* (2012) highlight that exposure to national and global political risks and government instability can lead to less freedom and flexibility, as well as a potential decrease in firm efficiency. They also show that in specific industries, local and global political risks can lead to increased return volatility. Consequently, uncertainty in political conditions introduces challenges for businesses. For this reason, Pastor and Veronesi (2012) argue that economic uncertainty should be considered a risk factor and warrant a premium.

However, the effects of Economic Policy Uncertainty (EPU) vary depending on the country, the strength of the economy, and the size of the stock market (Christou *et al.*, 2017). Findings from prior research indicate that EPU generally maintains a significantly negative relationship with the stock market (Ko and Lee, 2015). Nevertheless, the impact of uncertainty appears weaker in some countries (Li *et al.,* 2016). Moreover, there is a lack of consensus regarding both the direction and strength of the relationship between the EPU index and stock markets in emerging economies. Some studies suggest that the EPU index exerts a greater influence in emerging markets due to credit constraints (Carriere-Swallow and Cespedes, 2013), while others argue that its impact is lower in certain emerging markets (Das and Kumar, 2018). Despite these differences, there is broad agreement that uncertainty can have a spillover effect across countries (Balcilar *et al.*, 2016; Christou *et al.*, 2017). Finally, Neck *et al.* (2024) focus on the importance of optimal fiscal policy design in times of uncertainty, concluding that the application of models with active learning approaches are more complex and not necessarily better than simpler solutions.

Geopolitical risks, likewise, tend to negatively affect stock prices. This could be attributed to the way these risks quantify the evolving international political environment, such as the rise of protectionist tensions. While in the short term, protectionist measures may attract electoral support from citizens seeking security in foreign trade policies, over the long term these actions may create adverse economic effects. The significance of geopolitical risk lies in its potential to impact the economic outlook, and therefore, it should be closely monitored by businesses and political institutions. Gourio (2013) suggests that highly leveraged industries may, all else being equal, be more vulnerable to geopolitical risk. Although threats of adverse events can have substantial global economic effects, the actual occurrence of these events often results in relatively modest economic consequences (Ilut and Schneider, 2014; Kozlowski *et al.*, 2018). It is worth noting, however, that when an adverse event occurs within a specific country, it tends to lead to a marked decline in that country's economic activity (Barro, 2006; Glick and Taylor, 2010).

Lastly, the VIX index (often referred to as the 'fear index' in financial markets) was not found to be statistically significant in explaining cross-country stock market behaviour. This is likely because, as a US-centric measure, it fails to adequately capture domestic volatility conditions in other countries. While local volatility indices would be theoretically preferable, their calculation is based on local financial futures and options markets, which are a recent innovation in many of the countries in our panel. Consequently, these local indices do not cover the entire 2003-2020 sample period, making it impossible to construct a homogeneous dataset. The VIX was therefore retained as the only consistent and globally comparable proxy for financial uncertainty across all countries and the full-time horizon, despite its inherent limitations.

5. Conclusions

This study provides robust evidence on how uncertainty affects global stock markets through a comprehensive panel analysis of twenty countries from 2003 to 2020.

First and foremost, the empirical results establish that economic policy uncertainty and geopolitical risk function as significant transmission channels of financial stress, consistently depressing stock market performance across diverse economic landscapes. This finding positions policy-driven uncertainty as a fundamental risk factor in international portfolio management. Conversely, the limited explanatory power of the VIX index underscores the inadequacy of US-centric measures in capturing heterogeneous volatility conditions globally.

A key methodological insight emerges from the cluster analysis, which reveals a striking absence of convergence in uncertainty patterns even among nations with deeply integrated economic policies. The significant disparities within the Eurozone challenge conventional assumptions about regional financial integration and highlight the predominant role of national institutional frameworks in shaping uncertainty absorption capacity.

Furthermore, the analysis corroborates the persistent influence of fundamental macroeconomic forces on equity valuations, with economic growth and exchange rates serving as stabilising factors, while interest rate and inflation pressures systematically erode market valuations across the international sample.

The empirical evidence offers clear and direct implications for key market participants and policymakers. For central banks and financial regulators, our findings underscore that clear, consistent, and transparent communication is not merely beneficial but essential for financial stability. The significant market reactions to policy uncertainty suggest that implementing systematic forward guidance and well-communicated policy frameworks can substantially reduce volatility and anchor investor expectations. Specifically, pre-announced policy calendars and explicit inflation targeting regimes could mitigate the adverse effects identified in our study.

The cross-country evidence compellingly demonstrates the need for enhanced international policy coordination. As uncertainty spills over national borders, collaborative communication strategies and aligned policy timing among major economies could prevent the amplification of global uncertainty shocks. Establishing formal channels for joint policy announcements represents a concrete step toward managing worldwide financial stability.

For investors and portfolio managers, our results highlight the critical importance of systematically incorporating real-time uncertainty measures into investment processes. During periods of elevated uncertainty readings, strategies should emphasize dynamic hedging, geographical diversification into less-correlated markets, and increased liquidity buffers. Portfolio rebalancing protocols triggered by uncertainty thresholds could enhance risk-adjusted returns.

It is important to acknowledge the limitations of our study. Our empirical model is static by design, capturing the contemporaneous relationship between uncertainty and stock market indices. However, the full impact of economic policy and geopolitical uncertainty likely unfolds over time, exhibiting lagged effects and persistence that our framework cannot capture. Additionally, our reliance on the VIX as a global volatility proxy may not fully capture region-specific volatility dynamics. Future research could fruitfully build upon our findings by employing dynamic panel data methodologies, such as the Arellano-Bond estimator, to model these temporal dynamics.

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