Document for the exclusive attention of professional clients, investment services providers and any other professional of the financial industry

Investment Institute

WORKING PAPER 183 | MARCH 2026

Geopolitical Risk and Asset Pricing Across Market Regimes

Amundi
Investment Solutions

Trust must be earned

Geopolitical Risk and Asset Pricing Across Market Regimes

Natasha ABOU RJAILY
Amundi Investment Institute
natasha.abourjaily@amundi.com

Abstract

This paper examines how geopolitical risk (GPR) is transmitted across global financial markets by analyzing its effects on equities, sovereign bonds, foreign exchange, and commodities. Moving beyond single-regime and single-dimension approaches, the study adopts a two-regime Markov-switching framework to capture the state-dependent pricing of geopolitical shocks under low- and high-volatility market conditions. GPR is modeled along multiple dimensions, incorporating regional and national indicators as well as six major bilateral geopolitical tensions. This multidimensional design allows for a comprehensive assessment of how different sources of geopolitical stress affect asset returns across market regimes.

The empirical framework evaluates whether geopolitical shocks are priced heterogeneously across asset classes, market conditions, and levels of geopolitical aggregation, and whether bilateral tensions convey information beyond aggregate GPR indicators. The results reveal strong regime dependence and pronounced cross-asset heterogeneity, with regional and bilateral GPR emerging as the primary drivers of asset price responses, while national GPR plays a more limited role. The findings highlight marked differences across asset classes, identify assets that exhibit defensive or safe-haven characteristics, and document persistent and lagged effects in commodity markets. Overall, the study demonstrates that GPR is neither priced uniformly nor transmitted symmetrically across markets, emphasizing the importance of regime-aware, asset-specific, and tension-specific approaches to portfolio construction and risk management under geopolitical uncertainty.

Keywords: Portfolio management, asset pricing, geopolitical risk, econometric modeling, Markov-switching model, equities, sovereign bonds, commodities, foreign exchange.

JEL classification: C01, G11, G12.

Acknowledgement

The author is very grateful to Thierry Roncalli, Claire Loupias, Maxime Debon, Amina Cherief, Takaya Sekine, and Anna Rosenberg for their helpful comments. The opinions expressed in this research are those of the author and are not meant to represent the opinions or official positions of Amundi Asset Management.

About the author

Natasha ABOU RJAILY

Natasha Abou Rjaily is a Quantitative Researcher in the Quant Portfolio Strategy team at Amundi Investment Institute where she focuses on portfolio construction and asset pricing with a special interest in new risks such as climate, biodiversity and geopolitical risks.

She initially joined Amundi in April 2024 as part of the Quantitative Research team, working on an extension of the Black-Litterman model applied to multi-factor models, with a strong emphasis on risk premia analysis. In 2025, she worked as a Fixed Income Trade Support Analyst at Natixis CIB where she oversaw the pre-trade process of fixed income products, before rejoining Amundi in July 2025. Between 2015 and 2022, she was a Trade Support Analyst at an investment bank in Beirut.

Natasha is currently pursuing a PhD at University Evry Paris-Saclay. Her doctoral research focuses on new emerging risks and their impact on portfolio management. She also holds a Master's degree with honors in Risk and Asset Management from the same university.

1 Introduction

In recent decades, the increasing frequency and intensity of geopolitical events have underscored their substantial influence on financial markets and the global economy. From military conflicts and trade disputes to political crises and pandemics, geopolitical risk (hereafter referred to as GPR) has emerged as a critical factor shaping asset prices, investor behavior, and portfolio management strategies. The growing recognition of this influence has motivated researchers and practitioners alike to develop quantitative tools to measure GPR and investigate its effects across asset classes, market regimes, and geographical regions.

Central to the analysis of GPR is the development of reliable and comprehensive indices that track periods of heightened geopolitical tension. Among the most widely used measures is the GPR index introduced by Caldara and Iacoviello (2022), which employs a dictionary-based methodology to quantify news related to geopolitical events using ten newspapers[1]. This index distinguishes realized geopolitical events from anticipatory threats, offering global coverage from 1900 to the present. Country-specific versions of the index are also available for 44 developed and emerging economies, enabling a localized GPR perspective.

While the Caldara and Iacoviello (2022) GPR index has significantly advanced empirical research on geopolitical uncertainty, it remains largely Anglo-centric, potentially limiting its ability to fully capture global geopolitical developments. Subsequent indices have extended the dictionary-based approach to alternative contexts and levels of aggregation. For instance, Salisu *et al.* (2023), Hsu and Fang (2024), and Sheng *et al.* (2025) develop regional and firm-level measures, while the BlackRock Geopolitical Risk Indicator (BGRI) leverages machine learning techniques to track both financial news and brokerage reports, placing greater emphasis on market attention rather than public discourse.

Building on these foundations, this study employs the Geopolitical Sentiment Tracker (GST) proposed by Rosenberg *et al.* (2024). The GST uses natural language processing (NLP) techniques to capture contextual signals from the top 30 news sources in each included country, thereby offering a more globally representative measure of GPR. Unlike earlier indices that focus primarily on direct threats or realized events, the GST encompasses a broader set of conditions that may elevate the likelihood of geopolitical tension, including political and economic crises and pandemics. Importantly, the GST provides a range of indicators capturing local and cross-country geopolitical perceptions[2], thereby offering the granularity necessary for multidimensional empirical analysis.

A growing body of literature documents that geopolitical and political uncertainty is priced in financial markets, affecting asset returns(Yilmazkuday, 2024), volatility, and cross-market correlations (Pastor and Veronesi, 2013). These uncertainties often lead to significantly time-varying contributions to portfolio risk premia (Abou Rjaily *et al.*, 2024), resulting in a non-negligible risk premium, particularly during periods of economic stress (Gala *et al.*, 2023). Despite this expanding research examining GPR, several important gaps remain. First, many empirical studies analyzing the effects of GPR across different asset classes rely on single-regime frameworks (e.g., Będowska-Sójka *et al.*, 2022; Umar *et al.*, 2022, 2023), thereby abstracting from the possibility that geopolitical shocks may be priced differently across market states. This limitation is particularly relevant given the nonlinear behavior of financial markets during periods of stress. Second, although recent contributions incorporate state-dependent dynamics, their scope is often confined to specific asset classes or market segments. Markov-switching (MS) approaches have been applied to commodities (Choi and Hammoudeh, 2010; Abid *et al.*, 2023), renewable energy exchange-traded funds

[1]Six newspapers from the USA, three from the United Kingdom, and one from Canada
[2]See Table 1 for more information on the different indicators offered by the GST

(Dutta and Dutta, 2022), and bond markets (Sheenan, 2023), while regime-based analyses of cryptocurrencies rely on MS-VAR, GARCH (Buthelezi, 2024), or state-dependent local projection frameworks (Fang *et al.*, 2024). Moreover, even within the regime-dependent literature, most studies focus on a single dimension of GPR — typically a global or national indicator — and rarely examine how geopolitical tensions propagate across markets through bilateral relationships. Yet tensions involving systemically important economies may generate asymmetric and asset-specific responses that are not captured by aggregate measures of GPR. As a result, existing research provides valuable but fragmented evidence, leaving open the question of how multiple asset classes jointly respond to different layers of GPR across market regimes.

Against this backdrop, our paper introduces a comprehensive empirical framework designed to assess the transmission of GPR across multiple asset classes, including equities, sovereign bonds, foreign exchange (FX), and commodities, while explicitly accounting for the dynamic nature of financial markets. The analysis examines whether the pricing of GPR varies across market conditions, asset classes, and sources of geopolitical tension, and whether accounting for regime changes alters the magnitude, sign, or persistence of asset-level responses. The study further assesses the relative importance of GPR at different aggregation levels, exploring whether regional and cross-border tensions convey information beyond that captured by country-specific indicators. Particular attention is given to cross-border geopolitical relationships involving systemically important economies, evaluating whether such tensions generate distinct and asset-specific responses and whether their effects depend on market regimes. The study further explores cross-asset heterogeneity by evaluating differences in resilience and vulnerability to geopolitical shocks, thereby providing insight into the potential defensive role of certain assets under geopolitical stress.

The empirical framework employed in this study builds upon Markov-switching (MS) models, which allow asset returns to exhibit distinct behavior across market regimes commonly associated with low- and high-volatility states. This framework captures the dynamic, nonlinear, and state-dependent nature of financial responses to geopolitical shocks. For equities, FX, and commodities, the MS model is specified in a regression form with GPR measures included as exogenous variables, enabling the analysis of regime-dependent sensitivities. For sovereign bonds, an autoregressive MS specification is used to account for the persistence in bond returns while allowing GPR to affect both regimes differently. The three distinct measures provided by the GST — regional, bilateral, and national — allow the analysis to disentangle different layers of GPR. Regional GPR, constructed at the geographical level (North America, Europe, Latin America, and Asia-Pacific), captures broad market-wide tensions, such as elevated geopolitical stress in Europe during periods of regional instability or heightened tensions across the Asia-Pacific area. Bilateral GPR isolates specific country-pair tensions, for example strategic and trade tensions between China and the United States or diplomatic frictions between Russia and the United States. National GPR, in contrast, reflects country-specific political risk, such as domestic political instability in Venezuela or internal political uncertainty within a single sovereign state. Applying this framework consistently across asset classes provides a structured empirical setting in which the dynamic and multidimensional pricing of GPR can be systematically evaluated.

The remainder of the paper is organized as follows. Section 2 examines regional equity markets and their responses to GPR at different levels of aggregation, highlighting regime-dependent effects on returns. Section 3 focuses on other asset classes — including sovereign bonds, FX markets, and commodities — analyzing their sensitivity to regional, cross-country, and domestic tensions, while evaluating the role of safe-haven assets in mitigating risk and considering the persistence of effects across low- and high-volatility regimes. Section 4 synthesizes the key empirical findings and discusses their implications for portfolio construction, dynamic risk management, and investment strategies under geopolitical uncertainty. Finally, Section 5 concludes the paper.

Table 1: The GPR indices presented by the GST

Index	What it measures?
Global geopolitical index	Global GPR measure
Local instability index	Local GPR measure as seen by worldwide news
Bilateral relations index	Measures how global news perceive the relation between 2 countries
Fundamental stability index	Measures the strength of a country's political base (quality of governance, level of press freedom, conflict and human development, etc.)
Local viewpoints	Measures how one country perceives other countries and how other countries perceive that country
Multidimensional sentiment	Deduced using all the past measures

Source: Rosenberg *et al.* (2024)

2 Regional equities in a regime-switching framework

2.1 Data

For this study, daily data from four regional equity indices, retrieved from FactSet, are used: MSCI North America (NA) Index, MSCI Europe Index, MSCI Latin America (LATAM) Index, and MSCI Asia Pacific (APAC) Index. The equity series are denominated in USD and include dividends distributed by the various components of the indices. The time series span from January 2019 to August 2025, comprising 1,683 daily observations. Excess returns are calculated by subtracting the 1-month Treasury Bill[3] rate from the indices' returns.

Regarding GPR, three variations of the GST are employed in this section: regional GST, corresponding to GPR at the regional level[4]; country-level GST (referred to as the local instability index in Table 1), measuring GPR at the national level; and bilateral GST (referred to as the bilateral relations index in Table 1), quantifying GPR arising from tensions between two countries. To calculate the GPR at the regional level, we use the GST's local instability index specific to each country within equity indices. The regional GST at time t is computed as a weighted average of the local GST values of the countries included in the equity index at that time:

$$GST_t^R = \sum_{C \in I} w_t^C GST_t^C \tag{1}$$

where GST_t^R represents the GST of region R at time t, w_t^C is the weight of country C in the index I of region R at time t, and GST_t^C is the local GST of the country C at time t. Since our focus is on risk levels, the GST series for each region are adjusted to eliminate negative values by setting a floor at their 5$^{\text{th}}$ percentile. This study specifically considers geopolitical shocks. To facilitate comparisons across regions, the expanding Z-score of the

[3]Excess returns are computed by subtracting the daily risk-free rate, obtained from the 1-month US Treasury Bill, from daily asset returns. This convention is standard in the asset pricing literature and ensures consistency across assets and frequencies, irrespective of their underlying investment horizons.

[4]Regional GPR is constructed at a broad geographical level. The four regions considered in this study are North America, Europe, Latin America, and Asia-Pacific. These regions are defined on a geographical basis and do not correspond to institutional, monetary, or economic groupings.

shock (hereafter referred to as GST) is calculated and used[5]. The same transformation is applied to country-level and bilateral GSTs.

Stationarity tests were conducted on the timeseries of the indices. Both the equity indices and the GST series were found to be stationary based on the Augmented Dickey-Fuller (ADF) test (see Table A1 on page 40). Correlations were calculated between each region's index and the corresponding GST. Additionally, a collinearity assessment was performed using the Variance Inflation Factor (VIF). The results indicate low correlations, with the highest absolute correlation being 0.16 for the APAC region, and VIF scores close to 1, suggesting no significant collinearity among the series (refer to Table A2 on page 40). The GST series of the four regions exhibit a low but positive correlations, with the highest correlation of 0.44 observed between GST^{Europe} and GST^{APAC} (Figure A1 on page 40). An autoregressive MS model was applied to the regional GST to examine how GPR behaves under a two-regime framework and to analyze differences in the index's behavior between low- and high-volatility regimes. The results are presented in Appendix B on page 40.

2.2 The model

To capture the effect of different GPR measures on regional equities, a two-regime MS model is employed, incorporating each of the three variations of GST indices — one at a time — as exogenous variables. The univariate model used to study the effects of regional GPR and bilateral tensions is specified as follows[6]:

$$r_t^R = \mu_{S_t} + \beta_{S_t} GST_t + \varepsilon_t \quad \text{with} \quad \begin{cases} \varepsilon_t \sim \mathcal{N}(0, \sigma_{S_t}^2) \\ S_t = 1, 2 \end{cases} \tag{2}$$

where r_t^R is the excess return of the equity index for region R, μ_{S_t} is the mean return corresponding to regime S at time t, GST_t is the GPR index, β_{S_t} represents the exposure of returns to GPR in regime S_t, and ε_t is the error term. The GST_t variable is replaced by GST_t^R, the regional GPR for region R, and subsequently by $GST_t^{C_i/C_j}$, representing bilateral tensions between countries i and j. The variance of the error term $\sigma_{S_t}^2$ switches according to the regime.

To study country-level GPR, a multivariate MS model is employed, where the corresponding national GST indices are integrated as exogenous variables for each regional equity index:

$$r_t^R = \mu_{S_t} + \sum_{C \in I} \beta_{S_t}^C GST_t^C + \varepsilon_t \quad \text{with} \quad \begin{cases} \varepsilon_t \sim \mathcal{N}(0, \sigma_{S_t}^2) \\ S_t = 1, 2 \end{cases} \tag{3}$$

where $\beta_{S_t}^C$ represents the exposure of index I to country C in regime S_t, GST_t^C is the GPR index for country C at time t, and C denotes a country whose equities are included in index I.

The regime-switching mechanism in these models follows a Markov process, where the probability of the current regime depends solely on the regime in the previous period:

$$\Pr(S_t = s_t | S_{t-1}, S_{t-2}, S_{t-3}, \ldots) = \Pr(S_t = s_t | S_{t-1}) \tag{4}$$

[5] Standardization of shocks removes differences in scale and amplitude across regions and countries, sacrificing information on absolute magnitudes. However, it allows for meaningful comparisons of GPR exposures across regions and national markets.

[6] Model specifications for each study were selected after testing various MS model variations — including three-regime MS, autoregressive MS, MS with switching and non-switching variance, time-varying transition probabilities MS, threshold MS — using the GST index along with its first- and second-order lags. The model presented here was chosen based on the lowest Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC).

In our case, the transition probability matrix is:

$$\Pr = \begin{bmatrix} \Pr(S_t = 1|S_{t-1} = 1) & \Pr(S_t = 2|S_{t-1} = 1) \\ \Pr(S_t = 1|S_{t-1} = 2) & \Pr(S_t = 2|S_{t-1} = 2) \end{bmatrix} = \begin{bmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{bmatrix} \tag{5}$$

These probabilities can be interpreted as follows: p_{11} is the probability of remaining in regime 1 given that the system was in regime 1 in the previous period; p_{12} is the probability of switching from regime 1 to regime 2; and so forth.

To evaluate the quality of regime classification, we use the Regime Classification Measure (RCM) proposed by Ang and Bekaert (2002). For a two-state model, RCM is calculated as:

$$RCM = 400 \times \frac{1}{T} \sum_{t=1}^{T} p_t(1 - p_t) \tag{6}$$

where T is the total number of observations and p_t is the ex-ante probability of being in a particular regime at time t. This measure assesses how well the regime-switching model distinguishes between regimes based on the data. The constant 400 normalizes the measure to range between 0 and 100. A lower RCM indicates better regime classification: a value of 0 corresponds to perfect classification, while a value of 100 indicates poor regime identification.

2.3 Regional equities facing regional GPR

The two regimes identified by the model have clear economic interpretations. The first regime represents a calm market environment characterized by low volatility, with annualized volatilities ranging from 11.22% for MSCI NA to 20.70% for MSCI LATAM, accompanied by positive average returns. The second regime corresponds to a bearish phase marked by high volatility, with annual volatilities ranging from 34.42% for MSCI Europe to 69.92% for MSCI LATAM, and expected returns indistinguishable from zero (Table 3). These regimes will be referred to as the low-volatility and the high-volatility regimes, respectively.

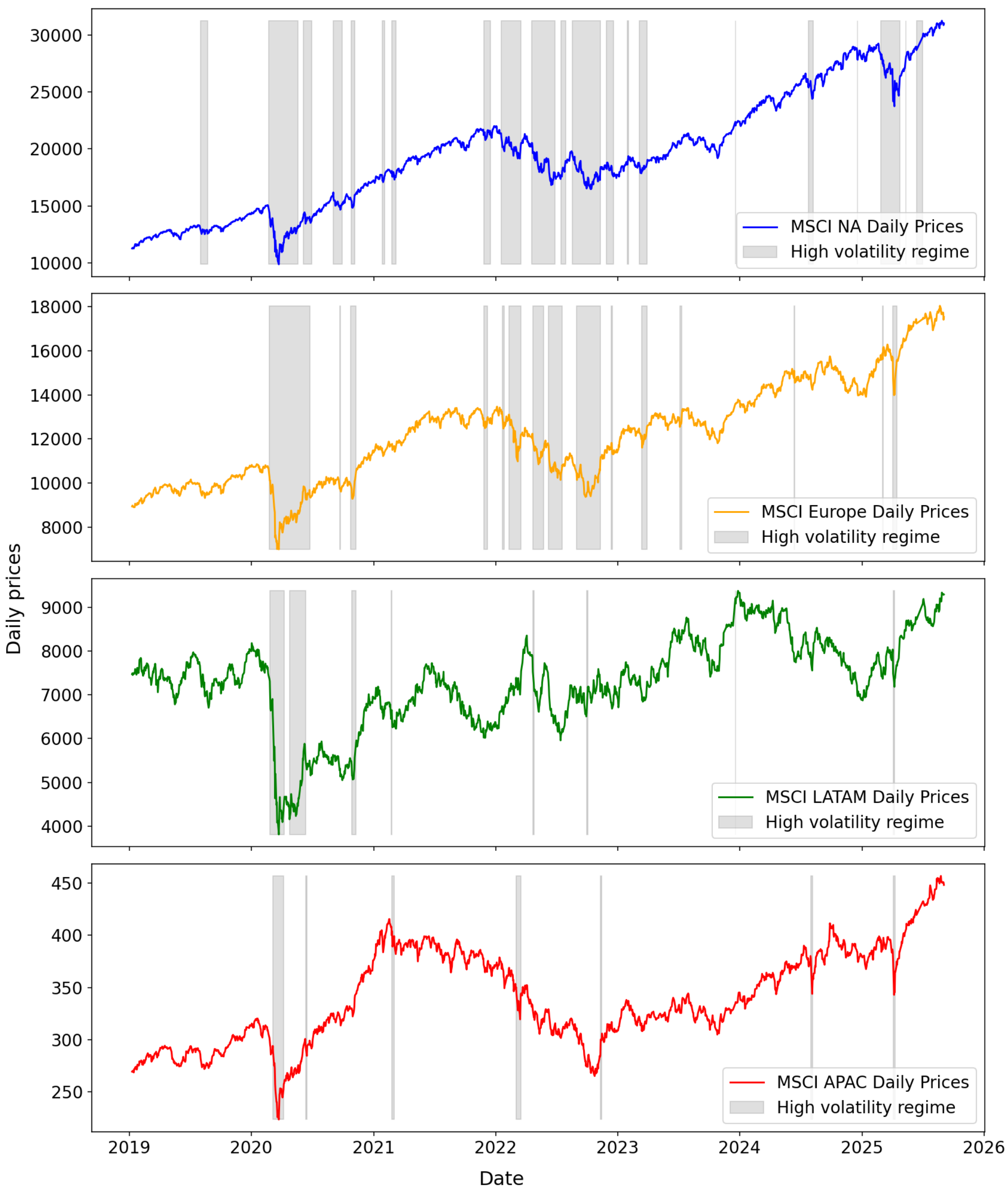
Table 2: Regime probabilities and durations in each region

Equity index	Low volatility regime			High volatility regime			RCM
	p_{11}	D_1	N_1	p_{22}	D_2	N_2	
MSCI NA	0.9777***	45	1266	0.9337***	15	417	17
MSCI Europe	0.9857***	70	1398	0.9357***	16	285	13
MSCI LATAM	0.9925**	133	1595	0.8854***	9	88	6
MSCI APAC	0.9931***	145	1623	0.8603**	7	60	6

***, ** and * indicate 1%, 5% and 10% significance levels for the probabilities.
Duration is expressed in days.
N_1 and N_2 represent the total number of days spent in regimes 1 and 2, respectively, over the analysis period.

The results in Table 2 indicate strong regime classification, with RCM values below 17 for all four regions. The probability results show that both regimes exhibit persistence, meaning it is more likely for the market to remain in the current regime than to switch to the other. For example, in the North America region, if the market is in the low-volatility regime, there is a 97.77% probability of staying in that regime and a 2.23% probability of switching to the high-volatility regime. In Asia Pacific, these probabilities are 99.31% and 0.69%, respectively. However, the high-volatility regime is generally less persistent than the low-volatility regime across all regions. For example, when markets are in the high-volatility regime, the probability of remaining there is 93.37% in North America and 86.03% in Asia

Figure 1: Daily prices of regional equity indices under two regimes



Pacific, with corresponding probabilities of switching back to the low-volatility regime at 6.63% and 13.97%, respectively. Comparing the four regions, markets in Asia Pacific and Latin America tend to be more persistent in the low-volatility regime than those in North America and Europe, but less persistent in the high-volatility regime. These findings are further supported by the average durations D_1 and D_2 of each regime (Table 2): the low-volatility regime lasts approximately 145 days in Asia Pacific and 133 days in Latin America, compared to only 70 days in Europe and 45 days in North America. Conversely, the high-volatility regime is much shorter-lived, with average durations of 16 and 15 days in Europe and North America, respectively, and even shorter durations of 9 and 7 days in Latin America and Asia Pacific, respectively. The difference in durations can also be seen in Figure 1, which displays indices' prices alongside periods dominated by the high-volatility regime. Periods of high volatility tend to last longer in North America and Europe than in Latin America and Asia Pacific. During these periods, regional equity indices across all four regions exhibit pronounced declines, as shown in the figure.

Remark 1. *It is important to understand that spending more days in the low-volatility regime does not necessarily mean an index is less volatile overall. The total number of days and average durations in each regime reflect the unique characteristics of each region, while actual volatility is determined by the variance $\sigma^2_{S_t}$ within those regimes. For example, Table 2 shows that MSCI APAC and MSCI LATAM spend 1623 and 1595 respectively in the low-volatility regime, with average durations of 9 and 7 days in the high-volatility regime. In contrast, MSCI North America and MSCI Europe spend far fewer days in the low-volatility regime — 45 and 70 days respectively — and longer in the high-volatility regime, with 15 and 16 days. However, as Table 3 reveals, the variances for MSCI LATAM and MSCI APAC during the high-volatility regime are higher than those for MSCI North America and MSCI Europe. Additionally, MSCI LATAM shows greater volatility even in the low-volatility regime compared to the others.*

Table 3: MS results on regional equity indices using regional GST

Equity index	Low volatility regime			High volatility regime			$\lvert\beta_2/\beta_1\rvert$
	$\mu_1(10^{-4})$	$\beta_1^R(10^{-4})$	$\sigma_1^2(10^{-4})$	$\mu_2(10^{-4})$	$\beta_2^R(10^{-4})$	$\sigma_2^2(10^{-4})$	
MSCI NA	11.1***	−7.2***	0.5***	−10.1	−13.0	4.8***	1.8
MSCI Europe	6.2***	−7.0***	0.7***	−8.6	−44.9***	4.7***	6.4
MSCI LATAM	2.9	2.0	1.7***	−16.1	−29.1	19.5***	14.2
MSCI APAC	3.8*	−15.5***	0.7***	−28.2	−127.8***	6.1***	8.2

***, ** and * indicate 1%, 5% and 10% significance levels.

Table 3 reveals that the mean return μ_{S_t} is statistically significant only in the low-volatility regime for three of the four regional equity indices: MSCI NA, MSCI Europe, and MSCI APAC. For MSCI LATAM in the low-volatility regime, as well as for all four indices in the high-volatility regime, the mean return is not statistically significant, suggesting that the mean return is effectively zero in these cases. Meanwhile, the variances $\sigma^2_{S_t}$ are highly significant across both regimes for all four indices. These findings indicate that MSCI NA, MSCI Europe, and MSCI APAC follow two regimes characterized each by a switching variance and a switching mean return, whereas MSCI LATAM follows two regimes characterized by switching variances but no significant mean return.

Regarding the exposure coefficients β_{S_t} (Table 3), regional equities generally exhibit a negative sensitivity to their corresponding regional GPR in both regimes, with the exception of the Latin America equities in both regimes and North America equities in the high-volatility regime, where exposures are statistically insignificant and indistinguishable from zero. In the low-volatility regime, Asia-Pacific equities display the highest absolute exposure, with a β_1 of -15.5, suggesting that MSCI APAC index is the most impacted by its regional GPR among the four regions. MSCI Europe and MSCI NA have very similar exposures to their respective GPRs with β_1 values of -7.0 and -7.2, respectively. In the high-volatility regime, MSCI APAC remains the most affected by its regional GPR, with the highest absolute β_2 value of -127.8, while MSCI Europe shows an exposure of -44.9.

It is also insightful to compare the magnitude of exposures across regimes using the ratio $\left|\frac{\beta_2}{\beta_1}\right|$. This ratio reveals that regional GPR has a stronger impact in the high-volatility regime for both MSCI Europe and MSCI APAC, with European equities being 6.4 times more sensitive to GPR in the high-volatility regime than in the low-volatility regime, and Asia-Pacific equities experiencing an impact 8.2 times greater.

Figure 2: Daily indices returns and GST shocks

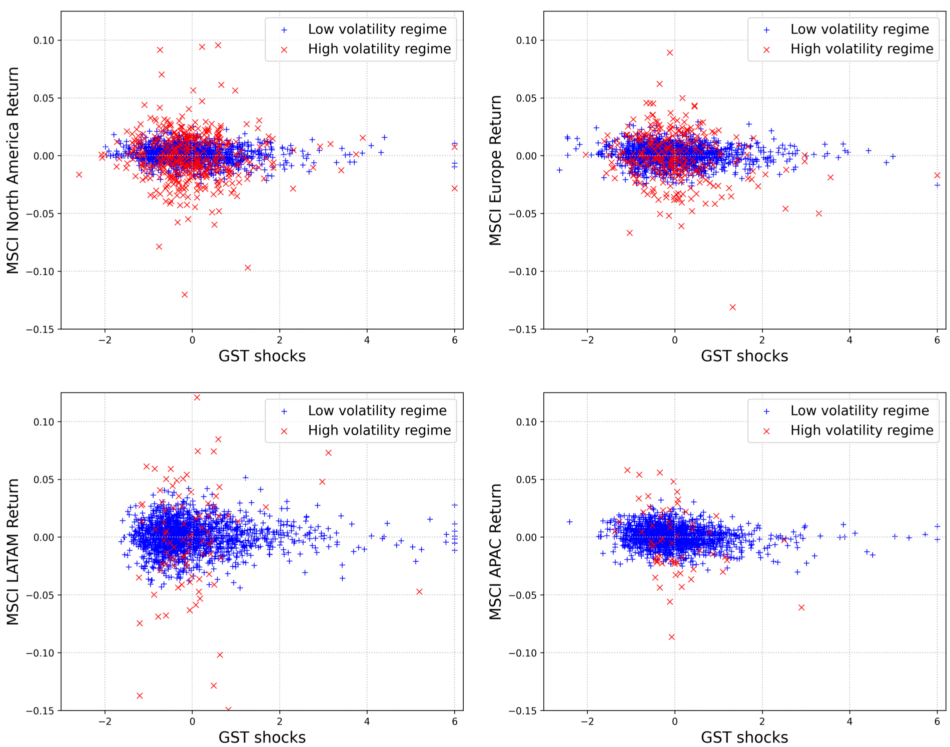


Figure 2 displays the returns of the four indices alongside the corresponding GST shocks for each region. It is evident that indices' returns exhibit greater absolute variation (wider range) during high-volatility regimes, while they tend to be more constrained during low-volatility regimes. For all indices, returns in the low-volatility regime generally range between -0.025 and $+0.025$ in the low-volatility regime, except for MSCI LATAM, where returns vary approximately between -0.05 and $+0.05$ — about twice the range of other regions — indicating higher volatility even in the low-volatility regime. Additionally, MSCI NA and MSCI Europe experience significantly more days in the high-volatility regime compared to MSCI LATAM and MSCI APAC. Examining the GST levels, we observe that when GST shocks lie between -2 and $+3$ standard deviations, regional equities can still exhibit high returns across all four regions. However, once GST shocks exceed $+3$ standard deviations, returns tend to cluster around zero, suggesting that extreme GST shocks have a diminished impact on regional equities.

2.4 Regional equities facing national GPR

After assessing the impact of regional GPR on regional equities, it is also important to examine whether individual countries' GPRs influence regional indices. To this end, the multivariate model specified in Equation (3) is employed. The exposures of the four regional indices to the countries' GST are reported in Table 4. For MSCI NA (Table 4a), the only statistically significant exposure at the 5% level is the sensitivity of the index to the GPR of the USA in the low-volatility regime; all other exposures are not significant. Similarly, MSCI Europe (Table 4b) only show two statistically significant exposures: to Switzerland's GPR in the low-volatility regime and to Spain's GPR in the high-volatility regime. MSCI LATAM (Table 4c) shows no significant exposures. In contrast, MSCI APAC (Table 4d) exhibits several significant exposures: the index is affected by the GPR of China, Hong Kong, Japan, and Singapore in the low-volatility regime, and by Australia, Indonesia and Singapore in the high-volatility regime.

Although some statistically significant results were found for MSCI LATAM, the overall findings suggest that country-level GPR does not sufficiently explain the returns of regional equities. Several factors may contribute to this outcome. First, regional equities may be more sensitive to broader GPR dimensions — such as regional GPR or trade tensions — than to local political events. Second, regional indices comprise equities from multiple countries, offering investors diversification against local GPRs: individual country-specific GPR shocks may be offset by stability or positive events in other countries within the region. This diversification effect can dilute the impact of country-specific shocks at the regional level. Finally, country-level GPR measures have some limitations when applied at the regional scale, as they may not fully capture regional investor sentiment and market expectations, resulting in weaker explanatory power.

2.5 Regional equities facing bilateral tensions

In recent years, bilateral tensions have played a major role in international commerce, politics, and global economics. This section examines whether the effects of such bilateral relations have spilled over into regional equity indices by incorporating bilateral GST indices as exogenous variables in the univariate MS model specified in Equation (2). The six bilateral relationships analyzed are: China-USA (CHN/USA), Russia-Ukraine (RUS/UKR), Mexico-USA (MEX/USA), Russia-USA(RUS/USA), China-India (CHN/IND), and Iran-USA (IRN/USA).

The results in Table 5 indicate that tensions between China and the USA have the most significant impact among the six bilateral relationships studied, followed by China-India and Russia-USA tensions. Moreover, bilateral tensions tend to exert a stronger influence during normal periods compared to turbulent ones. Specifically, exposures to China-USA tensions are statistically significant for MSCI NA only in the low-volatility regime, while for MSCI Europe and MSCI APAC, the exposures are significant in both regimes. MSCI LATAM, however, shows no significant exposure to these tensions. China-India tensions affect all regional equities during low-volatility periods, except for MSCI NA. Russia-USA tensions impact only MSCI NA and MSCI Europe during normal periods. For Russia-Ukraine tensions, the only statistically significant exposure is observed for MSCI LATAM during the low-volatility regime. Similarly, Iran-USA tensions show a significant impact only on MSCI APAC during high-volatility periods. The Mexico-USA relationship does

Table 4: Exposure of regional equities to their countries' GSTs

Equity index	GST^C	$\beta_1^C(10^{-4})$	$\beta_2^C(10^{-4})$	$\lvert\beta_2^C/\beta_1^C\rvert$
(a) MSCI NA	GST^{Canada}	−3.7	6.0	1.6
	GST^{USA}	−6.2**	−15.0	2.4
(b) MSCI Europe	$GST^{Austria}$	−0.5	−21.3	44.6
	$GST^{Belgium}$	0.2	−2.0	9.3
	$GST^{Denmark}$	2.7	6.4	2.4
	$GST^{Finland}$	−3.7	−9.5	2.6
	GST^{France}	−1.2	−7.6	6.5
	$GST^{Germany}$	−1.0	−16.2	16.0
	$GST^{Ireland}$	−3.4	10.4	3.0
	GST^{Italy}	−2.3	−27.7	12.2
	$GST^{Netherlands}$	−2.9	−17.7	6.1
	GST^{Norway}	2.0	−8.2	4.0
	$GST^{Portugal}$	3.0	10.9	3.6
	GST^{Spain}	1.5	37.9**	25.8
	GST^{Sweden}	−1.2	−19.8	16.9
	$GST^{Switzerland}$	−4.9*	9.6	2.0
	$GST^{United\ Kingdom}$	−4.1	−19.8	4.9
(c) MSCI LATAM	$GST^{Argentina}$	−0.4	−3.3	9.0
	GST^{Brazil}	−3.3	16.6	5.0
	GST^{Chile}	2.8	−37.9	13.5
	$GST^{Colombia}$	5.7	116.9	20.4
	GST^{Mexico}	4.2	−4.3	1.0
	GST^{Peru}	0.4	0.1	0.3
(d) MSCI APAC	$GST^{Australia}$	−1.4	−95.6*	69.2
	GST^{China}	−6.3**	−43.2	6.9
	$GST^{Hong\ Kong}$	−3.6*	−38.2	10.5
	GST^{India}	−0.7	15.7	22.9
	$GST^{Indonesia}$	−1.9	57.7*	30.5
	GST^{Japan}	−7.9***	−18.2	2.3
	$GST^{Malaysia}$	−0.1	−36.8	263.6
	$GST^{New\ Zealand}$	2.5	−138.2	55.4
	$GST^{Philippines}$	−0.6	30.4	48.0
	$GST^{Singapore}$	−5.0**	87.3**	17.5
	$GST^{South\ Korea}$	2.7	−72.7	27.2
	GST^{Taiwan}	−0.7	37.0	52.8
	$GST^{Thailand}$	−2.6	−66.2	25.4

***, ** and * indicate 1%, 5% and 10% significance levels.

not exhibit statistically significant effects, likely because tensions peaked in 2018, while the study period begins in 2019. These significance levels suggest that, despite their strong impact on country-specific economies and equities, Russia-Ukraine, Iran-USA, and Mexico-USA tensions have not substantially influenced regional indices over the past six years. Notably, all studied tensions negatively affect the impacted regional equities, as indicated by negative exposures, implying that heightened tensions lead to a negative GPR premium across regions. The only exception is MSCI LATAM, which shows positive exposure to Russia-Ukraine tensions, suggesting that increasing shocks between the two countries lead to higher returns in Latin American equities.

Focusing on China-USA tensions, in the low-volatility regime, the most affected regional index is MSCI Europe with an exposure of −0.00113, followed by MSCI APAC (−0.00085), and MSCI NA (−0.00041). In the high-volatility regime, China-USA tensions have the greatest impact on MSCI APAC (−0.01102), followed by MSCI Europe (−0.00274). Examining the ratio $\left|\beta_2^{China-USA}/\beta_1^{China-USA}\right|$, we observe that MSCI APAC is significantly more affected by China-USA tensions in the high-volatility regime, with an impact 13.0 times greater than in the low-volatility regime. The effect is approximately 1.5 times higher for MSCI Europe (Table A3 on page 41). Additionally, the exposures of MSCI Europe in both regimes, and of MSCI APAC in the high-volatility regime to $GST^{CHN/USA}$ are the highest in absolute value compared to their exposures to other bilateral tensions, suggesting that China-USA tensions not only impacted these regional equities but did so with substantial magnitude.

Table 5: Exposure of regional equity indices to bilateral GPR (Univariate MS model)

Equity index	$GST^{CHN/USA}$		$GST^{RUS/UKR}$		$GST^{MEX/USA}$	
	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$
MSCI NA	−4.1*	−10.1	−1.2	−8.4	−1.0	−8.8
MSCI Europe	−11.3***	−27.4*	−0.6	−16.6	3.0	−19.3
MSCI LATAM	−4.8	−31.0	7.7*	−42.3	2.9	12.5
MSCI APAC	−8.5***	−110.2**	3.7	−34.0	1.0	−32.0

Equity index	$GST^{RUS/USA}$		$GST^{CHN/IND}$		$GST^{IRN/USA}$	
	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$
MSCI NA	−6.2**	2.3	−0.6	−9.6	−2.4	4.5
MSCI Europe	−8.5***	−21.0	−8.5***	−21.4	−4.1	−21.1
MSCI LATAM	−1.8	−61.2	−9.6**	7.2	−3.0	19.3
MSCI APAC	−3.4	−31.6	−9.4***	−57.1	0.1	−71.2**

Reported coefficients are in units of 10^{-4}.
***, ** and * indicate 1%, 5% and 10% significance levels.

The negative significant impact of China-USA tensions on regional equities can be attributed to the elevated GPR generated by these tensions and transmitted globally through various channels. First, increasing customs tariffs have raised production costs (Bown *et al.*, 2021), which in turn reduce business profits and increase consumer prices (Hass and Denmark, 2020). These tariffs also lead to declines in both imports (Kinzius *et al.*, 2019) and exports, (Li *et al.*, 2020) adversely affecting business profitability (Bingura, 2023) and national economic cycles. Second, tensions between both countries have caused widespread uncertainty and costly disruptions in global value chains, significantly reducing economic activity in both countries (Zahoor *et al.*, 2023). These supply chain disruptions have further contributed to decreased sales and, consequently, lower corporate earnings (Bingura, 2023).

Remark 2. *A multivariate MS model, similar to the one specified in Equation (3) can also be applied to this context by integrating all six bilateral tensions simultaneously in the estimation. The results of the multivariate regression are presented in Table A4 on page 41.*

3 Other asset classes in a regime-switching framework

3.1 Data

In this section, the following data sets, retrieved from Bloomberg, are used: for the first study, ICE BofA total return indices of sovereign bonds with remaining maturities of 7 to 10 years from 13 emerging and developed countries[7] inclusive of coupon payments; for the second study, FX spot cross-rates of 19 currencies[8] from various regions, along with the DXY index representing the US dollar; and for the final study, futures prices of 12 commodities[9], including major metals, energy, and agricultural products. For Crude Oil, two contracts are included in the study: Crude Oil Brent (ICE exchange) considered as the global benchmark for light oil market (i.e. in Europe, Africa, and the Middle East), and Crude Oil WTI (NYMEX exchange) considered as a regional crude reflecting fundamentals of the midcontinent region of the USA[10]. The time series span from January 2019 to August 2025 with 1,670 daily observations for bonds, 1,684 for currencies, and 1,665 for commodities. Daily returns are calculated for each data set and incorporated into different regime-switching models. Excess returns for the bond indices are computed by subtracting the 1-month Treasury Bill rate, as the bond indices are denominated in USD. Additionally, yield time series corresponding to the bond indices are used to compute spread time series. Spreads are calculated by subtracting the yield of the US bond index from the yields of other sovereign bond indices of the same maturity. For US bonds, the spread is calculated by subtracting the German bond index yield from the US bond index yield.

Regarding GST, similar to Section 2, the same three variations of the index are employed: regional, bilateral, and national GSTs. In this section, the regional GST is calculated as the arithmetic average of the countries' GST values within each region, expressed as:

$$GST_t^R = \frac{\sum\limits_{C \in I} GST_t^C}{\sum\limits_{C \in I} C} \tag{7}$$

To measure country-level GPR for the Euro currency, the arithmetic average of the local GST indices of the European Monetary Union countries is used, referred to as GST^{EMU}. For the regional-level GPR, the GST^{Europe} index is employed. The same transformations applied to the weighted average GST in Section 2 are also applied to the arithmetic average GST series in this section.

3.2 Sovereign bonds

In this study, we focus on analyzing sovereign bonds from developed and emerging countries under a two-regime framework. To assess the impact of GPR on these bonds, we employ

[7]Countries include Australia, Brazil, Canada, China, France, Germany, India, Japan, Mexico, South Korea, Switzerland, United Kingdom, and United States.

[8]Currencies are CAD, EUR, GBP, CHF, NOK, SEK, PLN, DKK, ARS, MXN, BRL, AUD, NZD, JPY, CNY, HKD, INR, KRW, and TRY.

[9]Commodities are Gold, Silver, Copper, Aluminium, Crude Oil WTI, Crude Oil Brent, Natural Gas, Wheat, Corn, Soybeans, and Coffee.

[10]Source: `www.ice.com/insights/energy/what-are-the-differences-between-ice-brent-and-nymex-wti-futures`.

the autoregressive MS model of Hamilton (1989)[11]:

$$r_t^C = \mu_{S_t} + \beta_{S_t} GST_t + \phi_{S_t} \left(r_{t-1}^C - \mu_{S_{t-1}} - \beta_{S_{t-1}} GST_{t-1} \right) + \varepsilon_t \quad (8)$$

$$\text{with} \quad \begin{cases} \varepsilon_t \sim \mathcal{N}(0, \sigma_{S_t}^2) \\ S_t = 1, 2 \end{cases}$$

where r_t^C is the excess return of the bond index for country C, and ϕ_{S_t} is the autoregressive coefficient relative to regime S_t. The GST used for the below studies are: GST^R as the region-level GPR, GST^C as the country-level GPR to study the impact of national GPR and GST^{C_i/C_j} as the bilateral GPR between country i and country j to measure the bilateral tensions impact.

Remark 3. *As an alternative approach, we implement a deterministic regime specification in which the regime at time t is observed directly from the bond spread with a threshold set at the* 75$^{\text{th}}$ *percentile. Each regime is then estimated by OLS with Newey-West (HAC) standard errors; a full description of the method and the results are reported in Appendix C on page 44.*

3.2.1 Impact of regional GPR

The results for the probabilities and durations of each bond index, presented in Table 6, show that both regimes are persistent across all countries. Generally, the low-volatility regime is more persistent than the high-volatility regime in all countries, except for France, where the probability of remaining in the low-volatility regime is 0.9843, slightly lower than the 0.9853 probability of remaining in the high-volatility regime. However, persistence varies significantly between countries. For most countries, the probability of staying in the low-volatility regime, given that the regime is already in place, ranges from 0.9540 (South Korea) to 0.9904 (United States). Similarly, the probability of remaining in the high-volatility regime generally varies from 0.9109 (Brazil) to 0.9808 (United States). Some countries, however, exhibit notably lower persistence. For example, China and India have probabilities of 0.8966 and 0.8739, respectively, of remaining in the low-volatility regime, corresponding to average durations of 10 and 8 days. In the high-volatility regime, South Korea (0.8908), Mexico (0.8321), China (0.7783), and India (0.7600) show relatively low probabilities of persistence, with average durations of 9, 6, 5, and 4 days, respectively. Most bond indices demonstrate strong regime classification with RCM values below 24, suggesting that the model effectively captures shifts in market conditions for these bonds. However, South Korean, Chinese, and Indian bonds show higher RCMs of 32, 44 and 47 respectively, indicating that the model has more difficulty differentiating regimes in these cases. This could be due to more complex or less distinct regime dynamics in these countries, which might require further model refinement or additional data to improve classification accuracy.

Analyzing the model results presented in Table 7, we observe that sovereign bonds in most countries do not exhibit a statistically significant mean return in either regime, with the exception of Mexico and Japan, where the mean return is significant only in the low-volatility regime. However, the variances of bond returns are highly significant across all countries and regimes, indicating that sovereign bond markets generally follow two regimes characterized by switching variances but no consistent trend.

The exposure to GST shows that Asia-Pacific is the only region whose bonds are highly impacted by regional GPR. Nearly all bonds studied in this region exhibit sensitivity to

[11] The autoregressive MS model of Hamilton (1989) has been previously applied to bonds returns in the litterature, as per the works of Acharya *et al.* (2013) and Guidolin and Timmermann (2006).

Table 6: Regime probabilities and durations for sovereign bonds

Region	Bond index	Low volatility regime p_{11}	D_1	N_1	High volatility regime p_{22}	D_2	N_2	RCM
NA	United States	0.9904***	104	1117	0.9808**	52	553	17
	Canada	0.9871**	78	1137	0.9729***	37	533	20
Europe	France	0.9843***	64	801	0.9853**	68	869	15
	Germany	0.9763***	42	894	0.9715**	35	776	24
	United Kingdom	0.9853***	68	1436	0.9193***	12	234	15
	Switzerland	0.9844***	64	1266	0.9527***	21	404	19
LATAM	Mexico	0.9800***	50	1530	0.8321***	6	140	14
	Brazil	0.9802***	50	1398	0.9109***	11	272	21
APAC	Australia	0.9838***	62	1139	0.9654***	29	531	19
	Japan	0.9735***	38	1026	0.9596***	25	644	18
	China	0.8966***	10	1253	0.7783***	5	417	44
	India	0.8739***	8	1195	0.7600***	4	475	47
	South Korea	0.9540***	22	1217	0.8908***	9	453	32

***, ** and * indicate 1%, 5% and 10% significance levels for the probabilities.
Duration is expressed in days.
N_1 and N_2 represent the total number of days spent in regimes 1 and 2, respectively, over the analysis period.

regional GPR shocks in both regimes, with the exception of Chinese bonds, which show no significant exposure. In contrast, sovereign bonds in the other regions generally do not display statistically significant exposure to regional GPR in either regime, except for Swiss bonds in the low-volatility regime and Canadian bonds in the high-volatility regime. These findings suggest that regional GPR shocks have limited impact on sovereign bond markets outside Asia-Pacific. Among the affected bonds, exposures are predominantly negative, indicating that increasing GST shocks lead to declines in bond returns. However, Japanese and Swiss bonds exhibit positive exposures, consistent with their roles as safe-haven assets within their respective regions. In terms of magnitude, exposures in the low-volatility regime are relatively similar across bonds. In the high-volatility regime, the absolute exposures to GPR shocks rank as follows: South Korean bonds (16.4), Australian bonds (10.7), Japanese bonds (9.7), Canadian bonds (6.6), and Indian bonds (6.0).

Additionally, many sovereign bonds exhibit weak first-order autocorrelation, as shown in Table 7, represented by statistically significant ϕ_{S_t} coefficients in one or both regimes. This suggests that bond returns are influenced by their previous values. Australian and Chinese bonds display weak negative autocorrelation in the low-volatility regime, with ϕ_1 values of -0.088 and -0.107, respectively, suggesting a slight tendency for returns to reverse direction from one day to the next. In contrast, European bonds exhibit weak positive autocorrelation during the high-volatility regime, with coefficients ranging from 0.079 to 0.160, indicating that returns tend to continue in the same direction. Brazilian and South Korean bonds show autocorrelation in both regimes: Brazilian bonds have positive autocorrelation in low-volatility periods and a more pronounced negative autocorrelation in high-volatility periods, while South Korean bonds exhibit negative autocorrelation in both regimes.

3.2.2 Impact of national GPR

The results of sovereign bonds' exposure to national GST are presented in Table 8. For most countries, the exposure to GST is not statistically significant in either regime, with exceptions for Australian bonds in the low-volatility regime, and Swiss, Japanese, and Indian bonds in the high-volatility regime. These findings suggest that GPR shocks generally do not affect sovereign bond markets, except for these four countries during specific regimes. Specifically, Australian bonds exhibit a negative exposure to GST shocks in the low-volatility

Table 7: MS results of sovereign bonds indices using regional GST

GST^{R}	Bond index	Low volatility regime				High volatility regime				$\lvert\beta_2/\beta_1\rvert$
		$\mu_1(10^{-4})$	$\beta_1(10^{-4})$	ϕ_1	$\sigma_1^2(10^{-4})$	$\mu_2(10^{-4})$	$\beta_2(10^{-4})$	ϕ_2	$\sigma_2^2(10^{-4})$	
GST^{NA}	United States	0.3	0.4	−0.012	0.1***	−1.9	−0.8	0.011	0.4***	1.7
	Canada	0.8	−0.8	0.025	0.2***	−4.2	−6.6*	0.068	0.7***	8.1
GST^{Europe}	France	−0.5	2.0	0.016	0.1***	−2.0	−0.2	0.079**	0.6***	0.1
	Germany	−0.8	2.1	0.001	0.1***	−2.2	0.8	0.086**	0.7***	0.4
	United Kingdom	−1.0	−0.7	−0.011	0.3***	−0.2	−2.6	0.160**	2.1***	3.6
	Switzerland	−2.0	3.9**	0.014	0.2***	7.3	−0.3	0.109**	0.9***	0.1
GST^{LATAM}	Mexico	6.9***	0.3	0.042	0.6***	−32.0	−7.1	0.003	5.1***	23.7
	Brazil	3.5	1.6	0.064**	1.2***	−15.6	11.8	−0.127**	6.5***	7.4
GST^{APAC}	Australia	1.4	−3.6*	−0.088***	0.3***	−5.5	−10.7*	0.011	1.4***	3.0
	Japan	−5.3***	2.4*	0.042	0.1***	−0.3	9.7***	0.018	0.8***	4.0
	China	0.5	−0.3	−0.107***	0.0***	0.5	−3.4	0.008	0.2***	9.8
	India	0.7	−2.8***	−0.015	0.0***	0.5	−6.0**	−0.056	0.3***	2.2
	South Korea	−1.7	−2.8*	−0.100***	0.2***	−0.6	−16.4***	−0.081*	1.2***	5.9

***, ** and * indicate 1%, 5% and 10% significance levels.

regime, while Indian bonds show a similar negative exposure in the high-volatility regime, indicating that rising GST shocks correspond to declines in bond returns in these countries. Conversely, Japanese and Swiss bonds display positive exposures, implying that their returns tend to rise as national GST shocks increase. In terms of magnitude, the absolute exposure to GPR shocks ranks as follows: Swiss bonds (0.00146), Japanese bonds (0.00098), Indian bonds (0.00058), and Australian bonds (0.00029). Despite these few significant exposures, the overall bond markets appear largely unaffected by country-specific GPR shocks, suggesting that national GPR may represent an idiosyncratic risk already priced into the market.

Table 8: Exposure of sovereign bond indices to national GPR

Region	Bond index	$\beta_1^C(10^{-4})$	$\beta_2^C(10^{-4})$	$\lvert\beta_2^C/\beta_1^C\rvert$
NA	United States	0.3	-0.8	3.2
	Canada	0.7	-3.6	5.0
Europe	France	0.2	1.4	6.3
	Germany	0.5	1.8	3.9
	United kingdom	-1.9	5.4	2.9
	Switzerland	0.1	14.6^{***}	106.5
LATAM	Mexico	0.8	-19.6	25.2
	Brazil	3.6	2.1	0.6
APAC	Australia	-2.9^{*}	-3.1	1.0
	Japan	1.5	9.8^{***}	6.7
	China	-0.7	-1.6	2.3
	India	-1.0	-5.8^{**}	5.9
	South Korea	-2.7	-5.9	1.8

***, ** and * indicate 1%, 5% and 10% significance levels.

Remark 4. *The limited significance of national GPR in the sovereign bond and currency results suggests that domestic political risk does not systematically translate into macro-financial repricing. Bond yields and exchange rates are primarily driven by monetary policy expectations (well documented in the literature on economic policy uncertainty) along with inflation dynamics, fiscal sustainability, and global financial conditions. Unless domestic geopolitical tensions materially alter these macroeconomic fundamentals or threaten institutional credibility, their effects may remain contained. In contrast, regional and bilateral geopolitical shocks operate through cross-border trade, capital flows, and global risk channels, making them more likely to affect sovereign and currency markets. Moreover, news-based national GPR measures may capture the prominence of political events without necessarily reflecting structural economic disruptions, which may further explain their limited pricing power in this setting. However, national political risk remains a key consideration for investors when choosing between countries for their investments.*

3.2.3 Impact of bilateral tensions

Table 9 presents the exposure of sovereign bond indices to the same six bilateral tensions. The results indicate that five out of the six bilateral tensions have had a noticeable impact on bond returns. However, Mexico-USA tensions have only negatively affected Mexican bonds during high-volatility periods and shown a positive impact on Australian bonds during low-volatility periods, with no statistically significant effects on other sovereign bonds. Notably, the impact on Mexican bonds is pronounced, with an exposure of 33.4, suggesting that increasing tensions with the USA have led to a substantial decline in Mexican bond returns over the past six years.

During high-volatility periods, China-USA tensions have negatively impacted Australian, South Korean, and North American bonds, with a more pronounced effect on Canadian bonds (−7.7) compared to US bonds (−5.0). In the low-volatility regime, China-USA tensions have negatively affected Indian and Mexican bonds but positively influenced Japanese bonds. These findings suggest that escalating tensions between China and the USA generally lead to lower returns across the affected sovereign bonds, except for Japanese bonds, which appear to benefit, indicating a potential hedging opportunity in Japan. However, this hedging effect disappears during volatile market conditions, as the impact of China-USA tensions on Japanese bonds is not statistically significant in the high-volatility regime.

Table 9: Exposure of sovereign bond indices to bilateral GPR (Univariate MS model)

Bond index	$GST^{CHN/USA}$		$GST^{RUS/UKR}$		$GST^{MEX/USA}$	
	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$
United States	1.6	−5.0*	1.3	10.9**	0.2	0.7
Canada	−1.1	−7.7**	3.5**	1.6	−0.3	1.6
France	−1.2	−3.2	1.6	10.5**	1.6	1.1
Germany	−0.7	−2.9	1.7	12.1**	1.8	0.6
United Kingdom	−1.7	−3.7	5.0***	−1.1	2.5	−4.4
Switzerland	1.1	−1.9	4.5***	7.0	1.8	−0.2
Mexico	−4.5**	−24.2	5.2*	33.2	0.3	−33.4*
Brazil	−1.6	4.9	6.9	−0.2	−1.2	11.6
Australia	−0.6	−11.6**	5.1**	0.2	3.4*	2.7
Japan	2.8**	2.9	4.3***	15.6**	1.8	4.3
China	−0.2	−0.9	0.7	0.7	0.3	2.2
India	−1.5**	−2.4	1.9*	−4.4	0.5	−3.6
South Korea	0.3	−12.0**	1.2	10.0	0.8	−1.2

Bond index	$GST^{RUS/USA}$		$GST^{CHN/IND}$		$GST^{IRN/USA}$	
	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$
United States	1.7	−2.0	1.1	−0.4	0.6	−1.7
Canada	0.9	−6.8*	−1.2	−5.3	0.7	−1.5
France	1.0	−2.2	1.1	0.6	−3.9**	−1.4
Germany	1.4	−2.7	0.7	1.6	−3.9**	−1.0
United Kingdom	0.1	−8.6	0.2	−4.6	−3.5*	5.6
Switzerland	2.7*	−3.0	−0.4	7.3	−0.2	−3.1
Mexico	−2.8	14.8	−4.3**	−18.2	−1.2	−2.6
Brazil	1.0	−32.4*	−9.3***	14.4	−2.3	4.7
Australia	1.0	−10.7*	−2.0	−5.2	2.4	−13.4**
Japan	2.4*	4.8	1.8	9.5***	−1.0	7.9*
China	0.1	−2.2	−0.2	3.9*	0.5	−4.8
India	1.2*	−7.4***	−1.2*	−6.4**	0.6	−10.1***
South Korea	−0.3	−3.9	0.7	−2.7	−3.3*	4.2

Reported coefficients are in units of 10^{-4}.
***, ** and * indicate 1%, 5% and 10% significance levels.

The Russia-Ukraine conflict emerges as the most impactful among the studied tensions on sovereign bonds. European bonds from the four countries analyzed respond positively: French and German bonds during high-volatility periods, and Swiss and United Kingdom bonds during low-volatility periods. North American bonds are also positively influenced by Russia-Ukraine tensions, with Canadian bonds affected in the low-volatility regime and US bonds in the high-volatility regime. Additionally, Australian, Indian, and Mexican bonds exhibit positive exposure during the low-volatility regime, while Japanese bonds show positive impacts in both regimes, with the effect in the high-volatility regime being 3.6 times greater than in the low-volatility regime (Table 9). Notably, all these affected bonds display positive exposure to the GPR generated by the Russia-Ukraine conflict, suggesting falling yields (price appreciation) driven by investor demand for safe-haven assets. The timing of this effect varies: some bonds, such as those from France, Germany, and Japan, show this pattern primarily during high-volatility periods when investors seek safety amid market stress, while others exhibit positive exposure during low-volatility periods, reflecting their roles as either core safe havens or conditional refuges.

Turning to Russia-USA tensions, these positively impact Swiss, Japanese, and Indian bonds during the low-volatility regime. However, in the high-volatility regime, they negatively affect Canadian, Brazilian, Australian, and Indian bonds, with the exposure of Brazilian bonds being particularly substantial. China-India tensions show no impact on North American and European bonds but negatively affect Latin American bonds during normal periods. In the Asia-Pacific region, rising tensions lead to declines in Indian bond returns during normal periods, with the impact intensifying during turbulent times. Conversely, Chinese and Japanese bonds appear to benefit from these heightened tensions. Regarding Iran-USA tensions, French, German, UK, and South Korean bonds exhibit negative exposure during normal periods, while during turbulent periods, Australian and Indian bonds show negative exposure and Japanese bonds display positive sensitivity. Notably, Swiss and Japanese bonds either exhibit positive exposure or no significant exposure to the six bilateral tensions studied, reinforcing their role as safe-haven assets amid geopolitical uncertainties.

3.3 Currencies

In this study, the MS model specified in Equation (2) is employed to capture the effect of GPR on currency returns r_t^{FX} for various countries within each region. The variable GST_t is successively replaced by GST_t^R, representing the regional GPR corresponding to the currency's region; by GST_t^C, the national GPR specific to the country of the currency; and finally by $GST_t^{C_i/C_j}$ representing major bilateral tensions between countries C_i and C_j.

3.3.1 Impact of regional GPR

The regime persistence results, summarized in Table 10, reveal notable variation across regimes and regions. The low-volatility regime is highly persistent for most currencies, with probabilities of remaining in this regime ranging from 0.9553 to 0.9952, corresponding to average durations between 22 and 210 days. Exceptions include TRY (0.9388), HKD (0.9313), CNY (0.9021), and INR (0.8782), which have shorter average durations of 16, 15, 10, and 8 days, respectively.

In contrast, the high-volatility regime tends to be less persistent for most currencies, with probabilities ranging from 0.7482 to 0.9868. However, HKD and INR are exceptions, exhibiting greater persistence in the high-volatility regime. These currencies remain in the high-volatility regime for 34 and 18 days on average, respectively, compared to just 15 and 8 days in the low-volatility regime. Consequently, they spend more total days in the high-volatility regime (1183 and 1163 days) than in the low-volatility regime (501 and 521 days). For JPY, the probabilities of remaining in both regimes are quite similar (0.9745 for low-volatility and 0.9670 for high-volatility), leading to roughly balanced total days in each regime (924 days in low-volatility and 760 in high-volatility). Additionally, ARS, CHF, GBP, and NOK exhibit high persistence in the low-volatility regime and moderate persistence in the high-volatility regime, resulting in relatively few total days spent in the high-volatility regime over the six-year study period (233, 226, 135, and 88 days, respectively). It is also worth noting that BRL didn't show a statistically significant probability in the low-volatility regime.

Table 10: Regime probabilities and durations for currencies

Region	Currency	Low volatility regime			High volatility regime			RCM
		p_{11}	D_1	N_1	p_{22}	D_2	N_2	
NA	USD	0.9894***	94	1256	0.9708**	34	428	19
	CAD	0.9675***	31	1273	0.9145**	12	411	34
Europe	EUR	0.9839***	62	1217	0.9619**	26	467	25
	GBP	0.9858**	70	1549	0.8752***	8	135	14
	CHF	0.9613***	26	1458	0.8195***	6	226	29
	NOK	0.9796***	49	1596	0.7482***	4	88	13
	SEK	0.9882***	85	1125	0.9775*	44	559	24
	PLN	0.9692***	32	1103	0.9462***	19	581	32
	DKK	0.9852***	68	1202	0.9653**	29	482	24
	TRY	0.9388***	16	1165	0.8694***	8	519	15
LATAM	ARS	0.9652***	29	1451	0.7955***	5	233	5
	MXN	0.9553***	22	1231	0.8936***	9	453	29
	BRL	0.9887	89	1163	0.9745***	39	521	24
APAC	AUD	0.9860***	71	1228	0.9641*	28	456	23
	NZD	0.9952***	210	1229	0.9868*	76	455	0
	JPY	0.9745***	39	924	0.9670***	30	760	19
	CNY	0.9021***	10	1135	0.8332***	6	549	39
	HKD	0.9313***	15	501	0.9703***	34	1183	10
	INR	0.8782***	8	521	0.9432***	18	1163	27
	KRW	0.9708***	34	1248	0.9253***	13	436	30
	TRY	0.9388***	16	1165	0.8684***	8	519	15

***, ** and * indicate 1%, 5% and 10% significance levels for the probabilities.
Duration is expressed in days.
N_1 and N_2 represent the total number of days spent in regimes 1 and 2, respectively, over the analysis period.

Analyzing the parameter estimates presented in Table 11, we observe that most currencies do not exhibit a statistically significant mean return in either regime, with a few exceptions. This implies that, on average, there is no persistent directional drift attributable to the regimes themselves; regime differences primarily reflect changes in volatility (since variance switches are statistically significant in both regimes) and sensitivity to GPR. TRY, ARS, and MXN display switching means that are significant in both regimes. For TRY and ARS, the mean is negative in both regimes and more pronounced during the high-volatility regime, indicating persistent depreciation that intensifies during turbulent periods. In contrast, MXN has a positive mean in the low-volatility regime, which shifts to a more pronounced negative mean in the high-volatility regime. JPY, HKD, and INR exhibit statistically significant negative means during low-volatility periods, while CHF shows a positive significant mean in the high-volatility regime, suggesting that it tends to appreciate on average during turbulent periods — consistent with its safe-haven status.

Exposures to regional GPR vary considerably across currencies from different regions. In Europe and Latin America, only a few currencies are affected by their respective regional GPRs — and only during high-volatility periods — with SEK and PLN impacted in Europe and ARS in Latin America. In contrast, North American and Asia-Pacific currencies exhibit clearer effects. North American currencies are influenced by the North American GPR during high-volatility periods, with a stronger absolute effect on CAD than on USD; neither currency shows significant sensitivity during low-volatility periods. The strongest impact is observed in Asia-Pacific, where all currencies except JPY and HKD are affected.

CNY is impacted only in the high-volatility regime, while AUD, NZD, INR, and KRW are negatively affected in both regimes. For AUD, NZD, and KRW, the impact in the high-volatility regime is roughly twice as strong as in the low-volatility regime, and for INR, it is about four times stronger. For the TRY, two simulations were conducted — one using GST^{Europe} and the other using GST^{APAC} — to assess the impact of both European and Asian GPR on currency's returns. Results suggest that TRY is negatively affected by both regional GPRs during low-volatility periods, with a slightly stronger effect from the Asia-Pacific GPR. Notably, all impacted currencies show negative exposure to their corresponding regional GPR, except for USD, which exhibits positive exposure during turbulent times. This pattern is consistent with safe-haven and funding-flow dynamics that favor the dollar during episodes of rising regional GPR. In terms of magnitude, ARS and AUD are the most affected currencies, with exposures of −59.9 and −12.2, respectively. This implies that during high-volatility periods, GPR shocks could lead to substantial losses in the returns of both currencies.

Examining the variances, ARS stands out with an exceptionally high variance during the high-volatility regime. Despite spending only 233 days in this regime over the analysis period, the currency experienced significant stress during those times.

Table 11: MS results for currencies using regional GST

GST^R	Currency	Low-volatility regime			High-volatility regime		
		$\mu_1(10^{-4})$	$\beta_1(10^{-4})$	$\sigma_1^2(10^{-4})$	$\mu_2(10^{-4})$	$\beta_2(10^{-4})$	$\sigma_2^2(10^{-4})$
GST^{NA}	USD	1.3	0.1	0.1***	−2.7	5.3*	0.4***
	CAD	0.1	−0.6	0.1***	−0.9	−8.2**	0.4***
GST^{Europe}	EUR	−1.0	−0.4	0.1***	3.0	−3.4	0.5***
	GBP	0.1	−2.0	0.2***	3.7	−12.4	1.3***
	CHF	−1.6	1.5	0.1***	15.0***	−0.4	0.7***
	NOK	0.0	−2.2	0.4***	−8.7	−7.0	3.7***
	SEK	−0.9	−1.1	0.3***	1.4	−7.9*	0.8***
	PLN	0.6	−0.6	0.2***	−0.2	−9.2**	0.9***
	DKK	−0.9	−0.5	0.1***	2.9	−3.8	0.5***
	TRY	−7.3***	−2.1**	0.1***	−20.0**	−9.1	4.4***
GST^{LATAM}	ARS	−12.5***	0.2	0.0***	−59.2**	−59.9***	16.3***
	MXN	7.3***	0.3	0.2***	−15.3***	−5.2	1.5***
	BRL	−0.4	−1.0	0.5***	−5.2	4.9	1.6***
GST^{APAC}	AUD	−0.5	−6.1***	0.2***	0.1	−12.2**	0.9***
	NZD	−1.3	−4.4**	0.3***	1.2	−8.5*	0.8***
	JPY	−3.2***	1.6	0.1***	0.2	4.1	0.7***
	CNY	−0.1	−0.3	0.0***	−0.5	−3.6*	0.2***
	HKD	−0.1*	0.0	0.0	0.1	−0.3	0.0***
	INR	−0.8*	−1.0**	0.0***	−1.6	−4.1***	0.1***
	KRW	−1.7	−4.4***	0.2***	0.3	−8.2*	0.7***
	TRY	−7.3***	−2.7***	0.1***	−20.3**	−8.5	4.5***

***, ** and * indicate 1%, 5% and 10% significance levels.

3.3.2 Impact of national GPR

The results of currency exposures to their national GPR, presented in Table 12, reveal that fewer countries are impacted by their local GPR compared to those influenced by regional GPR. In North America, only the USD shows a positive exposure during high-volatility periods, suggesting that national US risk contributes to USD strength primarily during crises. In Europe, the GBP exhibits negative exposure during low-volatility periods, while the DKK

Table 12: Exposure of currencies to national GPR

Region	Currency	$\beta_1^C(10^{-4})$	$\beta_2^C(10^{-4})$	$\lvert\beta_2^C/\beta_1^C\rvert$
NA	USD	0.2	6.8**	29.3
	CAD	−1.0	−2.3	2.2
Europe	EUR	−0.7	−1.9	2.7
	GBP	−3.1**	1.1	0.4
	CHF	0.3	9.7	36.9
	NOK	1.8	−39.3	21.3
	SEK	−2.0	−0.3	0.1
	PLN	1.3	−7.5	5.7
	DKK	0.8	−7.8**	9.3
LATAM	ARS	0.0	4.3	110.1
	MXN	0.3	−3.0	8.6
	BRL	−1.2	3.2	2.6
APAC	AUD	−5.5***	−1.9	0.3
	NZD	−2.4	0.1	0.0
	JPY	1.8	8.3***	4.6
	CNY	−0.2	−3.9**	24.3
	HKD	0.0	−0.2	52.1
	INR	0.0	−1.0	29.2
	KRW	−3.1*	−3.4	1.1
	TRY	−0.8	−24.5**	29.1

***, ** and * indicate 1%, 5% and 10% significance levels.

is negatively exposed during high-volatility episodes. The Asia-Pacific region shows more impact: AUD and KRW exhibit negative exposure during low-volatility regimes, whereas CNY and TRY are negatively exposed to their local GPR during high-volatility periods. Interestingly, JPY shows positive exposure to Japan's GPR in high-volatility periods, possibly reflecting a reinforcing safe-haven role similar to the USD but driven by domestic shocks. In Latin America, however, no currency exhibits significant exposure to its local GPR in either regime.

These findings suggest that local GPR effects do exist but are regime-dependent and generally weaker or less widespread than regional effects. This implies that investors tend to react more strongly to broader regional GPRs than to purely domestic political risks when it comes to FX returns (refer to Remark 4 for a more detailed interpretation).

3.3.3 Impact of bilateral tensions

Table 13 presents the exposure of currencies to six major bilateral tensions. The results indicate that bilateral tensions significantly impact currency returns, with the magnitude and extent of this impact varying depending on the specific relationship. Among these, China-USA tensions are the most influential across all regions, followed by Russia-USA, China-India, and Iran-USA tensions. In contrast, fewer currencies are affected by Russia-Ukraine and Mexico-US tensions.

Focusing on China-USA tensions, all impacted currencies exhibit negative exposure to this bilateral risk, except for JPY and ARS, which show positive exposure during low-volatility periods. During low-volatility regimes, the negatively affected currencies include GBP, NOK, DKK, MXN, AUD, and NZD. In high-volatility regimes, China-USA tensions impact CAD, SEK, PLN, AUD, CNY, HKD, and INR. Overall, 14 out of the 20 currencies studied are affected in one or both regimes. Notably, the effect on AUD is approximately 2.5 times greater during turbulent periods. The currencies most impacted in terms of magnitude

Table 13: Exposure of currencies to bilateral GPR (Univariate MS model)

Currency	$GST^{CHN/USA}$		$GST^{RUS/UKR}$		$GST^{MEX/USA}$	
	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$
USD	1.7	4.7	−1.7	−0.2	−1.6	1.7
CAD	−1.8	−6.7*	1.5	−2.7	−1.3	1.0
EUR	1.5	−3.8	1.2	−3.6	1.8*	−1.5
GBP	−2.6*	−3.9	1.0	−2.7	2.1	−13.6
CHF	0.2	−5.9	2.5*	4.6	1.3	0.4
NOK	−4.1**	−20.4	1.4	−15.3	0.0	−2.6
SEK	0.0	−9.9**	−0.2	−6.6	3.0	−4.4
PLN	−1.8	−14.5***	0.4	−6.0	2.9	−6.5
DKK	−3.6*	−3.3	−3.5*	−3.0	2.1*	−1.2
ARS	0.9*	−10.9	0.2	−1.9	0.3	−128.1***
MXN	−3.9**	−5.1	3.5*	4.8	0.4	−9.0
BRL	−0.5	−6.9	4.8	−1.0	1.4	−2.2
AUD	−3.9**	−10.2*	2.9	−6.7	0.4	−1.2
NZD	−3.7*	−8.7	4.4**	−7.9	2.7	−8.6*
JPY	2.8**	−0.7	4.0***	10.5*	0.6	2.3
CNY	0.2	−4.7**	0.7	0.9	0.1	0.1
HKD	0.0	−0.3*	0.0	−0.4*	0.0	−0.4*
INR	−0.6	−3.4***	0.2	0.3	0.6	−3.2***
KRW	−0.3	−8.7	2.7*	−4.7	−1.0	−4.6
TRY	−0.8	−4.4	−0.5	4.4	−1.6*	4.3

Currency	$GST^{RUS/USA}$		$GST^{CHN/IND}$		$GST^{IRN/USA}$	
	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$
USD	1.3	6.2**	0.5	4.1	2.0*	2.5
CAD	−1.7	−5.8*	−1.5	−6.3*	1.5	−3.8
EUR	2.1*	−1.6	2.3*	−1.7	2.0*	−1.3
GBP	−3.0**	−12.0	−3.3**	4.2	−2.5*	9.1
CHF	1.5	−8.3	−1.7	4.9	0.6	−2.8
NOK	−2.0	−18.7	−5.0**	6.3	1.7	−26.3
SEK	−3.1*	−10.1**	−3.4*	−6.3	−3.8*	−3.9
PLN	−0.7	−14.5***	−0.2	−9.4**	−3.6*	−3.3
DKK	2.3*	−1.1	2.0*	−1.5	2.2*	−0.9
ARS	0.5	6.6	0.0	−6.9	0.1	6.8
MXN	−1.3	0.4	−3.8**	−6.3	−1.4	−8.3
BRL	1.1	−12.2*	−4.3*	−2.1	−0.2	−3.2
AUD	−2.6*	−9.4*	−4.4**	−4.7	−1.1	−6.6
NZD	−2.0	−5.0	−4.2**	−4.2	−4.4**	5.0
JPY	2.3*	0.1	1.6	5.0	−0.6	4.2
CNY	0.4	−2.0	−0.6	0.9	−0.7	−2.9
HKD	0.0	−0.4*	0.0	−0.4*	0.0	−0.4*
INR	0.2	−1.7	−0.9**	−4.6***	0.7*	−5.3***
KRW	−0.1	−5.8	−2.3	−3.2	−2.2	6.0
TRY	0.1	4.8	−1.3	−16.5	−1.8**	6.8

Reported coefficients are in units of 10^{-4}.
***, ** and * indicate 1%, 5% and 10% significance levels.

are PLN (-14.5), AUD (-10.2), and SEK (-9.9).

Turning to Russia-USA tensions (Table 13), these primarily affect North American currencies during high-volatility periods, with USD showing positive exposure and CAD negative exposure. In Europe, several currencies are impacted during low-volatility periods: EUR and DKK exhibit positive exposure, while GBP and SEK show negative exposure. Additionally, SEK and PLN display negative exposure during high-volatility periods. In Latin America, BRL is the only currency affected, and only during high-volatility regimes. Within the Asia-Pacific region, AUD is negatively exposed to Russia-USA tensions in both regimes, with the impact during the high-volatility regime nearly four times greater than in the low-volatility regime. JPY shows positive exposure during low-volatility periods, whereas HKD is negatively exposed during high-volatility periods.

Regarding China-India tensions, their impact is more pronounced during normal periods, affecting ten currencies: EUR, GBP, NOK, SEK, and DKK in Europe; MXN and BRL in Latin America; and AUD, NZD, and INR in Asia-Pacific. However, during turbulent periods, only four currencies show exposure to these bilateral tensions: CAD, PLN, HKD, and INR. All of these currencies exhibit negative exposure except for EUR and DKK. Notably, INR's exposure increases by 4.5 times during high-volatility regimes.

Similarly, Iran-USA tensions exert a greater impact during low-volatility periods, affecting nine currencies: USD, EUR, DKK, and INR exhibit positive exposure; while GBP, SEK, PLN, NZD, and TRY show negative exposure. During turbulent periods, only HKD and INR are negatively impacted. Notably, the magnitude of the impact on INR increases by approximately 7.5 times during high-volatility regimes.

Turning to Russia-Ukraine tensions , the effects are more pronounced during low-volatility regimes. These tensions have no significant impact on North American currencies and only a mild influence on European and Latin American currencies during normal periods, with CHF showing positive exposure and DKK negative exposure in Europe, and MXN being the sole affected currency in Latin America. In contrast, Asia-Pacific currencies are more sensitive to these bilateral shocks: NZD and KRW exhibit positive exposure during low-volatility regimes; HKD shows negative exposure during turbulent periods; and JPY displays positive exposure in both regimes, with a notably significant magnitude during high-volatility periods (10.5).

Finally, Mexican-USA tensions (Table 13) have the least impact on currencies, with only seven currencies affected. During normal periods, EUR and DKK exhibit positive exposure, while TRY shows negative exposure. In high-volatility regimes, a negative impact is observed on ARS in Latin America, as well as on a few Asia-Pacific currencies — NZD, HKD, and INR. Notably, the impact on ARS is substantial (-128.1), representing the largest exposure among all affected currencies across the six bilateral tensions studied.

The above findings identify a group of five relatively resilient currencies — USD in North America; EUR and CHF in Europe; and JPY and KRW in Asia-Pacific — standing out as exhibiting either positive or no statistically significant exposure to the six bilateral tensions studied. These currencies may be considered relatively safe investments during major bilateral tensions and can serve as defensive allocations or hedges. Conversely, DKK, MXN, and NZD display mixed exposures — both negative and positive — or no significant exposure, suggesting that investment decisions involving these currencies should be tailored to the specific bilateral tension and prevailing regime. The remaining currencies either show no systematic response or weaken in response to heightened bilateral tensions, underscoring the importance of regime-aware hedging and tension-specific stress testing when managing FX exposures.

3.4 Commodities

3.4.1 Impact of regional GPR

Since commodities are not tied to any specific country or region, this section examines whether the four regional GPRs influence the returns of 12 commodities using a multivariate MS model similar to the one in Equation (3), incorporating the four regional GSTs simultaneously.

The results in Table 14 demonstrate good regime classifications, with RCM values ranging from 3 to 52 and most values below 37, indicating that the model effectively distinguishes between the two regimes. The persistence probabilities indicate that most commodities tend to remain longer in the low-volatility regime than in the high-volatility regime, with the exceptions of natural gas and aluminium. Persistence within each regime varies significantly. The probability of remaining in the low-volatility regime generally ranges from 0.9174 for Coal to 0.9947 for crude oil WTI, corresponding to average durations of 12 and 88 days, respectively. For the high-volatility regime, persistence probabilities generally span from 0.7165 for copper to 0.9965 for natural gas, with average durations between 4 and 282 days. Outside these ranges, silver exhibits relatively low persistence, with probabilities of 0.8172 and 0.5157 in the low- and high-volatility regimes, respectively, indicating frequent regime shifts (average durations of 5 and 2 days, respectively). Similarly, coal shows low persistence in the high-volatility regime, with a probability of 0.5924 of remaining in that state, corresponding to an average duration of 2 days. Additionally, the findings reveal that natural gas predominantly remains in the high-volatility regime, spending a total of 1,190 days in that state over the past six years. The probability of natural gas being in the low-volatility regime, as well as the corresponding parameter estimates (reported in Table 15) are statistically insignificant.

Table 14: Regime probabilities and durations for commodities

	Commodity	Low volatility regime			High volatility regime			RCM
		p_{11}	D_1	N_1	p_{22}	D_2	N_2	
Metals	Gold	0.9445***	18	1390	0.8071***	5	275	37
	Silver	0.8172***	5	1399	0.5157***	2	266	52
	Copper	0.9808***	52	1596	0.7165***	4	69	12
	Aluminium	0.9415**	17	745	0.9504***	20	920	34
Energy	Crude Oil WTI	0.9947***	188	1582	0.9061**	11	83	3
	Crude Oil Brent	0.9789***	47	1463	0.8735***	8	202	15
	Natural Gas	0.9920	126	475	0.9965***	282	1190	6
	Coal	0.9174***	12	1427	0.5924***	2	238	18
Agricultural	Wheat	0.9858***	71	1370	0.9372**	16	295	19
	Corn	0.9711***	35	1524	0.7855***	5	141	17
	Soybeans	0.9889**	90	1388	0.9487***	19	277	17
	Coffee	0.9490***	20	1172	0.9053**	11	493	52

***, ** and * indicate 1%, 5% and 10% significance levels for the probabilities.
Duration is expressed in days.
N_1 and N_2 are the total number of days spent in regimes 1 and 2, respectively, over the analysis period.

Examining the model parameters in Table 15, we find that commodities generally do not display significant trend components. Only gold, copper, and crude oil brent exhibit statistically significant mean returns during low-volatility periods, while coffee is the only commodity with a significant mean return in high-volatility periods. The variance estimates show that all commodities — except natural gas, as previously noted — exhibit switching variances between the two regimes.

Table 15: MS results for commodities using regional GST

Commodity	Low volatility regime						High volatility regime					
	μ_1	β_1^{NA}	β_1^{Europe}	β_1^{LATAM}	β_1^{APAC}	σ_1^2	μ_2	β_2^{NA}	β_2^{Europe}	β_2^{LATAM}	β_2^{APAC}	σ_1^2
Gold	9.2***	−0.6	1.7	0.0	1.2	0.5***	−2.7	15.3	7.7	10.6	−18.6	2.7***
Silver	4.5	10.2**	−5.6	−5.8	−0.7	0.5***	16.1	−24.8	6.8	23.2	−15.0	10.5***
Copper	7.6**	−0.1	−6.1	4.5	−9.4*	0.5***	−40.7	−19.7	18.5	14.2	−28.1	15.8***
Aluminium	0.2	2.5	−3.6	3.3	0.2	0.5**	2.8	4.2	3.5	−0.6	−7.8	3.3***
Crude Oil WTI	7.3	0.8	−7.3	−2.2	−0.9	4.4***	37.9	484.8*	−41.1	−332.1	−192.3	115.2**
Crude Oil Brent	11.3**	4.0	−11.7*	−5.5	0.2	2.9***	−30.1	71.0	32.2	−31.2	−60.8	29.3***
Natural Gas	−6.1	1.9	−18.0	11.1	−5.5	5.1	14.7	−48.9**	−0.8	11.6	30.8*	25.9***
Coal	−0.5	4.9	3.0	−1.9	−4.0	0.7***	32.0	21.4	50.4	7.5	−69.1	37.0***
Wheat	−5.2	6.2	−4.9	8.3*	−3.7	2.5***	30.1	−59.9**	47.7*	21.8	18.0	11.7**
Corn	3.6	−6.4	0.9	5.3	−3.4	1.6***	−13.3	28.3	−35.8	14.9	0.7	13.3***
Soybeans	4.5	−1.4	−3.3	1.4	−0.7	1.1**	−12.9	−13.3	34.7*	28.5**	−37.4**	4.4***
Coffee	−9.4	−11.2	−1.7	6.3	−3.5	3.2***	46.3***	−20.0	29.8	−6.0	16.6	8.6**

Reported coefficients are in units of 10^{-4}.
***, ** and * indicate 1%, 5% and 10% significance levels for the probabilities.
Duration is expressed in days.
N_1 and N_2 represent the total number of days spent in regimes 1 and 2, respectively, over the analysis period.

Regarding exposure to regional GPR, commodities appear largely unaffected. During normal periods, the influence of regional GPR is limited, with each region impacting only one commodity: silver and wheat show positive exposure to North American and Latin American GPR, respectively; crude oil brent and copper exhibit negative exposure to European and Asia Pacific GPR, respectively. During turbulent periods, a larger number of commodities display sensitivity to regional GPR, though the number remains modest. Metals show no exposure to regional GPR under high volatility conditions. Among energy products, crude oil WTI is positively impacted by North American GPR, with a substantial exposure reaching 484.8. Natural gas exhibits negative exposure to North American GPR and positive exposure to Asia Pacific GPR. For agricultural products, wheat shows negative exposure to North American GPR and positive exposure to European GPR, while soybeans are positively influenced by European and Latin American GPR and negatively by Asia Pacific GPR.

3.4.2 Impact of bilateral tensions

Table 16 reports the estimated exposures from the multivariate MS model assessing the effect of bilateral tensions on commodities returns. The Russia-Ukraine conflict emerges as the most influential, affecting commodities across all categories. Metals generally show positive exposure to these tensions, with gold, copper and aluminium impacted during normal periods, while silver is affected during turbulent periods. Among energy products, crude oil brent experiences a substantial negative exposure during high-volatility periods, reflecting pronounced declines in returns when tensions intensify. For agricultural commodities, wheat appears to benefit from these tensions during normal periods, whereas soybeans display negative exposure in the same regime. Iran-USA tensions also exert notable effects on metals and energy products. In low-volatility regimes, gold, silver and natural gas exhibit positive exposures. During high-volatility periods, both crude oil contracts display substantial positive exposures (324.9 for crude oil WTI and 103.0 for crude oil brent), while coal is strongly negatively affected. China-USA tensions have a more moderate influence, primarily on metals and energy commodities. Gold and silver show negative exposure during the low- and high-volatility regimes, respectively. However, both crude oil contracts exhibit positive exposure during normal periods, suggesting that rising China-USA tensions tend to push crude oil prices higher. China-India tensions negatively affect copper and both crude oil contracts during normal periods, while coffee is positively affected during turbulent periods. In contrast, Mexico-USA and Russia-USA conflicts have minimal effects on commodity markets. Mexico-USA tensions positively influence only coal during turbulent periods, while Russia-USA tensions negatively affect copper during normal periods. Overall, the findings indicate that metals and energy products are the commodity groups most sensitive to bilateral geopolitical tensions.

A second simulation was conducted using 7-day lagged bilateral GST series, with the corresponding results reported in Table A5 on page 42. These findings indicate that several commodities previously identified as sensitive to contemporaneous bilateral tensions continue to be affected days later. For example, gold maintains a negative exposure to China-USA and a positive exposure to Russia-Ukraine tensions during low-volatility regimes, and additionally shows positive exposure to China-USA tensions during high-volatility periods. Other commodities, such as silver, exhibit a shift from negative to positive exposure in high-volatility regimes in response to China-USA tensions. This pattern suggests that escalating tensions may initially depress silver returns before eventually supporting them.

Some commodities respond only with a seven-day delay. Silver, in particular, exhibits exposure to China-USA (in low-volatility periods), Mexico-USA, Russia-USA, and China-India tensions across one or two regimes. Other affected commodities include copper, which

Table 16: Exposure of commodities to contemporaneous bilateral GPR (Multivariate MS model)

Commodity	$GST^{\text{CHN/USA}}$ $\beta_1^{C_i/C_j}$	$GST^{\text{CHN/USA}}$ $\beta_2^{C_i/C_j}$	$GST^{\text{RUS/UKR}}$ $\beta_1^{C_i/C_j}$	$GST^{\text{RUS/UKR}}$ $\beta_2^{C_i/C_j}$	$GST^{\text{MEX/USA}}$ $\beta_1^{C_i/C_j}$	$GST^{\text{MEX/USA}}$ $\beta_2^{C_i/C_j}$
Gold	−5.3**	−0.7	7.3*	9.3	3.1	−11.5
Silver	−1.0	−34.1*	6.5	40.9*	−4.0	−7.1
Copper	3.1	−41.5	9.9**	−66.2	1.3	−27.2
Aluminium	2.6	−1.2	9.3**	−16.2	4.1	7.0
Crude Oil WTI	11.6*	−135.0	6.6	−179.9	−3.5	−118.1
Crude Oil Brent	11.0**	−30.3	9.6	−94.3*	−4.0	5.2
Natural Gas	−8.1	0.8	−6.5	−18.2	−1.7	−15.3
Coal	−0.1	12.7	−0.7	−64.9	1.4	126.2***
Wheat	−0.6	1.7	12.7*	13.2	5.7	19.7
Corn	0.7	−25.1	−2.9	−5.3	0.3	24.8
Soybeans	2.3	−20.4	−8.5**	31.6	−1.3	7.8
Coffee	2.4	−11.8	−5.9	−11.3	2.0	13.4

Commodity	$GST^{\text{RUS/USA}}$ $\beta_1^{C_i/C_j}$	$GST^{\text{RUS/USA}}$ $\beta_2^{C_i/C_j}$	$GST^{\text{CHN/IND}}$ $\beta_1^{C_i/C_j}$	$GST^{\text{CHN/IND}}$ $\beta_2^{C_i/C_j}$	$GST^{\text{IRN/USA}}$ $\beta_1^{C_i/C_j}$	$GST^{\text{IRN/USA}}$ $\beta_2^{C_i/C_j}$
Gold	2.6	−5.8	1.8	11.8	10.0***	−1.2
Silver	−0.2	−0.7	2.3	18.2	11.0*	13.8
Copper	−10.1**	50.9	−9.8***	1.7	−1.2	−45.5
Aluminium	−3.0	9.9	−2.7	−8.0	4.1	−3.3
Crude Oil WTI	−6.7	−83.1	−17.1***	−3.1	8.1	324.9**
Crude Oil Brent	−7.0	0.1	−14.4***	4.5	7.2	103.0**
Natural Gas	19.0	6.4	7.4	16.8	23.2*	3.7
Coal	1.6	33.7	−2.1	−3.5	2.3	−88.9*
Wheat	−6.0	−23.1	−5.4	9.0	0.5	4.7
Corn	−4.4	−17.9	−2.2	23.3	−4.2	47.4
Soybeans	−2.1	−8.0	−3.1	−10.9	2.4	0.8
Coffee	0.1	−25.9	−9.2	45.8*	−1.1	17.1

Reported coefficients are in units of 10^{-4}.
***, ** and * indicate 1%, 5% and 10% significance levels.

shows positive exposure to China-India tensions and a substantial positive exposure (120.2) to Iran-USA conflicts during high-volatility periods; aluminium, which experiences negative exposure to Russia-USA tensions and positive exposure to Iran-USA tensions in turbulent periods; crude oil WTI, which is strongly negatively affected (exposure of −316.0) by Russia-USA tensions during high-volatility periods; coal, which benefits from Russia-Ukraine tensions but is negatively impacted by Russia-USA tensions during normal periods; and coffee, which suffers during normal period from China-India tensions and benefits from China-USA and Russia-USA tensions during high-volatility regimes. Soybeans also exhibit negative exposure to Mexico-USA tensions during normal periods. Overall, these results underscore that geopolitical tensions between countries can exert persistent and delayed effects on commodity markets, extending well beyond the immediate period of heightened tensions.

It is important to mention that the regime-dependent response of gold to China-USA tensions refines rather than contradicts its safe-haven role. In fact, the negative exposure observed in the low-volatility regime suggests that when markets remain stable and volatility is contained, geopolitical tensions are absorbed as part of normal risk re-pricing rather than as broad-based market threats. In such environments, investors continue to differentiate across assets and maintain exposure to risk-bearing positions, limiting the demand for defensive assets such as gold. As a result, contained geopolitical rivalry may coincide with relative underperformance of gold. By contrast, in the high-volatility regime, geopolitical tensions become embedded within broader market stress, prompting a shift away from risky assets toward stores of value. The switch to a positive exposure in this regime is therefore consistent with gold functioning as a hedge against severe or tail-risk episodes, rather than against all forms of geopolitical uncertainty.

4 Discussion

4.1 Key findings

This study documents several robust and economically meaningful patterns in the way geopolitical risk (GPR) is transmitted across global financial markets. First, GPR is primarily priced when it materializes at the regional or bilateral level, rather than at a purely national level. For equities, regional GPR exerts a strong negative influence across most markets, with exposures that intensify markedly during high-volatility regimes. This amplification is particularly pronounced in Europe and Asia-Pacific, where sensitivities increase by more than six times and eight times, respectively. These results underscore the heightened vulnerability of these regions to geopolitical shocks and highlight the dominant role of regional spillovers in shaping equity returns. Extreme regional GPR shocks — defined as events exceeding three standard deviations — generate returns clustering around zero, consistent with the interpretation that severe geopolitical stress primarily reflects heightened uncertainty rather than directional risk premia. In contrast, national GPR has limited explanatory power, suggesting that domestic political shocks are largely absorbed within broader regional indices. This distinction indicates that equity markets respond more strongly to geopolitical developments that threaten regional stability and global value chains than to idiosyncratic domestic political risk, which is likely diversified away or already incorporated into prices. Bilateral tensions further refine the understanding of geopolitical transmission. Among the six bilateral relationships studied, China-USA tensions emerge as the most economically significant driver of regional equity returns, reflecting the systemic importance of the two largest global economies and the central role of their relationship in global trade and production networks. Secondary but still economically meaningful effects are observed for China-India and Russia-USA tensions. Notably, bilateral shocks tend to exert effects during low-volatility regimes, suggesting that GPR is priced more clearly during normal market conditions than during crisis periods. Other tensions, such as Russia-Ukraine, Iran-USA, and Mexico-USA, display more region-specific or limited effects, indicating that geopolitical disputes do not transmit uniformly across asset markets. Overall, bilateral tensions give rise to a negative GPR premium for equities, with the notable exception of certain Latin American markets that display positive exposures in response to Russia-Ukraine conflicts.

Sovereign bond markets exhibit a different yet complementary pattern. Among the four regions, Asia-Pacific bonds are particularly sensitive to regional GPR shocks, with all markets affected except China and with exposures that are predominantly negative — Japanese bonds being the main exception. This pattern reflects declining bond returns during periods of heightened regional tension. Outside Asia-Pacific, sovereign bonds generally display limited sensitivity to regional GPR, with notable exceptions such as Swiss and Canadian bonds. At the national level, sovereign bond indices are largely unaffected by GPR, reinforcing the view that country-specific political shocks are either anticipated or already embedded in bond prices. While national GPR generally exerts only a minor influence on bond returns, the significant positive exposure of Swiss and Japanese bonds to their respective national GPRs during high-volatility regimes points to idiosyncratic safe-haven effects under conditions of elevated geopolitical stress. Importantly, these responses remain exceptions rather than systematic features of bond markets. By contrast, bilateral GPR emerges as the most economically meaningful source of GPR in sovereign bond markets. All bilateral geopolitical tensions significantly affect bond returns, with the notable exception of the Mexico-USA relationship. In particular, the Russia-Ukraine conflict generates positive exposures across affected countries, consistent with flight-to-quality dynamics. European bonds tend to exhibit positive or neutral exposure to most bilateral tensions, except in the case of Iran-USA tensions, where exposures turn negative. Finally, Swiss and Japanese bonds consistently display positive or insignificant exposures across regional, bilateral, and national GPR measures, confirming their defensive and safe-haven characteristics.

Foreign exchange markets display differentiated responses depending on both currency and regime. Certain currencies, such as HKD and INR, exhibit persistent high-volatility states, indicating prolonged periods of stress and suggesting that elevated volatility should be modeled as a persistent regime rather than as a transitory shock. Regional GPR exerts its strongest influence on Asia-Pacific currencies, with AUD, NZD, INR, and KRW consistently exhibiting negative exposures. In contrast, North American currencies (CAD and USD) display heightened sensitivity primarily during high-volatility regimes. Regional geopolitical shocks trigger a broad depreciation of currencies against the US dollar, which systematically appreciates in line with its safe-haven role. National GPR effects are generally weaker and regime-dependent, with positive exposures concentrated in domestic safe-haven currencies such as the USD and JPY. Bilateral tensions — most notably China-USA, China-India, and Russia-USA — also exert significant effects on FX returns, but the effect is heterogeneous across currencies and regimes. A subset of currencies, including USD, EUR, CHF, and JPY, demonstrates notable resilience, consistently exhibiting neutral or positive exposures across regional, bilateral, and national GPR measures, highlighting their potential role as defensive assets in periods of geopolitical stress. Beyond these safe-haven currencies, heterogeneity remains substantial. DKK, MXN, NZD, and KRW display mixed exposures across regimes and sources of GPR, implying that FX positions in these currencies require more tailored and tension-specific investment strategies. By contrast, the remaining currencies are predominantly characterized by negative exposures to GPR, underscoring the importance of regime-aware hedging and tension-specific stress testing when managing foreign exchange portfolios.

Commodity markets exhibit generally muted sensitivity to regional GPR, with statistically significant effects emerging primarily during high-volatility regimes. Energy products (crude oil WTI, natural gas) and agricultural commodities (wheat, soybeans) display the strongest responses to regional GPR shocks, whereas metals remain largely unaffected. Bilateral geopolitical tensions generate more heterogeneous effects across commodities, with the Russia-Ukraine and Iran-USA conflicts emerging as the most influential. These tensions primarily affect energy and metal markets and, in some cases, give rise to persistent or delayed responses. An analysis of lagged exposures confirms that geopolitical shocks can influence commodity returns beyond the immediate tensions period, underscoring the importance of accounting for temporal spillovers in both risk assessment and portfolio planning. By contrast, agricultural commodities appear to be the least sensitive to bilateral GPR, suggesting a comparatively lower exposure to direct geopolitical disruptions. Overall, these findings highlight meaningful differences in geopolitical exposure across commodity classes, driven by variations in market structure, production concentration, and degrees of global integration.

4.2 Implications for portfolio management

These findings carry important practical implications for portfolio construction, risk management, and asset allocation under geopolitical uncertainty. First, the study highlights the necessity of distinguishing between different dimensions of GPR. Treating GPR as a single and homogeneous factor may lead to a misestimation of risk exposures, as markets respond very differently to regional, bilateral, and national shocks. Portfolio strategies should therefore emphasize regional and bilateral GPR indicators, which carry stronger and more systematic pricing effects. It is also important to integrate multidimensional GPR metrics into portfolio risk frameworks, so that investors can gain a richer understanding of both direct and indirect channels through which GPR affects asset returns. This approach supports more informed asset allocation, dynamic risk management, and scenario-based stress testing, ultimately enhancing portfolio robustness in an increasingly uncertain geopolitical environment.

Second, the evidence of regime-dependent sensitivities underscores the importance of incorporating dynamic risk models that adjust exposures to geopolitical shocks according to market conditions. Investors should recognize that the pricing of GPR differs markedly between low- and high-volatility periods, and that strategies effective during calm periods may not be robust during crises. For currencies such as HKD and INR, where high volatility is persistent, portfolio managers should treat stress regimes as a baseline source of risk rather than as rare events. These insights support the implementation of dynamic allocation strategies, regime-aware hedging, and stress-testing protocols that are explicitly tailored to the persistence and intensity of geopolitical shocks.

Third, the heterogeneous effects of bilateral tensions emphasize the value of conflict-specific portfolio adjustments. Not all geopolitical tensions transmit equally across regions or asset classes; for example, China-USA tensions affect a broad range of assets, whereas Mexico-USA tensions have minimal impact. Portfolio managers can leverage this knowledge to implement targeted hedges, optimize risk-adjusted exposures, and prioritize monitoring of high-impact geopolitical relationships. Moreover, the persistence and delayed effects observed in commodities suggest that investment decisions should consider lagged responses, allowing managers to anticipate secondary market reactions and adjust positions proactively.

Fourth, the identification of safe-haven assets across the four asset classes provides clear guidance for constructing resilient multi-asset portfolios. Japanese and Swiss bonds, along with USD, EUR, CHF, JPY, and Gold, emerge as consistent buffers against geopolitical shocks, offering protection during periods of elevated uncertainty. Their inclusion enhances portfolio robustness by reducing tail risk and stabilizing returns during geopolitical stress. Similarly, the positive bond market responses to specific tensions, such as Russia-Ukraine, point to potential hedging roles for sovereign bonds under certain geopolitical stress scenarios. On the other hand, the heterogeneous exposure of regions and assets to GPR creates scope for tailored currency and fixed-income strategies. Portfolios heavily exposed to Asia-Pacific equities, bonds, and currencies (except for JPY), as well as energy markets — identified as particularly vulnerable — can benefit from dynamic allocations toward resilient currencies and sovereign bonds. This targeted use of defensive assets allows investors to mitigate GPR while preserving strategic return objectives.

5 Conclusion

This study assesses the effects of geopolitical risk (GPR) on global asset returns across equities, sovereign bonds, foreign exchange, and commodities, considering multiple GPR dimensions. Using a two-regime Markov-switching framework, we show how the impact of geopolitical shocks varies across low- and high-volatility regimes. Relative to the existing literature, the paper advances GPR analysis by jointly integrating regional GPR, national GPR, and six major bilateral tensions within a unified, regime-dependent framework, offering a dynamic and multidimensional view of GPR transmission across asset classes.

The empirical results reveal pronounced heterogeneity in how geopolitical shocks are priced. Markets primarily price regional GPR and bilateral tensions, while national GPR plays a limited role. GPR pricing is strongly regime-dependent, with exposures differing markedly between calm and stress periods, and some assets exhibiting lagged responses, indicating that transmission may extend beyond the immediate shock. The analysis also identifies a set of defensive assets that remain resilient to geopolitical shocks and can serve as effective hedging instruments. Overall, these findings show that incorporating GPR into asset pricing and portfolio management requires a granular, regime-aware, and asset-specific approach. Although GPR is partially incorporated into asset prices, this integration is neither uniform nor systematic across assets, regions, or volatility regimes, highlighting the limitations of aggregate GPR measures and static modeling assumptions.

While quantitative, news-based GPR measures provide a systematic and comparable framework, they may not fully capture the complex, multifaceted nature of geopolitical tensions. The complexity of geopolitical events suggests that purely quantitative indicators may overlook important contextual and narrative dimensions. Future research could therefore combine quantitative indicators with qualitative or narrative-based approaches and event-study methodologies in order to capture both the intensity and the context of geopolitical shocks, along with their timing and transmission channels.

By explicitly accounting for multiple sources of GPR, this paper identifies asset-specific vulnerabilities, safe-haven instruments, and key transmission dynamics, providing practical tools for constructing, adjusting, and stress-testing resilient portfolios in an increasingly geopolitically uncertain global environment.

References

Abid, I., Dhaoui, A., Kaabia, O., and Tarchella, S. (2023). Geopolitical Risk on Energy, Agriculture, Livestock, Precious and Industrial Metals: New Insights from a Markov Switching Model. *Resources Policy*, 85, 103925.

Abou Rjaily, N., Roncalli, T., and Xu, J. (2024). Risk Factor, Risk Premium and Black-Litterman Model. *SSRN*, 4976695, 59 pages.

Acharya, V.V., Amihud, Y., and Bharath, S.T. (2013). Liquidity Risk of Corporate Bond Returns: Conditional Approach. *Journal of Financial Economics*, 110(2), pp. 358-386.

Ang, D. and Bekaert, M. (2002). Regime Switches in Interest Rates. *Journal of Business & Economic Statistics*, 20(2), pp. 163-182

Będowska-Sójka, C.P., Demir, E., and Zaremba, A. (2022). Hedging Geopolitical Risks with Different Asset Classes: A Focus on the Russian Invasion of Ukraine. *Finance Research Letters*, 50, 103192.

Bingura, F. (2023). The Global Impact of the US-China Trade War: Firm-Level Evidence. *Review of World Economics*, 159(4), pp. 827-851.

Bown, C.P., Conconi, P., Erbahar, A., and Trimarchi, L. (2021). Trade Protection Along Supply Chains. *SSRN*, 3783883, 75 pages.

Buthelezi, E.M. (2024). Navigating Global Uncertainty: Examining the Effect of Geopolitical Risks on Cryptocurrency Prices and Volatility in a Markov-switching Vector Autoregressive Model. *International Economic Journal*, 38(4), pp. 564-590.

Caldara, D. and Iacoviello, M. (2022). Measuring Geopolitical Risk. *American Economic Review*, 112(4), pp. 1194-1225.

Cheng, S., Han, L., Cao, Y., Jiang, Q., and Liang, R. (2022). Gold-Oil Dynamic Relationship and the Asymmetric Role of Geopolitical Risks: Evidence from Bayesian pdBEKK-GARCH with Regime Switching. *Resources Policy*, 78, 102917.

Choi, K. and Hammoudeh, S. (2010). Volatility Behavior of Oil, Industrial Commodity and Stock Markets in a Regime-Switching Environment. *Energy Policy*, 38(8), pp. 4388-4399.

Dutta, A. and Dutta, P. (2022). Geopolitical Risk and Renewable Energy Asset Prices: Implications for Sustainable Development. *Renewable Energy*, 196, pp. 518-525.

Fang, Y., Tang, Q., and Wang, Y. (2024). Geopolitical Risk and Cryptocurrency Market Volatility. *Emerging Markets Finance and Trade*, 60(14), pp. 3254-3270.

Gala, V.D., Pagliardi, G., and Zenios, S.A. (2023). Global Political Risk and International Stock Returns. *Journal of Empirical Finance*, 72, pp. 78-102.

Guidolin, M. and Timmermann, A. (2006). An Econometric Model of Nonlinear Dynamics in the Joint Distribution of Stock and Bond Returns. *Journal of Applied Econometrics*, 21(1), pp. 1-22.

Hamilton, J.D. (1989). A New Approach to the Economic Analysis of Nonstationary Time Series and the Business Cycle. *Econometrica*, 57(2), pp. 357-384.

Hass, R. and Denmark, A. (2020). More Pain than Gain: How the US-China Trade War Hurt America. *Brookings Institution*, https://www.brookings.edu.

Hsu, Y.J. and Iacoviello, J.J. (2024). Effects of Firm-level Geopolitical Risk on Leverage. *American Economic Review*, 112(4), pp. 1194-1225.

Kinzius, L., Sandkamp, A., and Yalcin, E. (2019). Trade Protection and the Role of Non-Tariff Barriers. *Review of World Economics*, 155(4), pp. 603-643.

Li, M., Balistreri, E.J., and Zhang, W. (2020). The US-China Trade War: Tariff Data and General Equilibrium Analysis. *Journal of Asian Economics*, 69, 101216.

Newey, W.K. and West, K.D. (1994). Automatic Lag Selection in Covariance Matrix Estimation. *Review of Economic Studies*, 61(4), pp. 631-653.

Pastor, Ĺ. and Veronesi, P. (2013). Political Uncertainty and Risk Premia. *Journal of Financial Economics*, 110(3), pp. 520-545.

Rosenberg, A., Sekine, T. and Stagnol, L. (2024). Geopolitical Risk Will Grow: Here Is How We Track It. *Amundi Investment Institute*, 9 pages.

Salisu, A., Salisu, S., and Salisu, S. (2023). Constructing Geopolitical Risk Index for Nigeria. *Scientific African*, 22, e01948.

Sheenan, L. (2023). Green Bonds, Conventional Bonds and Geopolitical Risk. *Finance Research Letters*, 58, 104587.

Sheng, J., Sun, Z., and Wang, Q. (2025). Geopolitical Risk and Stock Returns. *SSRN*, 5207012, 67 pages.

Umar, Z., Polat, O., Choi, S.Y., and Teplova, T. (2022). The Impact of the Russia-Ukraine Conflict on the Connectedness of Financial Markets. *Finance Research Letters*, 48, 102976.

Umar, Z., Bossman, A., Choi, S.Y., and Vo, X.V. (2023). Information Flow Dynamics Between Geopolitical Risk and Major Asset Returns. *PLoS One*, 18(4), e0284811.

Yilmazkuday, H. (2024). Geopolitical Risk and Stock Prices. *European Journal of Political Economy*, 83, 102553.

Zahoor, N., Wu, J., Khan, H., and Khan, Z. (2023). De-Globalization, International Trade Protectionism, and the Reconfigurations of Global Value Chains. *Management International Review*, 63(5), pp. 823-859.

A Results

Add the correlation and stationarity results of GST local and bilat.

Table A1: ADF test results on equity indices and GST

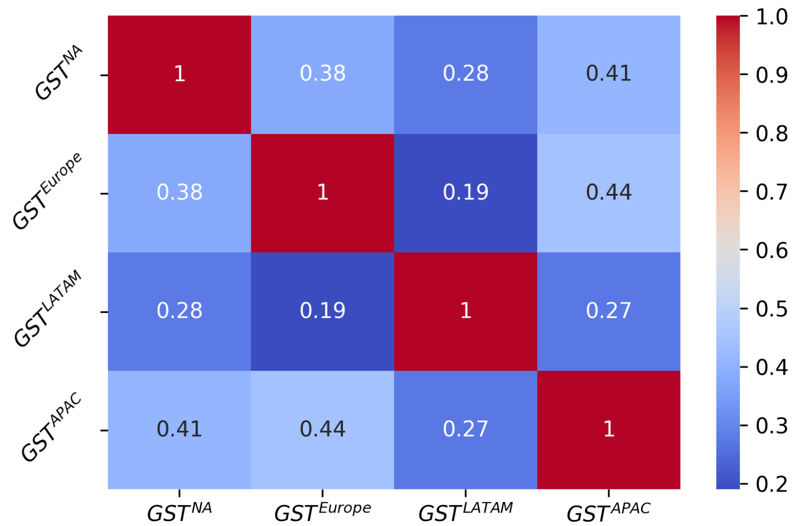
Equity index	Test Statistic	GPR index	Test Statistic
MSCI NA	-12.56^{***}	GST^{NA}	-17.70^{***}
MSCI Europe	-15.22^{***}	GST^{Europe}	-18.55^{***}
MSCI LATAM	-14.36^{***}	GST^{LATAM}	-26.29^{***}
MSCI APAC	-26.78^{***}	GST^{APAC}	-23.47^{***}

***, ** and * indicate 1%, 5% and 10% significance levels.

Table A2: Correlation and VIF test results of equity indices and GST

	ρ_{MSCI_R/GST^R}	VIF_{MSCI_R/GST^R}
MSCI NA	-0.06	1.00
MSCI Europe	-0.11	1.01
MSCI LATAM	0.02	1.00
MSCI APAC	-0.16	1.03

Figure A1: Correlation among GST^R



B Studies on regional GST

To study the behaviour of the GST under a two-regime framework, a two-order autoregressive MS is applied to the timeseries:

$$GST_t^R = \mu_{S_t} + \phi_{S_t}^1 \left(GST_{t-1}^R - \mu_{S_{t-1}}\right) + \phi_{S_t}^2 \left(GST_{t-2}^R - \mu_{S_{t-2}}\right) + \varepsilon_t \quad \text{with} \quad \begin{cases} \varepsilon_t \sim \mathcal{N}(0, \sigma_{S_t}^2) \\ S_t = 1, 2 \end{cases} \tag{9}$$

Table A3: Magnitude of regional equities' exposures to bilateral tensions (Univariate MS model)

	$GST^{CHN/USA}$	$GST^{RUS/UKR}$	$GST^{MEX/USA}$
Equity index	$\left\lvert\beta_2^{C_i/C_j}/\beta_1^{C_i/C_j}\right\rvert$	$\left\lvert\beta_2^{C_i/C_j}/\beta_1^{C_i/C_j}\right\rvert$	$\left\lvert\beta_2^{C_i/C_j}/\beta_1^{C_i/C_j}\right\rvert$
MSCI NA	2.4	7.2	9.4
MSCI Europe	2.4	30.4	6.4
MSCI LATAM	6.4	5.5	4.3
MSCI APAC	13.0	9.3	31.7

	$GST^{RUS/USA}$	$GST^{CHN/IND}$	$GST^{IRN/USA}$
Equity index	$\left\lvert\beta_2^{C_i/C_j}/\beta_1^{C_i/C_j}\right\rvert$	$\left\lvert\beta_2^{C_i/C_j}/\beta_1^{C_i/C_j}\right\rvert$	$\left\lvert\beta_2^{C_i/C_j}/\beta_1^{C_i/C_j}\right\rvert$
MSCI NA	0.4	14.9	1.9
MSCI Europe	2.5	2.5	5.1
MSCI LATAM	33.5	0.7	6.4
MSCI APAC	9.2	6.1	640.1

Table A4: Exposure of regional equity indices to bilateral GPR (Multivariate MS model)

	$GST^{CHN/USA}$		$GST^{RUS/UKR}$		$GST^{MEX/USA}$	
Equity index	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$
MSCI NA	−2.9	−11.7	2.4	−9.4	0.8	−9.3
MSCI Europe	−9.3***	−11.3	4.9	0.0	5.9**	−11.8
MSCI LATAM	−2.5	−33.2	11.3**	−27.4	4.8	16.0
MSCI APAC	−7.9***	−75.8	6.9**	−36.9	4.0*	−33.6

	$GST^{RUS/USA}$		$GST^{CHN/IND}$		$GST^{IRN/USA}$	
Equity index	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$
MSCI NA	−6.6**	12.3	1.4	−5.6	−0.1	8.5
MSCI Europe	−7.2***	−3.3	−4.9*	−10.8	1.4	−10.1
MSCI LATAM	−3.5	−58.8	−9.3**	21.5	−1.4	49.8
MSCI APAC	−3.6	4.2	−7.4***	−58.4	3.9	−51.7

Reported coefficients are in units of 10^{-4}.
***, ** and * indicate 1%, 5% and 10% significance levels.

Figure A2: Bonds' spreads across low- and high-volatility regimes

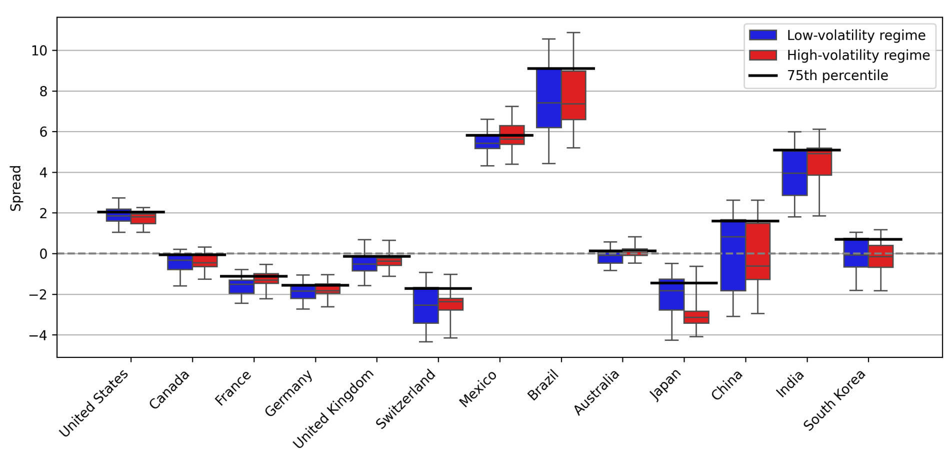


Table A5: Exposure of commodities to 7-day-lagged bilateral GPR (Multivariate MS model)

Commodity	$GST^{CHN/USA}$		$GST^{RUS/UKR}$		$GST^{MEX/USA}$	
	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$
Gold	-6.5^{**}	16.7^{*}	6.3^{*}	-6.3	-1.7	-10.2
Silver	-12.0^{**}	30.8^{*}	2.7	-12.1	9.2^{**}	-46.6^{**}
Copper	-2.4	-13.3	2.3	-69.6	-1.5	-15.7
Aluminium	-1.8	1.9	5.0	-9.5	2.8	-4.4
Crude Oil WTI	-6.8	128.6	-2.6	55.6	-5.0	-65.0
Crude Oil Brent	-5.8	45.3	1.7	-4.8	-0.7	-54.9
Natural Gas	-3.0	-30.2	-6.7	67.8	16.8	-16.2
Coal	1.4	-74.5	5.9^{*}	-108.8	0.0	-46.7
Wheat	-0.1	38.1	-7.7	15.3	5.0	10.6
Corn	-0.1	-21.3	-3.8	-0.4	0.1	-10.6
Soybeans	-1.3	14.2	-2.5	13.0	-5.7^{*}	11.5
Coffee	-7.3	43.1^{**}	8.8	-36.0	2.2	-6.9

Commodity	$GST^{RUS/USA}$		$GST^{CHN/IND}$		$GST^{IRN/USA}$	
	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$
Gold	4.8	2.5	1.1	11.9	-4.0	6.8
Silver	12.4^{**}	-32.4	-1.5	34.7^{*}	0.7	11.3
Copper	1.7	-90.1	1.5	65.3^{*}	-1.5	120.2^{*}
Aluminium	2.5	-22.5^{*}	-3.5	12.3	-3.3	18.8^{*}
Crude Oil WTI	7.4	-316.0^{*}	-1.8	69.4	-4.8	11.5
Crude Oil Brent	3.5	-30.6	-2.8	1.0	-8.3	59.7
Natural Gas	8.2	-52.1	16.0	26.4	-8.1	50.0
Coal	-6.2^{**}	35.1	2.9	-21.5	2.5	48.0
Wheat	7.0	43.1	2.2	24.1	3.9	-4.5
Corn	3.2	-27.4	4.2	32.0	1.2	-2.0
Soybeans	-2.3	-13.0	3.0	13.2	4.6	6.2
Coffee	4.1	40.3^{*}	-12.7^{*}	11.8	-5.0	-17.7

Reported coefficients are in units of 10^{-4}.
***, ** and * indicate 1%, 5% and 10% significance levels.

where GST_t^R is the GPR shock for region R, μ_{S_t} is the mean shock corresponding to regime S at time t, $\phi^1_{S_t}$ and $\phi^2_{S_t}$ are the first- and second-order regression coefficients of regime S, ε_t is the error term, and $\sigma^2_{S_t}$ is the variance of the error term in regime S.

Table B1: Regime probabilities and durations of regional GSTs

	Low-volatility regime			High-volatility regime		
GST^R	p_{11}	D_1	N_1	p_{22}	D_2	N_2
GST^{NA}	0.9514***	21	1528	0.7006***	3	157
GST^{Europe}	0.8746***	8	1500	0.5294***	2	185
GST^{LATAM}	0.8286***	6	1533	0.0025***	1	152
GST^{APAC}	0.9246***	13	1579	0.3951***	2	106

***, ** and * indicate 1%, 5% and 10% significance levels for the probabilities.
Duration is expressed in days.
N_1 and N_2 represent the total number of days spent in regimes 1 and 2, respectively, over the analysis period.

Table B1 reveals that regional GST exhibits limited persistence overall, but it tends to remain longer in the low-volatility regime compared to the high-volatility regime across all regions. In particular, the low-volatility regime shows strong persistence in North America and Asia Pacific, with probabilities of staying in this regime at 0.9514 and 0.9246, respectively. Europe and Latin America also demonstrate notable persistence, with respective probabilities of 0.8746 and 0.8286. On the other hand, the high-volatility regime is much less stable. The likelihood of remaining in this regime once entered is considerably lower: 0.7006 in North America, 0.5294 in Europe, 0.3951 in Asia Pacific, and only 0.0025 in Latin America.

Correspondingly, the duration of high-volatility periods is quite short, lasting only a few days–3 days in North America, 2 days in Europe and Asia Pacific, and just 1 day in Latin America. In contrast, the low-volatility periods persist much longer, averaging 21 days in North America, 13 days in Asia Pacific, 8 days in Europe, and 6 days in Latin America (Table B1).

Table B2: MS results of regional GSTs

	Low-volatility regime				High-volatility regime			
GST^R	μ_1	ϕ^1_1	ϕ^2_1	σ^2_1	μ_2	ϕ^1_2	ϕ^2_2	σ^2_2
GST^{NA}	−0.09***	−0.36***	−0.21***	0.39***	0.26***	−0.46***	−0.36***	2.57***
GST^{Europe}	−0.12***	−0.33***	−0.19***	0.33***	0.21***	−0.41***	−0.18**	2.05***
GST^{LATAM}	−0.08***	−0.19***	−0.13***	0.33***	−0.43***	−0.15***	−0.01	5.45***
GST^{APAC}	−0.10***	−0.30***	−0.15***	0.29***	0.35***	−0.95***	−0.64***	2.29***

***, ** and * indicate 1%, 5% and 10% significance levels.

The results of the MS model, presented in Table B2 indicate that regional GSTs exhibit a mean, variance, and two autoregressive coefficients that switch between low- and high-volatility regimes. The exception is the Latin American GST, which shows a second-order autoregressive coefficient only in the low-volatility regime. Notably, the daily variance is high even in the low-volatility regime, reflecting the substantial volatility of regional news-driven GPR shocks. All four regional GSTs display a negative mean in the low-volatility regime, which shifts to a positive mean in the high-volatility regime — except for the Latin American GST, which maintains a negative, but more pronounced, mean across regimes. Examining the autoregressive coefficients, both are negative in each regime, suggesting that regional GSTs are negatively influenced by their first- and second-lagged values, with a tendency to reverse direction from one day to the next. The magnitude of this autocorrelation ranges from moderate to strong, between −0.13 and −0.95.

Table B3: Correlation between the dominant regimes and regime probabilities of regional GST with regional equity indices

Region	$\rho_{\frac{\text{Dominant index regime}}{\text{Dominant GST regime}}}$	$\rho_{\frac{\text{Index regime probability}}{\text{GST regime probability}}}$
North America	0.0007	−0.0044
Europe	0.0002	−0.0160
Latin America	0.0525	−0.0264
Asia Pacific	0.0091	−0.0095

Examining the results of the MS model applied to regional GST in this section and those of the MS model applied to regional equities in Section 2.3, we find no significant correlation between the dominant regimes of regional GST and the dominant regimes of equities within the same region, with correlation values close to zero (Table B3). Similarly, there is no meaningful correlation between the switching probabilities of regional GST and those of the corresponding regional equities.

C An alternative modeling approach for sovereign bonds using spread-based regimes

In this section, we propose an alternative approach to analyze sovereign bonds within a two-regime framework. Since spreads are commonly used to assess bond risk, we adopt a method in which the regime at time t is observed and identified deterministically based on the level of the bond's spread at that time. In this specification, regime switching does not follow a Markov process; instead, transitions are imposed by a spread threshold. The threshold is defined as the 75^{th} percentile of the spread time series for each bond index. This choice is motivated by the fact that models estimated with this threshold exhibit the lowest AIC and BIC among the alternatives tested. Observations below this threshold are classified as belonging to a low-risk regime (represented hereafter as low-spread regime), while those above it correspond to a high-risk regime (represented hereafter as high-spread regime). The datasets are therefore divided into two subsets — one for each regime — and the parameters are estimated using ordinary least squares (OLS) regressions with a heteroskedasticity-and-autocorrelation-consistent (HAC) estimator[12]. The regressions equations mirror those of the autoregressive MS model of Hamilton (1989):

$$r_t^C = \mu_{S_t} + \beta_{S_t} GST_t + \phi_{S_t} \left(r_{t-1}^C - \mu_{S_{t-1}} - \beta_{S_{t-1}} GST_{t-1} \right) + \varepsilon_t \tag{10}$$

$$\text{with} \quad S_t = \begin{cases} 1, & \text{if spread} \leq 75^{\text{th}} \text{ percentile,} \\ 2, & \text{otherwise.} \end{cases}$$

Remark 5. *Another alternative approach consists of applying a simple MS model with switching means and variances directly to bond spreads to identify distinct spread regimes. Bond returns can then be divided into two subsets corresponding to these regimes, and the exposure of sovereign bonds to GPR can be assessed separately within each regime through two regressions — one for each spread regime.*

[12] The HAC estimator used is the Newey-West estimator (Newey and West, 1994).

C.1 Impact of regional GPR

Table C1 presents the regime probabilities and average durations under the imposed spread-regime model. The results indicate that all bond indices exhibit greater persistence in the low-spread regime compared to the high-spread regime. Specifically, all bonds show high persistence in the low-spread regime, with probabilities exceeding 0.9703, corresponding to an average duration of 34 days, except for Australian bonds, which have a slightly lower persistence probability of 0.9543 and an average duration of 22 days. In contrast, the high-spread regime is less persistent, with probabilities ranging from 0.8651 for Australian bonds to 0.9832 for Chinese bonds.

Table C1: Regime probabilities and durations for sovereign bonds under the threshold regime model

Region	Bond index	Low-spread regime		High-spread regime	
		p_{11}	D_1	p_{22}	D_2
NA	United States	0.9839	62	0.9495	20
	Canada	0.9775	44	0.9330	15
Europe	France	0.9872	78	0.9639	28
	Germany	0.9856	69	0.9590	24
	United Kingdom	0.9920	125	0.9783	46
	Switzerland	0.9864	73	0.9591	24
LATAM	Mexico	0.9703	34	0.9087	11
	Brazil	0.9751	40	0.9277	14
APAC	Australia	0.9543	22	0.8651	7
	Japan	0.9839	62	0.9519	21
	China	0.9944	178	0.9832	60
	India	0.9769	43	0.9305	14
	South Korea	0.9880	83	0.9640	28

Duration is expressed in days.

The regressions parameter estimates are reported in Table C2. Overall, bond index returns do not exhibit a significant trend, as mean returns are generally statistically insignificant. Exceptions include German, Mexican, and Japanese bonds in the low-spread regime, as well as Chinese bonds in the high-spread regime. Several bond indices display weak first-order autocorrelation in at least one regime: German, Mexican, and South Korean bonds in the low-spread regime (with coefficients ranging from 0.055 to 0.080), and Canadian, Swiss, Japanese, Indian, and South Korean bonds in the high-spread regime (coefficients between 0.101 to 0.199).

Regarding variances, a low-spread regime (or high spread regime) is not necessarily associated with low (or high) volatility. Variance estimates appear scattered across the two spread regimes with no systematic pattern. Applying a MS model with switching variances, as described in Section 3.2, confirms that low-volatility (high-volatility) regimes are not consistently linked to lower (higher) spreads (see Figure A2 on page 41).

Concerning exposure to regional GPR, Asia Pacific bond markets are primarily affected during the low-spread regime: Australian, Indian, and South Korean bonds exhibit negative exposure, while Japanese bonds display positive exposure to the region's GPR. Australian bonds also show a more pronounced negative exposure — more than twice as large — during the high-spread regime. In North America, Canadian bonds exhibit negative exposure in low-spread periods, whereas US bonds show positive exposure during high-spread periods. No significant effects are observed for other regions.

Table C2: Results of the threshold regime model on sovereign bonds indices

Region	Bond index	Low-spread regime				High-spread regime				$\lvert\beta_2/\beta_1\rvert$
		$\mu_1(10^{-4})$	$\beta_1(10^{-4})$	ϕ_1	$\sigma_1^2(10^{-4})$	$\mu_2(10^{-4})$	$\beta_2(10^{-4})$	ϕ_2	$\sigma_2^2(10^{-4})$	
NA	United States	0.1	−1.3	0.018	0.2	−2.1	3.2*	−0.064	0.2	2.5
	Canada	−1.6	−3.0*	0.034	0.4	1.5	−1.7	0.119**	0.3	0.6
Europe	France	−2.4	1.5	0.069	0.4	2.1	−1.5	0.067	0.5	1.0
	Germany	−3.4**	1.1	0.080*	0.4	4.4	2.0	0.034	0.4	1.8
	United Kingdom	−0.7	−0.8	0.043	0.5	−1.8	−4.6	0.166	0.7	5.9
	Switzerland	0.0	2.8	0.055	0.4	1.2	2.1	0.154**	0.3	0.7
LATAM	Mexico	6.1**	1.6	0.055*	0.8	−7.1	−5.9	0.000	1.7	3.7
	Brazil	1.6	2.7	−0.048	2.3	−4.1	4.5	0.021	2.1	1.6
APAC	Australia	−0.3	−4.6**	−0.025	0.6	−2.9	−9.8**	−0.010	0.8	2.1
	Japan	−4.7**	6.3**	0.005	0.5	1.0	4.4	0.112*	0.3	0.7
	China	−0.5	−1.0	−0.045	0.1	3.0**	−1.7	−0.047	0.1	1.7
	India	0.3	−4.0***	−0.009	0.1	1.7	−3.2	−0.101**	0.2	0.8
	South Korea	−1.8	−8.6***	−0.067**	0.6	0.1	−0.4	−0.199***	0.3	0.1

***, ** and * indicate 1%, 5% and 10% significance levels.

C.2 Impact of national GPR

Analyzing the impact of national GPR on sovereign bond indices, we find that eight indices show no significant exposure to their respective national GPR (Table C3). In the low-spread regime, Swiss and Japanese bonds display positive exposure to their countries's GPR, whereas Indian bonds show negative exposure. In the high-spread regime, US bonds exhibit positive exposure, while Mexican bonds display a negative and substantial exposure, reaching −18.5.

Table C3: Exposure of bond indices to national GPR under the threshold regime model

Region	Bond index	$\beta_1^C(10^{-4})$	$\beta_2^C(10^{-4})$	$\lvert\beta_2^C/\beta_1^C\rvert$
NA	United States	−1.5	3.1*	2.1
	Canada	−1.1	1.4	1.2
Europe	France	0.0	2.3	100.4
	Germany	1.2	0.7	0.6
	United kingdom	−1.1	−0.8	0.7
	Switzerland	4.2**	0.9	0.2
LATAM	Mexico	3.1	−18.5***	6.0
	Brazil	4.9	0.1	0.0
APAC	Australia	−2.3	−5.2	2.2
	Japan	5.5*	5.1	0.9
	China	−1.0	−0.5	0.5
	India	−2.7***	−0.4	0.2
	South Korea	−4.1	−0.9	0.2

***, ** and * indicate 1%, 5% and 10% significance levels.

C.3 Impact of bilateral tensions

Table C4 summarizes the exposure of sovereign bond indices to six major bilateral tensions.The results differ substantially from those obtained in Section 3.2, where the same analysis was conducted using a MS autoregressive model that does not incorporate spread information.

Russia-Ukraine tensions emerge as the most impactful and primarily affect European bond markets. UK and French bonds exhibit exposure in both regimes. Swiss bonds are affected during the low-spread regime, while UK bonds are impacted during the high-spread regime. Outside Europe, Canadian bonds show exposure in the low-spread regime, US bonds in the high-spread regime, and Japanese bonds maintain positive exposure across both regimes. Notably, all these exposures are positive, suggesting that heightened tensions are associated with higher bond returns.

China-USA tensions affect bond markets across multiple regions. Canadian, Mexican, and Australian bonds exhibit negative exposure during low-spread periods, whereas UK, Japanese, and South Korean bonds benefit from positive exposure during high-spread regimes.

Iran-USA tensions also exert significant effects, mainly in Europe and the Asia-Pacific region. Swiss and Indian bonds are affected during low-spread periods — positively for Switzerland and negatively for India — while French and German bonds display positive exposure during high-spread regimes. Japanese bonds show a mixed response, with positive exposure in the low-spread regime and negative exposure in the high-spread regime.

China-India tensions have a significant impact primarily within the Asia-Pacific region. Indian bonds are negatively affected in both regimes, with the effect being 1.7 times stronger during high-spread periods. Australian bonds also exhibit negative exposure during low-spread regimes. Conversely, Japanese bonds appear to benefit from these tensions, showing positive exposure in the high-spread regime. Outside the Asia-Pacific region, Mexican bonds display negative exposure during low-spread periods.

Mexico-USA tensions have a relatively mild effect on bond markets. Mexican, Australian, and Chinese bonds exhibit positive exposure during low-spread regimes, while Japanese bonds are negatively affected during high-spread periods. Finally, Russia-USA tensions are the least influential, with Indian bonds showing negative exposure during low-spread periods and Japanese bonds exhibiting positive exposure during high-spread regimes.

Table C4: Exposure of bond indices to bilateral GPR under the threshold regime model (Univariate MS model)

Bond index	$GST^{CHN/USA}$		$GST^{RUS/UKR}$		$GST^{MEX/USA}$	
	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$
United States	−0.9	0.3	2.9	3.2*	0.7	−0.2
Canada	−2.7*	−4.8	0.4***	10.8	1.1	−1.4
France	−1.8	−3.4	3.3**	7.9*	1.6	0.8
Germany	−1.4	−2.8	3.7*	7.5**	1.9	−0.6
United Kingdom	−3.9	1.3*	4.3	6.4*	0.8	3.8
Switzerland	0.8	−2.7	3.6**	6.1	2.7	−4.8
Mexico	−4.3*	−11.0	6.9	11.1**	2.4***	−21.4
Brazil	−0.2	−2.5	6.6	2.6	0.5	1.2
Australia	−2.8*	−8.0	3.1	8.5	1.9**	7.4
Japan	3.4	1.1*	6.6**	6.3**	4.2	−2.6*
China	−0.3	−0.6	1.0	0.5	0.6*	3.1
India	−1.5	−3.1	−0.2	−1.7	−1.8	1.5
South Korea	−5.2	3.5**	2.2	3.7	−0.5	3.4
Bond index	$GST^{RUS/USA}$		$GST^{CHN/IND}$		$GST^{IRN/USA}$	
	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$	$\beta_1^{C_i/C_j}$	$\beta_2^{C_i/C_j}$
United States	1.0	−0.5	1.0	−1.7	−1.3	2.4
Canada	−1.5	−0.1	−2.3	−4.0	0.8	−2.6
France	−0.2	−2.0	0.6	1.9	−3.8	3.3**
Germany	0.2	−2.9	0.7	3.8	−3.8	3.7**
United Kingdom	−1.4	−1.5	−2.2	2.6	−3.6	4.8
Switzerland	1.1	0.6	1.6	3.4	0.2**	−6.4
Mexico	−0.5	−2.5	−4.0*	−8.7	−0.3	−4.0
Brazil	−2.9	−7.4	−5.4	−8.1	1.9	−9.4
Australia	−1.8	−2.6	−1.0**	−9.7	−0.5	−10.5
Japan	3.9	0.7**	5.0	4.9**	3.8**	−6.2*
China	−0.1	−2.0	1.4	−0.1	−0.3	−2.0
India	−1.3*	−4.5	−2.7*	−4.8**	−1.8**	−8.6
South Korea	−1.7	−0.2	−1.1	1.5	−0.9	−0.1

Reported coefficients are in units of 10^{-4}.
***, ** and * indicate 1%, 5% and 10% significance levels.

Investment Institute

WORKING PAPER 183 | **MARCH 2026**

Find out more about Amundi Investment Institute Publications

Visit our Research Center

SCAN ME

Amundi
Investment Solutions

Trust must be earned