Master Thesis U.S.E.

Impact of Geopolitical risks on the Food, Beverage & Tobacco industry

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Abstract

This thesis investigates the impact of geopolitical risks on the stock performance of the Food, Beverage, and Tobacco (FBT) industry. Utilizing a comprehensive dataset from 1999 to 2024, including 110 firms, this study employs a Fixed Effects (FE) model to analyze the way geopolitical acts and threats influence FBT stock prices. The findings reveal a significant negative impact of geopolitical acts on stock prices, while geopolitical threats exhibit a positive effect, indicating potential safe havens during heightened geopolitical tensions. The analysis also highlights the regional differences in the impact of geopolitical risks. The research underscores the importance of considering geopolitical risks in investment strategies and policy-making within the FBT industry.

JEL classifications: C12, C33, G11, G15.

Keywords: Geopolitical risks, panel data, Food, Beverage & Tobacco, stock prices.

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1. Introduction

The interplay between geopolitical risk and stock return is critical in today's global economic landscape. According to the findings of the 2017 Wells Fargo/Gallup Survey, a significant majority of investors, bankers, and other market participants, totaling 75%, expressed concerns regarding worldwide military and diplomatic conflicts potentially impacting the US investment climate. This apprehension surpassed worries about the political climate, which stood at 69%, and the performance of the economy, which registered at 49%.

Geopolitical risks exert a notable influence on food prices and markets due to various interconnected channels. Smales (2021) highlights a robust correlation between the Geopolitical Risk (GPR) index and oil prices, while AL-Rousan et al. (2024) affirm that higher oil prices coincide with increased food prices. Moreover, AL-Rousan et al. (2024) underscore the ramifications of geopolitical events such as the COVID-19 pandemic and the Russia-Ukraine conflict on escalating food prices.

Understanding the impact of geopolitical crises on food production is pivotal, especially within the food, beverage, and tobacco (FBT) industry. Deng (2024) emphasizes that such crises can trigger adverse shocks, exacerbating food shortages and posing threats to global food security. This is particularly concerning for countries with low GDP, as they are more susceptible to disruptions in food availability due to geopolitical unrest. In this context, studying the Food, Beverage, and Tobacco industry gains significant importance given its substantial economic contributions and integral role at the global level.

Food prices are influenced by various factors, including climate change, economic fluctuations, and political shocks. According to the World Food Programme's (WFP) 2023 report, the global community experienced the most severe famine since 1995, which was accompanied by a significant rise in inflation rates worldwide. Key contributors to supply chain disruptions and subsequent price increases included the COVID-19 pandemic, the Ukraine-Russia conflict, and the Israeli-Palestinian conflict. In the aftermath of the Ukraine-Russia war, global food prices in December 2022 were 14.3% higher than in December 2021. During the same period, the global prices of maize and wheat surged by 24.8% and 15.6%, respectively (WFP, 2023). Additionally, the climate crisis played a substantial role. As outlined by the WFP (2023), the decade from 2012 to 2022 witnessed severe droughts and floods across different regions.

Although the Food and Beverage industry does not account major part for the World's Gross Domestic Production, in terms of workforce and food security it is important to understand the dynamics and channels affecting the industry. Top FD&T companies are from Europe and the US, however, the sector is on the increase in emerging and developing countries, especially in Brazil, India, and China, countries with enormous populations. It is also worth mentioning that the Food and Drinks sector purchases almost 80% of the agricultural products, which contributes to rural livelihoods (ILO, 2020).

Even though the Food Drink sector is comparatively on a decline in developed countries, as highlighted by the Food & Drink Europe report, the FBT sector stands as the foremost manufacturing industry in Europe, generating an impressive €1,112 billion in revenue and employing approximately 4.6 million individuals. With household expenditure on food and drinks averaging 21.4% and totaling €1,551 billion in 2023, these industries are indispensable components of the European economy and essential for the well-being of consumers. Therefore, examining the FBT industry is essential not only for understanding the economic dynamics of the region but also for comprehending how geopolitical risks impact food markets and prices, ultimately affecting consumer welfare and global food security.

Looking ahead, the projected increase in the global population to 9.8 billion by 2050 indicates a corresponding rise in food demand, estimated to surge between 35-56% (van Dijk et al., 2021). Consequently, the financial performance of food and beverage companies becomes paramount in ensuring global food security. Given the interconnectedness of markets, any shock to one region would have global repercussions, while a global shock would cause a domino effect in other markets (Omar et al., 2017). Thus, understanding the impact of geopolitical risk on FBT stocks is imperative. In light of the aforementioned discussion, this research aims to address the following question:

Research Question: How does geopolitical risk impact the stock performance of Food, Beverage, and Tobacco companies, and what are the implications for global food security?

In this paper, the Geopolitical Risk (GPR) Index, developed by Caldara and Iacoviello in 2018, is utilized for the analysis as a fundamental tool. This index, available in both monthly and daily frequencies and tailored to specific countries, serves as a comprehensive measure of geopolitical risk. Spanning back to the year 1985 and updated weekly, benchmark GPR draws upon data from 11 prominent English-language newspapers from the US, Canada, and the GB, employing automatic text searches to capture a broad spectrum of geopolitical events. Ranging from terror attacks to climate change to financial upheavals, these events collectively contribute to the index's calculation.

Additionally, Baker et al. (2016) introduced the Economic Policy Uncertainty (EPU) index, which shares similarities with the Geopolitical Risk (GPR) index. Their findings suggest that elevated levels of the EPU index correspond to increased volatility, reduced investment, decreased output, and employment declines across various sectors in the United States. Specifically, the health, defense, construction, and financial sectors are notably affected.

Caldara and Iacoviello’s research, as cited in 2022, highlights the substantial influence of geopolitical risk on financial markets. Their study indicates that increased geopolitical tensions, as denoted by a higher GPR, are associated with diminished stock prices. Similarly, Balcilar (2016) examined the impact of GPR on stock markets in BRICS countries and found significant effects in some countries, and also for stocks with below-average returns. In contrast, Bouras (2018) finds a relationship between the GPR index and stock volatility of 18 emerging markets, but no impact on returns. Conversely, Logrono's study in 2022 concludes that there is a relationship between both GPR Acts and returns, as well as GPR Threat and stock volatility for stocks listed in STOXX 600 Europe.

The stock performance of FB&T companies holds significant importance for global food security due to several reasons. Firstly, these companies play a vital role in ensuring the availability and accessibility of food products to consumers worldwide. Any disruptions or challenges faced by these companies can directly impact the supply chain, potentially leading to shortages or price volatility in essential food items (Šimáková et al., 2019). Additionally, Saâdaoui et al. (2022) have observed that geopolitical events such as Brexit, the Ukraine-Russia war, and the COVID-

19 pandemic have had a significant impact on rising food prices. Secondly, the financial health and stability of these companies influence their ability to invest in research and development, innovation, and infrastructure, all of which are crucial for enhancing agricultural productivity, improving food quality, and addressing sustainability challenges in food production. Moreover, according to Ramiah et al. (2019), geopolitical risk can disrupt supply chains and company operations, dampen consumer confidence, subsequently affect consumption patterns, and have significant impacts on commodity markets. The stability of FB&T companies is essential for meeting the increasing demand for food products resulting from population growth and changing dietary preferences.

This paper makes several notable contributions to the existing literature. Firstly, it addresses a gap by investigating the impact of geopolitical risk on the Food, Beverage, & Tobacco stocks, an area that has not been extensively researched before and the impact on the market is inconclusive. While previous studies have examined the effects of geopolitical risk on commodities and overall stock returns and volatility, this paper focuses specifically on the food, beverage, and tobacco industry stocks. Given the essential nature of these industries for food security, particularly in light of global population growth, this is a significant area of inquiry.

Secondly, this paper covers stocks from different regions and countries, making it a comprehensive study within a specific sector and presenting potential differences between regions, while previous studies focused on one specific region or market. For example, Balcilar (2018) focused on the BRICS countries' stock markets, Chandra (2019) studied the Indonesian stock market only, and Bouras (2018) took the emerging markets as a focus.

Lastly, this research sheds light on a counter-cyclical and traditional industry that has not been studied distinctly before. The food beverage and tobacco industry is one of the traditional industries and is usually considered a stable industry due to the characteristics of its products. Based on the results of this research, it can be seen whether this industry can act like a haven on the verge of increasing geopolitical risks due to its counter-cyclical behavior.

The subsequent section offers an overview of prior research findings pertinent to the topic at hand. Following this, Section 3 delves into the theoretical framework and formulates the research hypotheses. Section 4 outlines the dataset utilized for empirical analysis and details the models employed to test the hypotheses. The ensuing Section 5 presents the findings of the analysis. Section 6 discusses the robustness checks undertaken to validate the reliability of the analysis. Lastly, Section 7 summarizes the outcomes and draws conclusions based on the findings presented in this paper.

2. Literature Review

Previous research has explored the influence of geopolitical risk on stock markets, typically concentrating on specific industries or countries, leading to varied results depending on the focus. Balcilar et al. (2016) studied the impact of geopolitical risk on the return and volatility of the BRICS stock market by implementing the GPR index, via the causality-in-quantiles method. They find that impact is not homogenous across the stock market and volatility is more affected than returns by the geopolitical risks. While financial markets in Russia experienced the volatility shocks the most, the Indian stock market was the most resilient within BRICS countries. As a possible explanation, they argue that high domestic demand and lower exposure to the US dollar make the Indian stock market less volatile than the rest of the BRICS markets. Additionally, the IT boom observed during the sample period can be another explanation. Their research indicates strong evidence of causality for stock-market returns in most countries. On the other hand, they observed that acts of terror impacted volatility only in Japan and the UK for their sample. Moreover, their research also sheds light on the different quantiles of the conditional distribution of returns. The firms below the median stock return were more strongly impacted by the effects of GPR. Additionally, they find no difference within geopolitical tensions: from terror attacks to wars, investors react to the news in the same behavior (Balcilar et al, 2016).

Bouras et al. extend the BRICS research by including 13 other emerging country markets and also take into account the importance of country-level and global GPR indices. For this purpose, they employed the panel GARCH model and stated important results. They first used the country-level GPR index and did not find statistical significance in the stock returns. On the contrary, when the impact of a broad measure of global GPR is studied, they indicate a strong influence on the volatility of the market, even though still no significance for returns.

Schroders's 2019 research adopted a distinctive approach, spearheaded by Wade and Lauro, who scrutinized market behavior and investor sentiment surrounding major geopolitical events spanning from 1985 to January 2019. Using the GPR index to gauge geopolitical risk, they classified events with an index reading above 100 as major. Initially, they presented cumulative returns during these global events, noting that Gold exhibited the highest returns, closely followed by US 10-year Treasury bonds, albeit with a slightly lower yet still positive return. Conversely, the S&P 500 and MSCI indices experienced approximately a 10% decrease in their returns. Concluding that safe-haven assets yield superior returns during geopolitical events, they constructed three portfolios to evaluate asset performance across five major events. The safe portfolio allocated 50% of its assets to US 10-year government bonds, with the remaining weight equally distributed among gold, the Swiss franc, and the Japanese yen. The risky portfolio comprised 50% of the S&P 500, while the remainder was divided between the MSCI World Index (25%) and the MSCI Emerging Market (EM) equity index (25%). The third portfolio consisted of a 60/40 ratio of safe and risky assets.

The results indicate that, except for the annexation of Crimea and the rise of ISIS in 2014, the safe portfolio's return and Sharpe ratio were consistently positive and higher than those of the risky and 60/40 portfolios during the remaining four major events. However, they also assessed returns at the point of extreme risk, defined as a GPR above 200. In three out of five cases, the risky portfolio outperformed the safe portfolio (Wade & Lauro 2019). Additionally, the risky portfolio began to recover even before the index fell back. Overall, it's evident that each geopolitical risk possesses unique characteristics, and investors perceive them individually.

The geopolitical risk can affect markets depending on the country. Chen et al. (2014) utilize an event study methodology to examine the impact of terrorism on both US and global markets. Their findings indicate that the US market tends to recover more swiftly from such events compared to global markets. Moreover, they observe that the impact of terrorism on markets has diminished over time. They attribute this trend partially to the growth of the financial sector, which provides sufficient liquidity to foster market stability and mitigate panic reactions.

Chesney et al. also conducted an event study to analyze the impact of the number of terror attacks across various industries and financial indices in different countries. Their findings suggest that the United States experiences relatively less impact from terror attacks, whereas Switzerland is the most affected. Interestingly, the commodity and gold markets, typically regarded as safe havens, exhibit prolonged negative effects. Among industries, the airline and insurance sectors are the most affected, whereas the banking sector appears to be the least sensitive to terror attacks. Additionally, Fossung et al. (2021) examined the effects of geopolitical events on the Information Technology, Communication Services, and Consumer Staples sectors of the S&P 500 Index. Their findings yield contrasting results: a positive impact of Geopolitical Risk (GPR) on the Information Technology sector while indicating a negative impact on the Consumer Staples sector.

In contrast to previous literature, Logrono (2022) concentrated on the European stock market to evaluate the impact of geopolitical risk. This study stands out for its focus on firm-level geopolitical risks and its departure from conventional findings on stock returns. Logrono investigated the influence of the firm-level GPR index on both stock returns and volatility of companies listed in STOXX Europe 600. The findings suggest that stock returns are affected by increasing geopolitical actions rather than threats. Conversely, geopolitical threats exhibit a positive relationship with stock return volatility, whereas geopolitical actions do not. Meanwhile, Umar et al. (2022) have discovered a mixed pattern of positive and negative relationships between the returns of various assets and geopolitical risk. Their conclusion suggests that the effect depends on the type of market and its prevailing conditions.

3. Theoretical Framework and Hypotheses

This study aims to use the GPR indices to investigate the direct relationship between geopolitical events and the stock prices of FBT companies. Given the various channels through which increased risks can impact those listed stocks, this research builds upon previous findings to establish several hypotheses regarding the expected results.

Research by Caldara and Iacoviello (2022) reveals that heightened geopolitical tensions, reflected by a higher GPR, correspond with lower stock prices. Additionally, Fossung et al. (2021) state the negative impact of geopolitical events on consumer staples stocks of the S&P 500. Berkmann et al. (2011) assert that changes in disaster risk harm consumer confidence, while Logrono (2022) finds the impact of actual events on stock prices rather than threats. Through this channel, they argue that both stock returns and prices are affected.

Hypothesis 1:

Geopolitical events and acts harm FBT stock prices.

Indeed, the opposite perspective can also be applicable when considering the stable and safe characteristics often associated with the food and drinks sector. According to the findings of Omar et al. (2017), during international crises and wars, returns on oil and international sovereign bond indexes exhibited abnormally high returns around the event dates. Schroders's 2019 study also states that safe-haven assets yield superior returns during geopolitical events, noting that Gold exhibited the highest returns, closely followed by US 10-year Treasury bonds. Additionally, Baker et al. (2016) state the correlation between higher EPU Index and reduced investment, and decreased output in cyclical sectors. This suggests that these investments can potentially offer protection to investors as a safe haven during such turbulent times.

Hypothesis 2:

Increased geopolitical threat positively affects the Food, Beverage, and Tobacco stock prices

Salisu et al. (2021) reveal that markets tend to experience greater adverse effects from the perceived threat of geopolitical risks compared to actual geopolitical events or acts. According to the Efficient Market Hypothesis (EMH), proposed by Fama in 1970, stock prices are believed to fully incorporate all available information about the stock. As per this hypothesis, any perceived news should already be factored into the market before the act itself.

Hypothesis 3:

Geopolitical threats have a stronger effect than actual events on stock prices.

Moreover, Hon et al. (2004) present evidence indicating that the European market exhibits a notably swifter response than other markets to shocks originating in the US market. Meanwhile, Bouras et al. (2019) state that emerging markets are much more strongly affected by geopolitical risk than developed markets. This heightened responsiveness is attributed to the increased interconnectedness of global markets. Hoque and Zaidi, (2020) find results supporting emerging markets are more highly exposed to geopolitical risk than developed markets. On the contrary Fernandez (2008) also shows that political instability and events in the Middle East mostly hit the developed markets.

Hypothesis 4:

Western and Non-western listed companies' stock prices react differently to geopolitical events.

To account for the cases where a conflict or event was followed by faster or slower economic growth, the quantile regression method is used by Caldara and Iocevello (2022) since it can be associated with different outcomes at the low and high quantiles of the distribution. Results show that the tenth quantile faced a 4 times larger decline in the economy than OLS by increase in political tensions. However, the ninetieth quantile showed only slightly increased (Caldara & Iacoviello, 2022). Balcilar et al. (2016) also find a stronger impact of risk on the extreme tails of the conditional distribution of stock-market returns. Additionally, Gkillas et al. (2018) also states stronger impact for quantiles in higher GPR levels.

Hypothesis 5:

Extreme geopolitical events and threats have much higher magnitute in stock prices.

4. Data and Methodology

4.1. Data

To investigate the proposed topic and test the hypotheses, the first step was data collection, covering the period from 1999 to 2024. This period is choosen as it covers the geopolitical risk in 21st century. The firms included in this study are the largest firms, accounting for the majority of market capitalization. It worths mentioning that in this study, the imputation with mean method was applied to maintain as much data as possible for the analysis by filling in missing data with the mean for each individual variable. For various firms over the years, historical data for one or more variables was missing. To avoid dropping entire rows and thus having a smaller sample size, unbalanced panel data was utilized in this study.

The construction of GPR index in 2018 by Caldara and Iacoviello contributed substantially to the research by introducing consistent index that measures real-time geopolitical tensions. Additonal to daily general GPR Index, country specific monthly index is also available. Moreover, seperation between geopolitical threat and act is also important as timing of events matters for analysis. Since focus of this study is global food and drink sector, it can be questioned that how relevant is their GPR index which is derived from British and North American newspapers. Authors checked the sensitivity of language and region and state 0.88 correlation between the US and non-US newspapers showing global nature of events have similar coverage across all the newspapers. After constructing the index, they studied its impact on overall economy and stock market by employing VAR models, OLS, and quantile regression to account for possible differences in tails. Results show differences across countries and industries, but in general higher risk is accounted with adverse negative impact on stock prices.

4.1.1. Dependent variable

The dependent variable in this study is the yearly stock price, collected from the Eikon Database. The use of yearly frequency is due to the annual frequency of firm financial ratios used as control variables, which reduces the sample period. Dataset includes total of 110 firms across various regions and countries. Western firms consist of 28 European firms from 12 countries and

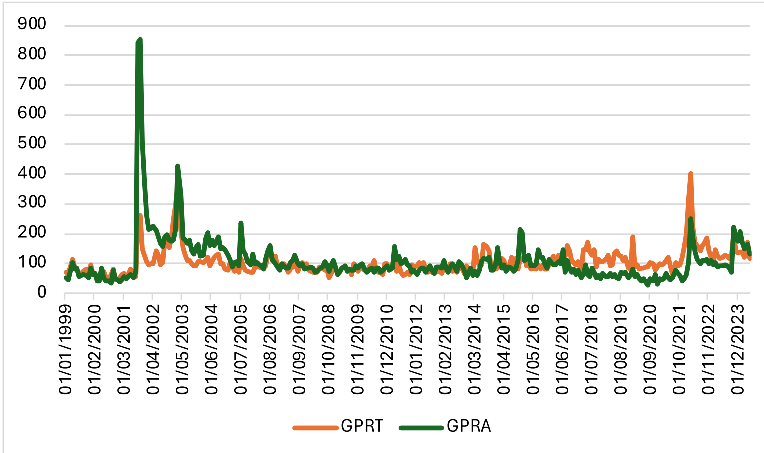
36 US based companies. The 46 Non-Western firms are from 16 countries, including those in the Middle East, Russia, Asia, Australia, and South America.

Unfortunately, it is not feasible to categorize these firms based on their specialization, such as food production, meat, or alcoholic beverages, because many firms, like Pepsico, are involved in the production of a wide range of products under a single umbrella. While it would be ideal to examine differences within the Food, Beverage, and Tobacco industry, the diverse product portfolios of these firms make such categorization impractical.

4.1.2. Independent variables

The Geopolitical Risk Index (GPR) developed by Caldara and Iacoviello in 2017 stands out as a reliable measure to account for global disturbance and it has been used by many authors to study the impact on financial markets**.** Both the GPR Threat and GPR Act indices are essential in understanding the impact of geopolitical risk on financial markets. The GPR Threat index provides insights into the perceived threat of geopolitical events, capturing anticipatory reactions and market sentiment regarding potential risks. On the other hand, the GPR Act index tracks actual geopolitical events as they unfold, reflecting tangible occurrences that may directly affect market dynamics. Utilizing both indexes allows for a comprehensive analysis of how market participants respond to both perceived and realized geopolitical risks, shedding light on the nuanced relationship between geopolitical events and stock market outcomes. Both of GPR indices are extracted from Matteo Iacoviello own website, where data is published in monthly and daily frequency and updated weekly. Yearly GPR indices are computed by taking average of past 12 months data in a year. General GPR index is dropped from the analysis since it is highly correlated with GPRAct and GPRThreat. Both indices over the past 25 years are shown in below figure.

Figure 1 GPR Threat vs GPR Act



Additionally, since GPR Act and GPR Threat indices are not entity variant, individual firm exposure to both of these indices are computed to include in this research.

This approach to measuring the exposure of returns to various variables is well-documented in academic literature. For example, Favara et al. (2020) determine an industry's exposure to Geopolitical Risk (GPR) by calculating the beta of the industry's monthly returns relative to changes in the GPR index, utilizing a 60-month rolling regression. Similarly, Hong & Kacperczyk (2009) estimate a firm's time-varying industry beta by analyzing monthly returns over the previous 36 months. Caldaza (2022) adopts a comparable method, employing 24 months of data to assess an individual firm's exposure to GPR risk.

To do this, past 12 months percentage changes in the GPRActs and GPRThreat indices are regressed on the 12 months stock price changes to compute $\text{GPRThreat}^{\text{Exposure}}$ and $\text{GPRAct}^{\text{Exposure}}$, and it is done by using the following equations:

1. $return_{i,t=\beta_0+\beta_1 \Delta GPRAct_t+\epsilon_{i,t}}$
2. $return_{i,t=\beta_0+\beta_1 \Delta GPRThreat_t+\epsilon_{i,t}}$

Where $return_{i,t}$ denotes the monthly returns of $firm_i$ over the last 12 months and *ΔGPRAct* and *ΔGPRThreat* represents the percentage changes in the GPR indices over past 12 month, calculated as $\frac{GPR_t - GPR_{t-1}}{GPR_{t-1}}$. Therefore, β_1 gauges the annual, firm-specific exposure of returns to changes in *GPRAct* and *GPRThreat* seperately. Thus, these 2 newly computed variables become eligible to be included and studied in Fixed Effects model, since they are both time and entity variant variables.

4.1.3. Control variables

Previous studies have identified several control variables essential for studying the relationship between stock market and GPR (Geopolitical Risk) index. One such variable is VIX, which is Chicago Board Volatiltiy Index and measures the implied volatility of the options and is used frequently to study the stock returns. Including VIX is crucial as it helps distinguish market risk attributed to geopolitical factors from overall market volatility and is used by many authors (Caldara&Iacoviello, 2018; Baker, 2016).

Oil is another widely used variable in stock market studies. Chandra (2019) finds significant and positive effect of oil prices on FBT stocks listed on the Indonesian Stock Exchange. Yearly crude oil prices were extracted from Factset for this research. Additionally, Smales (2021) provides evidence indicating that geopolitical risk is positively correlated with oil prices, demonstrating that as geopolitical risks increase, oil prices tend to rise.

Including the stock index as a control variable in this research is crucial for several reasons. It ensures the regression analysis produces accurate, unbiased, and interpretable results by isolating the specific effects of the variables of interest and controlling for market-wide movements. This inclusion enhances model specification and provides clearer insights into the data, leading to a more robust and comprehensive analysis of stock returns. The MSCI World Food, Beverage & Tobacco Index is used because historical data for the S&P 500 and STOXX 600 Food, Beverage & Tobacco indices is only available from 2009 and 2014, respectively. In contrast, MSCI historical data is available from 2004, making it the most suitable common index for all the included stocks.

Firm-specific variables, namely Return on Equity, Debt-to-Equity ratios, Earnings per Share, and Price to Earnings data, are collected from the Eikon Database. Hong & Kacperczyk (2009) have previously used Return on Equity (ROE) as a control variable to account for a firm's profitability. Murniati (2016) identifies significant impacts of the debt-to-equity ratio and return on equity on the stock prices of food and beverage companies listed on the Indonesian Stock Exchange.

The price-to-earnings and Earnings per Share ratios of each individual company are included as measures of the firm's valuation. Previous literature often incorporates a valuation ratio when analyzing the effect of various variables on stock returns (Hong & Kacperczyk, 2009). For instance, Berkman et al. (2011) find that both the PE ratio and the EPS for the S&P 500 index are significantly positively correlated with crisis risk. Lastly, 1 lag of log price variable is also included in the model to control for autocorrelation (Chen et al., 2013).

As presented in Appendix 1, distribution of variables Price, Price to Earnings, Debt to Equity and Enterprice value show a highly skewed distribution with a heavy right tail, which can lead to heteroscedasticity and inefficiency in parameter estimates. This skewness can violate the assumptions of normality and homoscedasticity that are crucial for accurate and reliable panel data regression analysis. By applying the log transformation, as depicted in the second histogram (Appendix 2), the distribution becomes more symmetric and closer to a normal distribution. This transformation reduces the influence of outliers and extreme values, making the variance more constant across observations. As a result, the regression model will produce more robust and interpretable results. Additionally, using the log-transformed variable helps in interpreting the coefficients in terms of percentage changes, which is often more intuitive and meaningful in economic and financial studies. Thus, the log transformation improves the suitability of the data for panel data regression and enhances the overall quality of the analysis.

Table 1 Definitions of variables

Variable	***Definition***	***Source***
Dependent Variable		
log_Price	Natural logarithm of stock Price	Eikon
Independent variables		
GPRAct	Geopolitical Risk Acts Index	Caldara & Iacovello (2018)
GPRThreat	Geopolitical Risk threats Index	Caldara & Iacovello (2018)

$GPRAct^{Exposure}$	Individual firm exposure to changes in the GPR Acts Index	Computed through regression
$GPRThreat^{Exposure}$	Individual firm exposure to changes in the GPR Threats Index	Computed through regression
Control variables		
Oil	Crude Oil Price	Factset
VIX	Chicago Board Volatility Index	Factset
Index	MSCI World F,B&T Index	Factset
EPS	Earning Per Share ratio	Eikon
ROE	Return on Equity ratio	Eikon
Log_EV	Enterprise Value	Eikon
Log_PE	Price to Earnings ratio	Eikon
Log_Debt	Debt to Equity ratio	Eikon
log_Price_lag1	Log_Price 1 year lagged	Computed through Python

4.2. Methodology

This research employs panel data, and Python software is used to investigate the impact of geopolitical risk on the Food, Beverage, and Tobacco industry. The appropriate regression method is selected using the Hausman test (Hausman, 1978), which compares Random Effects and Fixed Effects models. The Hausman test determines the suitability of these models by assessing whether the individual-specific effects are correlated with the independent variables.

After selecting the appropriate method, several different regressions are conducted by incrementally adding extra variables. This approach is beneficial for multiple reasons. Firstly, it allows for a more comprehensive analysis by progressively including additional factors that may influence the dependent variable. Each additional variable helps to isolate the specific impact of the main independent variables by controlling for other potential confounding factors. Secondly, by gradually incorporating more variables, the model can better account for variations in the data, reducing omitted variable bias and increasing the accuracy of the results (Wooldridge, 2016). Therefore to test the previously mentioned hypothesis, the following regression is employed:

$$log\_Price_{i,t} = \alpha_i + \beta_1 GPRThreat^{Exposure}{}_{i,t} + \beta_2 GPRAct^{Exposure}{}_{i,t} + \beta_3 GPRThreat_{i,t} + \beta_4 GPRAct_{i,t} + \beta_5 Oil_t + \beta_6 VIX_t + \beta_7 EPS_{i,t} + \beta_8 PE_{i,t} + \beta_9 ROE_{i,t} + \beta_{10} Debt_{i,t} + \beta_{11} log\_Price\_lag1_{i,t-1} + \varepsilon_{i,t}$$

This model, $log\_Price_{i,t}$ represents the stock price of firm *i* in year *t*, where α_i represents firm-fixed effects. ${GPR^{Threat}}_{i,t}$ and ${GPR^{Act}}_{i,t}$ measure the exposure of returns to changes in the GPR Threat and GPR Act index of firm *i* in year *t*, while $GPRThreat_t$ and $GPRAct_t$ which are general GPR indices per year *t*. Time invariant control variables include Oil_t and VIX_t that are yearly Crude oil price and yearly Chicago Board Volatility Index. Firm-specific control variables are $EPS_{i,t}$, denoting Earning per Share, $PE_{i,t}$ is Price to Earnings ratio, $ROE_{i,t}$ measures the Return on Equity, $Debt_{i,t}$ denotes Debt to Equity ratio, all for firm *i* at year *t*. Finally, $log\_Price\_lag1_{i,t-1}$ represents the one-year lagged logarithmic stock price for firm *i* at year *t-1*, and $\varepsilon_{i,t}$ represents the error term for firm *i* at year *t* in the model.

Additionally, to test the previously mentioned, 4th hypothesis, the regression model is applied separately to Western and Non-Western firms. Separating the analysis between Western and Non-Western firms is beneficial for several reasons. First, it allows for a more nuanced understanding of how geopolitical risks affect firms in different regions. This differentiation is crucial because economic, political, and market structures vary significantly between these regions. Western countries often have more stable political environments and mature financial markets, which might influence how geopolitical risks are perceived and managed by firms. In contrast, Non-Western countries may have more volatile political climates and emerging markets, leading to different responses to geopolitical events.

Previous literature supports this regional differentiation, finding distinct empirical results for developed versus developing countries or other regions. For instance, studies focusing on U.S. stock markets often highlight the resilience of these markets to geopolitical risks, while research on emerging markets reveals a greater sensitivity to such risks (Bouras et al., 2019), and Hoque and Zaidi (2020) find differences between developed and emerging markets.

By conducting separate analyses for Western and Non-Western firms, this research can better capture these regional differences, leading to more accurate and relevant conclusions. It enables a tailored examination of how geopolitical risks influence firm performance in diverse economic and political contexts, ultimately providing deeper insights into the global impacts of geopolitical events on the Food, Beverage, and Tobacco industries.

5. Results

5.1. Descriptive statistics

Table 3 presents descriptive statistics and shows the mean, standard deviation, maximum, and minimum values for the variables used in the general Fixed Effects (FE) model over the sample period from December 1999 to May 2024. Before delving into the regression analysis, it is important to observe how the Beta_Act and Beta_Threat variables are almost identically opposite.

Table 2 Descriptive statistics for the FE model

	count	***mean***	***std***	***min***	***max***
log_Price_lag1	2105	2,828403	1,462583	0,001187	9,410245
log_Debt	2105	4,160761	1,191912	0,015824	10,5566
log_EV	2105	22,88064	1,887138	15,07681	26,78607
log_P_E	2105	3,031724	0,548727	0,070959	8,373571
ROE	2105	24,04374	106,9944	-1900	1888,235
EPS	2105	3,326058	13,94055	-13,753	240,3935
Beta_Act	2105	-0,00897	0,138383	-1,66516	2,130647
Beta_Threat	2105	0,00804	0,142124	-1,01624	1,729931
GPRThreat	2105	107,2767	29,86534	74,77942	199,273
GPRAct	2105	99,57954	35,66292	49,32102	211,9633
Oil	2105	68,03188	21,36935	26,73	98,69417
VIX	2105	19,82381	6,181129	11,04583	31,79333
Index	2105	218,3868	68,31022	95,0999	312,2177

The table reveals that while Beta_Act has a mean of -0.00897 and Beta_Threat has a mean of 0.00804, their standard deviations are very close, indicating that the variables are similarly dispersed around their respective means. This opposing nature of Beta_Act and Beta_Threat can be summarized to indicate that individual firm exposure to geopolitical acts and threats impacts stock prices in opposite directions. This highlights the importance of considering both types of geopolitical risks when analyzing stock price movements.

5.2. Empirical results

The Fixed Effects (FE) regression results provide insight into the impact of various financial ratios and geopolitical risks on stock prices. Among the four models (FE(1), FE(2), FE(3), FE(4)), FE(3) appears to be the most robust and informative, and in all the models country and year effects are fixed. By having country and year effects fixed, the model controls for unobserved heterogeneity by accounting for firm-specific characteristics that do not change over time (Wooldridge, 2016). This ensures that the impact of geopolitical risks on stock prices is isolated from other factors. Additionally, fixing country effects controls for country-specific policies, economic conditions, and institutional factors, while fixing year effects accounts for global trends and economic cycles.

FE(3) model excludes the correlated variable GPRAct which is moderately correlated with GPRThreat, thereby minimizing multicollinearity and focusing on the key independent variables, Beta_Act and Beta_Threat, which represent individual firm exposure to geopolitical acts and threats, respectively.

The main variables of interest, individual firm exposure to geopolitical acts and threats, show significant and opposing effects on stock prices. Beta_Act, which measures individual firm exposure to geopolitical acts, is negative and significant with a coefficient of -0.1071. This implies that for each unit increase in exposure to geopolitical acts, the stock price decreases by approximately 10.71%. This suggests that geopolitical acts, such as actual events of conflict or terrorism, tend to depress stock prices due to increased uncertainty and perceived risks.

In contrast, Beta_Threat, which measures exposure to geopolitical threats, implies that for each unit increase in exposure to geopolitical threats, the stock price increases by approximately 17.78%. This indicates that geopolitical threats, which may not materialize into actual events, can have a positive impact on stock prices. This could be due to defensive or speculative market behavior where investors react to the possibility of future instability by reallocating their portfolios, sometimes leading to higher stock prices.

Table 3 FE models with incremental variable addition

	FE(1)	***FE(2)***	***FE(3)***	***FE(4)***
const	0.6740	-6.8550	-14.029	-18.744
	0.1079(***)	2.9096(**)	3.6039(***)	10.099(*)
log_Price_lag1	0.7835	0.7737	0.5992	0.5963
	0.0378(***)	0.0343(***)	0.0472(***)	0.0496(***)

log_Debt		-0.0355	-0.0310	-0.0310
		0.0089(***)	0.0103(***)	0.0104(***)
log_P_E		0.0491	0.0169	0.0164
		0.0170(***)	0.0165	0.0177
log_EV			0.2329	0.2369
			0.0641(***)	0.0679(***)
ROE		0.0002	0.0001	0.0001
		7.7e-05(**)	4.499e-05(***)	4.537e-05(***)
EPS			0.0052	0.0052
			0.0015(***)	0.0015(***)
Beta_Act	-0.1123	-0.1092	-0.1071	-0.1072
	0.0737	0.0734	0.0562(**)	0.0561(*)
Beta_Threat	0.2145	0.2217	0.1778	0.1790
	0.0573(***)	0.0554(***)	0.0446(***)	0.0442(***)
Index		0.0151	0.0343	0.0226
		0.0055(***)	0.0121(***)	0.0145
GPRAct				0.0250
				0.0416
GPRThreat			-0.0130	-0.0416
			0.0197	0.0412
Oil		0.0498	-0.0239	0.0196
		0.0583	0.0428	0.0879
VIX		0.0420	0.2769	0.5203
		0.0985	0.1384(**)	0.3358
Observations	1996	1996	1996	1996
R-squared	0.671	0.679	0.7537	0.7543
Number of Firms	110	110	110	110
Year FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes

*Note: This table reports the results for the effect of geopolitical threats and geopolitical acts on firm stock prices based on the regression. Clustered standard errors are reported below each coefficient. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.*

These findings confirm the first and the second hypotheses and are in line with the findings of previous studies with additional characteristics. While Caldara and Iacoviello’s study (2018) focuses on global stock returns, my results provide similar evidence at the firm level within the Food, Beverage, and Tobacco industries. The negative impact of Beta_Act (geopolitical acts) on stock prices and the positive impact of Beta_Threat (geopolitical threats) align with Caldara and Iacoviello's broader conclusions, suggesting consistent patterns across different contexts and levels of analysis. Moreover, the results also point out that the non-cyclical characteristic of the F, B&T sector does not absorb the impact of geopolitical events, similar to the findings of Fossung et al. (2021) and Berkmann et al. (2011), which shows lower investor confidence on market.

On the contrary and surprisingly, positive and economically significant result of exposure to geopolitical threats may signal the non-cyclical behavior of the food and beverage industry during increased tensions and points out that those stocks can play as a safe haven for investors. Those results also confirm the findings of Omar et al. (2017) and Schroder (2021) studies, concluding that during uncertain times, safe considered assets yield better returns.

Additionally, findings of firm exposure to events and threats prove hypothesis 3, since the impact of exposure to Threats is 17%, whereas exposure to the Geopolitical Act is relatively smaller, 10%. This suggests that markets might react more swiftly to immediate events, whereas threats might provoke preemptive actions by investors. The finding supports the notion that perceived threats can have a more pronounced effect on stock prices than actual events since threats usually follow the events. For example, a few weeks before the Russia-Ukrain war started, the market was already concerned by the news about escalated tensions in the region.

The lagged log price (log_Price_lag1) remains highly significant with a positive coefficient of 0.5992. This implies that a 1% increase in the stock price in the previous period is associated with approximately a 0.60% increase in the current stock price. This finding underscores the importance of past stock prices in predicting current prices, reflecting market memory and investor behavior.

The debt-to-equity ratio (log_Debt) is negative and highly significant with a coefficient of -0.0310. This indicates that a 1% increase in the debt-to-equity ratio is associated with a 3.10% decrease in the stock price. This relationship aligns with the financial theory that higher leverage increases financial risk, which is often penalized by the market as investors view higher debt levels as increasing the company's financial instability.

The price-to-earnings ratio (log_P_E), although significant in earlier models, loses its significance in FE(3), indicating that its impact diminishes when other variables are considered. This suggests that while the price-to-earnings ratio may have some effect, other factors play a more dominant role in explaining stock price movements.

Enterprise value (log_EV) is positively and significantly associated with stock prices, which highlights the importance of firm size and market valuation in determining stock performance, as larger firms with higher enterprise values tend to be more stable and attract more investor confidence.

Although the coefficient of Return on Equity is very small, it indicates that higher profitability, measured by ROE, is associated with higher stock prices. Showing that investors favor firms with better returns on equity. Another profitability ratio, Earnings per share (EPS) is also positive and highly significant, and an increase in EPS by one unit is associated with a 0.52% increase in the stock price. This reinforces the positive relationship between profitability and stock prices, as higher earnings per share indicate better financial performance and are often rewarded by the market.

The MSCI World Food, Beverage & Tobacco Index is positive and significant with a coefficient of 0.0343, emphasizing the role of overall market movements in shaping individual stock prices, and indicating that broader market trends have a substantial impact on individual firm performance. The Volatility Index also becomes significant in FE(3), signaling that higher market volatility is associated with higher stock prices in the Food, Beverage, and Tobacco industries. This may indicate that during periods of high market volatility, these stocks are perceived as safer investments, driving up their prices.

Overall, the results from FE(3) provide a comprehensive understanding of how financial ratios and geopolitical risks impact stock prices in the Food, Beverage, and Tobacco industries. The significant coefficients and high R-squared value (0.7537) indicate a well-specified model with strong explanatory power. This model effectively captures the dynamic interplay between firm-specific financial characteristics and broader geopolitical factors, offering valuable insights for investors and policymakers navigating these complex environments.

The next step in the study is checking hypothesis test 4, by looking for differences between Western and Non-Western stocks. The analysis of the impact of geopolitical risks on stock prices reveals notable differences between Western and Non-Western FBT firms. The analysis reveals significant differences in how Non-Western and Western firms respond to geopolitical risks. Non-Western firms experience a substantial negative impact on stock prices from actual geopolitical events (Beta_Act coefficient: -0.0966), while perceived threats lead to significant speculative gains (Beta_Threat coefficient: 0.2238), indicating a higher market sensitivity to geopolitical uncertainties. In contrast, Western firms show negligible responses to both actual events and perceived threats reflecting their greater market stability and effective risk management. Additionally, the magnitude of coefficients for control variables is notably larger for Non-Western stocks compared to Western stocks, even though some control variables are significant for Western stocks. These findings suggest that investment strategies and policy interventions should be tailored to regional contexts, with Non-Western markets requiring more robust measures to mitigate geopolitical risks.

Table 4 Western vs Non-Western differences

	Nonwestern	***Western***
const	-9.5150	-3.1996
	6.6195	1.7218(**)
log_Price_lag1	0.5862	0.4535
	0.0550(***)	0.0557(***)
log_Debt	-0.0427	-0.0083
	0.0114(***)	0.0092
log_P_E	0.0454	0.0120
	0.0286	0.0102
log_EV	0.1708	0.4108
	0.0601(***)	0.0798(***)
ROE	0.0003	6.937e-05
	0.0005	2.438e-05(***)
EPS	0.1010	0.0037
	0.0341(***)	0.0012(***)
Beta_Act	-0.0966	0.0053
	0.0556(*)	0.0524
Beta_Threat	0.2238	0.0005
	0.0614(***)	0.0494
Index	0.0292	-0.0205

	0.0177(**)	0.0147
GPRAct	0.0044	
	0.0297	
GPRThreat	0.0017	
	0.0302	
Oil	-0.1042	
	0.0514(**)	
VIX	0.3293	
	0.2591	
Observations	740	1256
R-squared	0.7225	0.8133
Number of Firms	44	66
Year FE	Yes	Yes
Country FE	Yes	Yes

*Note: This table reports the results of the effect of geopolitical threats and geopolitical acts on firm stock prices for 2 different regions. Clustered standard errors are reported below each coefficient. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.*

Several reasons explain the differences in how Western and Non-Western firms respond to geopolitical risks. Western markets tend to be more economically stable and mature, providing a buffer against the immediate impacts of geopolitical events. Additionally, stronger regulatory frameworks and institutions in Western countries mitigate these risks. Investor behavior also varies, with Western investors possibly being more accustomed to and prepared for geopolitical uncertainties. Furthermore, the geopolitical context itself differs; Non-Western firms may face more direct effects from regional conflicts and political instability, whereas Western firms often have diversified operations that diffuse the impact of such events. These factors highlight the importance of considering geographic and economic contexts in financial analysis.

It is also worth mentioning that in the Western model, the variables GPRAct, GPRThreat, Oil, and VIX, or combinations thereof, have been fully absorbed or become perfectly collinear after the effects are removed, therefore dropping from the regression. This collinearity likely arises due to the relatively homogenous nature of the data for Western firms, which might be similarly affected by geopolitical and market factors, leading to a lack of independent variation among these variables once fixed effects are accounted for.

6. Robustness

6.1. Diagnostic tests

The variables used in the regression analysis were initially selected based on a correlation matrix. This step is crucial for identifying multicollinearity and choosing the most appropriate variables to include in the model. Appendix 3 presents the correlation matrix heat map. From this analysis, the total market cap variable was dropped due to its very high correlation with Enterprise Value. Additionally, no other variables exhibited seriously high correlations with each other.

Another potential issue to consider is multicollinearity among the variables in the model. The table below presents the Variance Inflation Factors (VIF) for the variables used in the regression model. Overall, variables exhibit very low multicollinearity, none exceed a level that typically warrants concern (commonly, a VIF above 5). The model appears to be well-specified with minimal multicollinearity issues, ensuring reliable coefficient estimates.

Table 1 VIF test results

Variable	***VIF***
const	291,6037
log_Price_lag1	2,325835
log_Debt	1,047201
log_P_E	1,122372
log_EV	1,736993
ROE	1,009952
EPS	1,528069
Beta_Act	1,190015
Beta_Threat	1,211375
GPRAct	2,632846
GPRThreat	3,239864
Oil	1,234403
VIX	1,107248
Index	2,864351

The next step in the robustness check is the Fisher unit root test. The Fisher unit root test is a statistical procedure used to determine whether a time series variable in panel data is nonstationary and possesses a unit root (Wooldridge, 2016). The Fisher unit root test combines the p-values from individual Augmented Dickey-Fuller (ADF) tests performed on each cross-sectional unit in the panel data (Appendix 4).

The Fisher test statistic is 397.318 and suggests significant evidence against the null hypothesis. The extremely small p-value (2.0346e-16) indicates that the null hypothesis of a unit root is rejected at any conventional significance levels. Rejecting the null hypothesis implies that the stock prices are stationary across the different firms in the dataset. This ensures that the time series data used in the regression model have consistent statistical properties over time, thus making the results of the regression analysis more reliable and valid (Wooldridge, 2016).

The Hausman test was conducted to determine whether a fixed effects (FE) or random effects (RE) model is more appropriate for our panel data analysis (Wooldridge, 2016). The Hausman test yielded a test statistic of 1011.701 with a p-value of 0.0. The extremely low p-value indicates that we reject the null hypothesis at any conventional significance level. This result suggests that the unique errors are correlated with the regressors, making the FE model the appropriate choice for this analysis.

By using the FE model, the time-invariant characteristics of the firms are accounted for in the dataset, ensuring that the estimated relationships between the dependent variable (log_Price) and the independent variables are not biased by omitted variable bias due to unobserved heterogeneity. Thus, the FE model provides more reliable and valid results for the analysis of the impact of geopolitical risk on food and beverage stock prices.

Another important diagnostic test is checking for heteroskedasticity using the Breusch-Pagan test. This test involves regressing the squared residuals on the independent variables. Some of these regressions show significant results, implying the presence of heteroskedasticity (see Appendix 6). The BP test statistic is 364.566, derived from the auxiliary regression of squared residuals on the independent variables. The p-value is extremely low (much less than 0.05), providing strong evidence against the null hypothesis of homoskedasticity. This indicates that heteroskedasticity is present in the model. To address this problem, Newey-West standard errors are used, which correct for both potential heteroskedasticity and autocorrelation in the residuals.

Lastly, I test for the presence of serial correlation in the residuals of the models using the Breusch-Godfrey test. This test involves using the residuals from the regressions as the dependent variable, while the lagged values of these residuals, along with the original regressors, serve as the independent variables (Wooldridge, 2016). As shown in Appendix 7, the lagged residuals are not statistically significant, indicating that the null hypothesis of no autocorrelation cannot be rejected. Both p-values (0.426483 for the test statistic and 0.428156 for the F-statistic) are greater than 0.05, and the Breusch-Godfrey test statistic is 0.62238. This indicates that we fail to reject the null hypothesis of no autocorrelation in the residuals. In other words, there is no significant evidence of autocorrelation in the residuals of the Fixed Effects model.

6.2. Robustness checks

To ensure the robustness of the regression model, I performed a 5-fold cross-validation using the R-squared metric to evaluate model performance. This method divides the data into five subsets, training the model on four subsets and testing it on the remaining one, rotating this process to cover all data points. The cross-validation results indicated high and consistent R-squared scores across all folds, with values ranging from 0.950 to 0.975 (Appendix 8). The mean R-squared score is 0.966 with a standard deviation of 0.008.

These results demonstrate that the model generalizes well and is not overly sensitive to any particular subset of the data, reducing the risk of overfitting. The low standard deviation further confirms the stability of the model's performance. This robust evaluation indicates that the linear regression model is reliable and likely to perform well on new, unseen data, thereby validating the findings of the analysis.

Additionally, to ensure the robustness of the Fixed Effects model and test the 5th hypothesis, a second robustness check was performed by eliminating outliers from the dataset. This involves removing data points below the 1st percentile and above the 99th percentile for each variable. By focusing on the central 98% of the data, this approach helps to ensure that the regression results are not unduly influenced by extreme values.

After eliminating the outliers, the regression results indicate several key differences compared to the original model. Notably, the coefficients for Beta_Act and Beta_Threat, which represent individual firm exposure to geopolitical acts and threats, remain significant but show adjustments in magnitude. Beta_Act, which was previously -0.1071, becomes slightly less negative at -0.0922. This suggests that the negative impact of geopolitical acts on stock prices persists but is somewhat moderated after excluding extreme values. This change implies that extreme geopolitical events exert a greater negative impact on stock prices, and when these outliers are removed, the overall effect appears less severe.

Similarly, Beta_Threat, originally 0.1778, decreases to 0.0919. This indicates that the positive impact of geopolitical threats on stock prices remains significant, though less pronounced without the influence of outliers. This suggests that extreme geopolitical threats tend to have a more substantial positive effect on stock prices, potentially due to heightened defensive or speculative market behavior during such events. When these extreme values are excluded, the observed impact of geopolitical threats is reduced. Additionally, the control variables exhibit some changes in their coefficients. Especisally the Enterprise value (log_EV) sees a notable increase in its positive coefficient from 0.2329 to 0.4762, suggesting a stronger positive relationship between firm size and stock prices when outliers are excluded.

When outliers were removed, the coefficients for Beta_Act and Beta_Threat adjusted, showing that extreme values exacerbate the observed effects. This finding is crucial for understanding that while general trends can be observed, the magnitude of geopolitical risk impact is significantly amplified during extreme events, which in turn proves Hypothesis 5: Extreme geopolitical events and threats have a much higher magnitude in stock prices.

Overall, the second robustness check confirms that the main findings of the original model (FE3) hold even after eliminating outliers. The consistency in the significance and direction of most coefficients underscores the robustness of the analysis, while the changes in the magnitudes of some coefficients provide a more nuanced understanding of the relationships between the variables and stock prices. This check enhances confidence in the results, indicating that they are not driven by extreme values but rather reflect genuine underlying patterns in the data.

Table 2 Filtered results

Variable	Coefficient	Std. error
log_Price_lag1	0.3953	0.0439(***)
log_Debt	-0.0418	0.0099(***)
log_P_E	0.0213	0.0132
log_EV	0.4762	0.0525(***)
ROE	0.0016	0.0003(***)
EPS	0.0179	0.0031(***)
Beta_Act	-0.0922	0.0448(**)
Beta_Threat	0.0919	0.0380(***)
GPRThreat	-0.0072	0.0380(*)
Index	0.0071	0.0037(**)
Oil	0.2068	0.0381(***)
VIX	0.3398	0.4685(**)
Observations	1746	
Number of Firms	107	
R-squared	0.8143	
Year FE	Yes	
Country FE	Yes	

*Note: This table reports the results for the effect of geopolitical threats and geopolitical acts on firm stock prices, outliers excluded. Clustered standard errors are reported next to each coefficient. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.*

7. Conclusion and discussion

This thesis investigates the impact of geopolitical risks on the stock performance of the Food, Beverage, and Tobacco (FBT) industry. The motivation for this study stems from the critical role that the FBT industry plays in global food security and its susceptibility to geopolitical events. Given the industry's substantial economic contributions, understanding how geopolitical acts and threats influence FBT stock prices is crucial. This research utilizes a comprehensive dataset comprising stock prices, financial ratios, the Geopolitical Risk (GPR) indices developed by Caldara and Iacoviello, and individual firm exposure to those indices for major food and drink firms across various regions, covering the period from 1999 to 2024.

Key findings from the analysis reveal significant and contrasting effects of geopolitical acts and threats on FBT stock prices. Specifically, exposure to geopolitical acts (Beta_Act) has a negative impact on stock prices, indicating that actual events of conflict or terrorism lead to decreased investor confidence and stock prices. Conversely, exposure to geopolitical threats (Beta_Threat) shows a positive impact, suggesting that the market reacts preemptively to potential risks, often driving up stock prices due to defensive investment strategies. Furthermore, the analysis highlighted notable differences between Western and Non-Western firms. Non-Western firms experienced a substantial negative impact from actual geopolitical events, while Western firms showed more stability, reflecting their greater resilience or effective risk management strategies.

This research provides valuable insights into the complex relationship between geopolitical uncertainty and the FBT industry, highlighting the significant yet nuanced impacts of geopolitical events and threats. The results indicate that the food, beverage, and tobacco industry experiences negative impacts from geopolitical events, similar to other sectors in the market. Nonetheless, this industry demonstrates potential as a safe haven and high-yield investment opportunity for investors during periods of heightened geopolitical threats. Investors must recognize regional differences in these impacts. Non-Western stocks, in particular, may present valuable opportunities for portfolio diversification during uncertain times. Consequently, policymakers and industry leaders should prioritize geopolitical risk as a critical consideration due to its substantial impact on the sector.

While this study provides valuable insights into the stock performance of the Food, Beverage, and Tobacco industries, it is important to acknowledge several limitations that may affect the interpretation and generalizability of the findings. Firstly, a significant limitation arises from the inability to distinctly differentiate the impact of geopolitical risk on food, beverage, and tobacco stocks within the FBT industry. Many firms, such as Pepsico, operate across multiple sectors, producing both beverages and foods and may also have interests in other industries under the same corporate name. This diversification makes it challenging to isolate the effects of geopolitical risks on specific segments within the FBT industry. The available data does not allow for granular analysis by sub-sector without extensive and detailed research to assign appropriate weights to each sector's contribution within diversified firms. Consequently, the results presented in this study should be interpreted as reflecting the overall impact on the FBT industry rather than on individual sub-sectors.

Secondly, the Geopolitical Risk Index is collected from 11 English-language news sources from Canada, the United States, and Great Britain. This geographical and linguistic limitation means that the GPR index may not fully capture geopolitical events that are more regionally focused or less covered by Western media. Events occurring in the Middle East or Asia, for example, might not be adequately reflected in the GPR index if they do not receive significant attention from the selected news sources. This limitation may lead to an underrepresentation of the geopolitical risks pertinent to non-Western regions, potentially skewing the analysis and conclusions drawn from the data.

Thirdly, the study faced challenges related to missing data for some firms. To address this issue, imputation methods were employed to fill in gaps, ensuring that a larger dataset could be utilized for analysis. However, this approach introduces its own set of limitations. For instance, the Return on Equity (ROE) data was missing for more than 350 observations. While imputation helps maintain the dataset's size, it can also introduce biases and reduce the robustness of the findings. The imputed values may not perfectly represent the actual missing data, potentially affecting the accuracy and reliability of the results.

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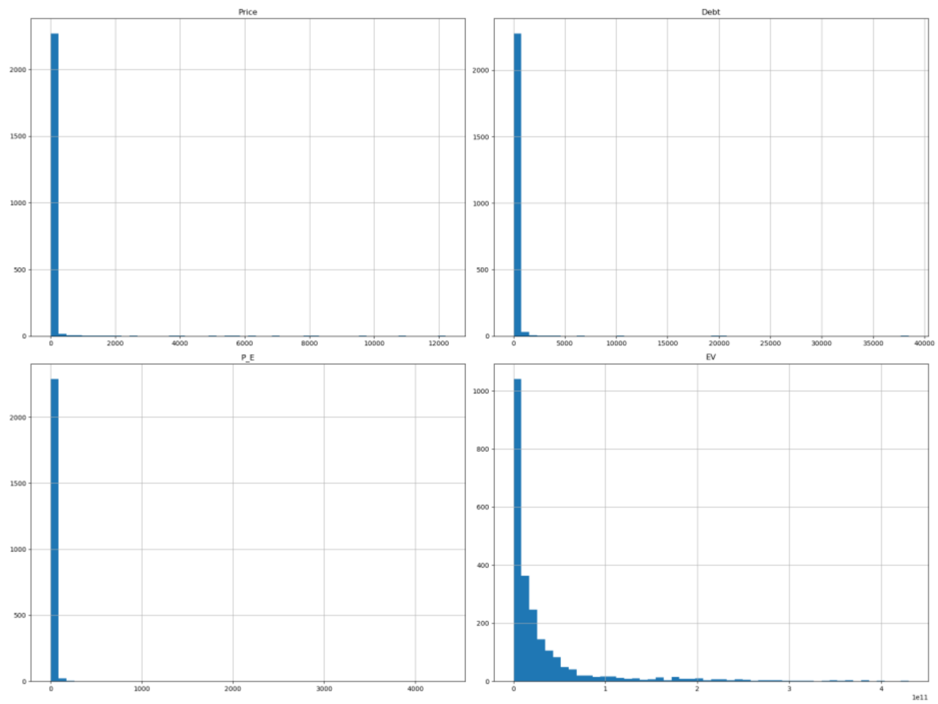
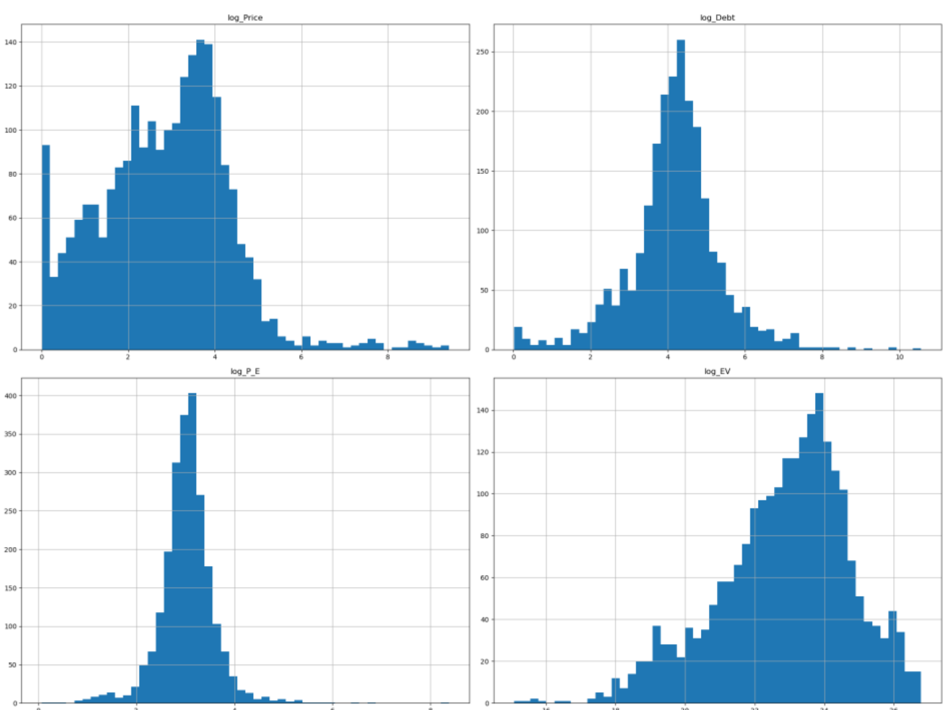
Appendix.

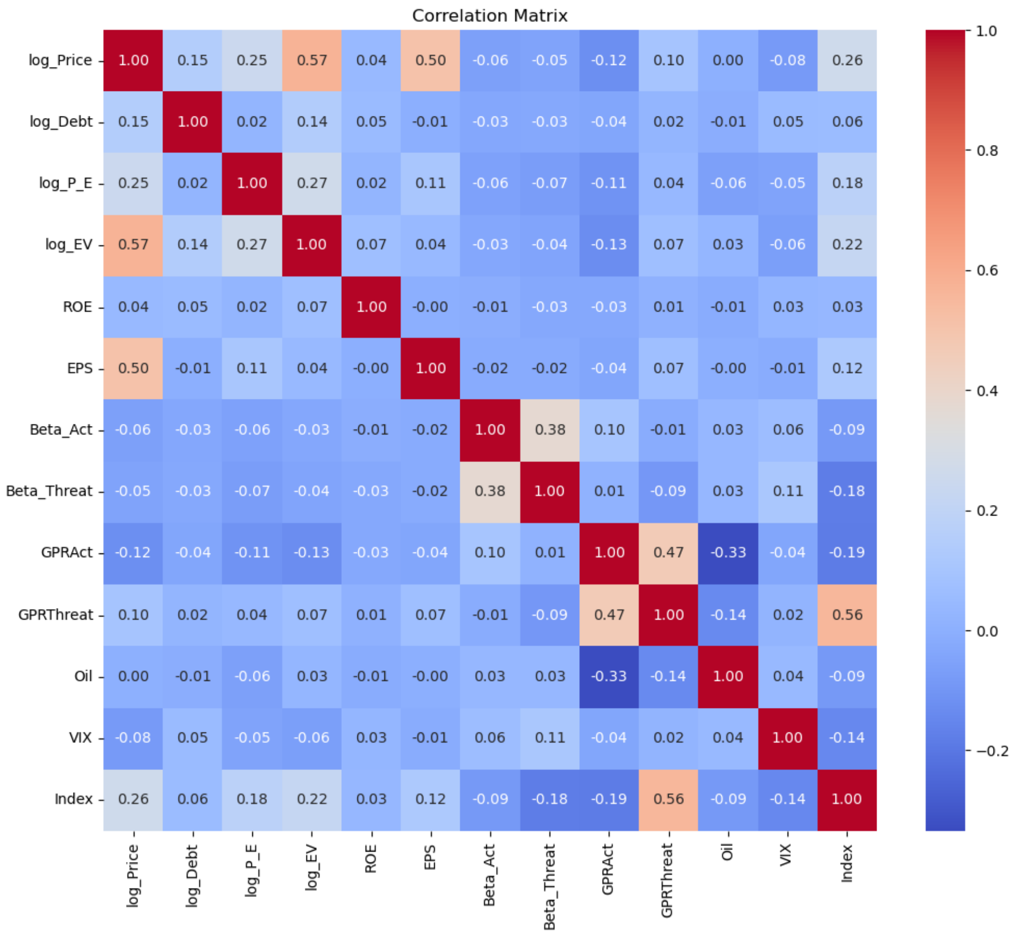
Appendix 1 Histogram before log transformation



Appendix 2 Histogram after log transformation



Appendix 3 Correlation Matrix Heat Map



Appendix 4 ADF test results

	ADF Test Statistic	***p-value***	***Observations***
log_Price	-8,8195	1,89E-14(***)	2096
log_Price_lag1	-9,8566	4,34E-17(***)	2104
log_Debt	-10,9072	1,12E-19(***)	2102
log_P_E	-9,1074	3,47E-15(***)	2089
ROE	-10,6992	3,56E-19(***)	2086
EPS	-5,6536	9,73E-07(***)	2078
Beta_Act	-9,4506	4,63E-16(***)	2082

Beta_Threat	-8,6898	4,07E-14(***)	2079
GPRAct	-7,9401	3,33E-12(***)	2079
GPRThreat	-12,2088	1,18E-22(***)	2078
Index	-10,6207	5,52E-19(***)	2078
Oil	-10,4313	1,61E-18(***)	2081
VIX	-11,0127	6,27E-20(***)	2079

Appendix 5 Hausman test comparison

Variable	***FE Coefficient***	***FE Std. Error***	***RE Coefficient***	***RE Std. Error***
const	-3,66378	0,192089	-0,0321	0,095454
log_Price_lag1	0,618936	0,012874	0,962855	0,00583
log_Debt	-0,03239	0,006601	-0,01588	0,0048
log_P_E	0,019019	0,01059	0,001066	0,010795
log_EV	0,217612	0,008972	0,024395	0,003905
ROE	0,000135	4,54E-05	0,000213	5,25E-05
EPS	0,007187	0,000899	0,002424	0,000496
Beta_Act	-0,17071	0,037446	-0,1913	0,044075
Beta_Threat	0,195234	0,036944	0,256607	0,043299
GPRThreat	0,000373	0,000281	0,000319	0,000337
GPRAct	-0,001	0,000217	-0,00106	0,000254
Oil	-0,00045	0,000244	-0,00022	0,000291
VIX	-0,00579	0,000797	-0,0068	0,000952
Index	0,000319	0,000133	-0,00046	0,000139

Appendix 6 Heteroskedasticity test

Variables	*Sq. Residuals*
const	1,791
	4,046
log_Price_lag1	0,024
	0,0051(***)
log_Debt	0,003
	0,003
log_P_E	0,021
	0,0067(***)
ROE	0,000
	0,0007(***)

EPS	-0,001
	0,0003(**)
Beta_Act	-0,013
	0,028
Beta_Threat	-0,009
	0,028
GPRAct	0,006
	0,009
GPRThreat	-0,009
	0,014
Index	-0,025
	0,0075(***)
Oil	0,023
	0,054
VIX	0,127
	0,129

Standard errors at firm level are reported next to each coefficent. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.

Appendix 7 Autocorrelation test

	Coef.	***Std.Err.***
const	-0,25092	0,091099(***)
Lagged_Residuals	-0,03461	0,022788
log_Price_lag1	-0,00923	0,005603(*)
log_Debt	-0,00102	0,004547
log_P_E	-0,00592	0,010291
log_EV	0,012977	0,003748(***)
ROE	-7E-06	4,82E-05
EPS	0,000783	0,000474(*)
Beta_Act	0,0289	0,042879
Beta_Threat	0,00355	0,040272
GPRAct	5,9E-05	0,00024
GPRThreat	-2,3E-05	0,000313
Index	-2,1E-05	0,000129
Oil	3,72E-05	0,000269
VIX	-5,1E-05	0,000898

Standard errors at firm level are reported next to each coefficent. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.

Appendix 8 Cross validation results

Fold	***R^2 Score***	***Mean R^2***	***Std R^2***

0	1	0,969827	0,965696	0,008152
1	2	0,974761	0,965696	0,008152
2	3	0,966645	0,965696	0,008152
3	4	0,950498	0,965696	0,008152
4	5	0,96675	0,965696	0,008152