

# Game of Semiconductor Thrones: A Comprehensive Analysis of Geopolitical and Stock Market Uncertainty Transmission

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## Abstract

The technological advances observed for more than a decade have set the stage for a Second Cold War between the US and China (Schindler et al. 2023; Li, He, Lin 2018). Technology is being used as a hacking tool for espionage and disinformation campaigns. The prize is the new geopolitical order and economic domination of the world. The technology itself requires hardware, making the semiconductor industry a crucial weapon in this war.

The literature on geopolitical risk examines its impact on stock returns (Salisu, Lasisi, Tchankam 2022) and market volatility (Bouras et al. 2017). Our research contributes to both areas, while focusing on the semiconductor sector in the US and China. The semiconductor war, and more broadly the US-China trade war, has been extensively analysed in the literature (Fajgelbaum 2024; Kempf, Bobek, Horvat 2021), while our research contributes to the discussion by treating the war in a quantitative manner.

In this paper, we aim to identify and assess the transmission mechanisms of geopolitical uncertainty on the semiconductor sector of the US and Chinese stock markets. First, we propose three different measures of uncertainty based on the three dimensions of price (one-factor Sharpe model), return, and conditional variance of ARMA-GARCH models. We then assess the synchronisation of the US and Chinese markets using moving correlation coefficients. Next, we assess the transmission of geopolitical uncertainty from equity markets to the semiconductor sector. Finally, we analyse the adjustment mechanisms of geopolitical uncertainty transmission to stock market uncertainty using VAR models and Granger causality. In this last step, we also analyse impulse response functions. Our dataset consists of market data of the semiconductor industry in the US

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and China for the period from 1990 to 2024. We also use the Geopolitical Risk (GPR) index proposed by Caldara and Iacoviello (2021).

There are two hypotheses that we intend to test in our five-step approach:

Hypothesis 1: There is a difference in the transmission mechanism of geopolitical uncertainty on semiconductor company valuations in the US and Asian markets. There is a causal relationship between geopolitical uncertainty and uncertainty in semiconductor company valuations.

We expect that an increase in geopolitical uncertainty will be preceded by an increase in company valuation uncertainty, which will be visible in the US and Asian markets.

Hypothesis 2: There is a difference in the reaction of the US and Asian markets to increased geopolitical uncertainty.

We expect the increase in geopolitical uncertainty to be more correlated with corporate valuation uncertainty in US markets than in Asian markets.

The results obtained can be summarised as follows. First, we analyse the proposed uncertainty measures. Based on the price uncertainty measure, the higher skewness and kurtosis for the Chinese market suggest that this could be the result of fierce competition within the market and between China and the US. A more asymmetric distribution is also the case for return uncertainty, but to a much greater extent. This may indicate a relatively sharp reaction of investors to changes in expectations.

Second, the analysis of the synchronisation of the US and Chinese markets shows that there are statistically significant dependencies between market and geopolitical uncertainty for both markets. They tend to be relatively stable for the price dimension. Interestingly, a much higher divergence of the moving correlation coefficients for expected values suggests a much broader impact of geopolitical uncertainty on investors' expectations. More interestingly, we identify periods of higher correlation for excess returns and the semiconductor sector. As a result, investors' actions may be driven by changes in geopolitical uncertainty. Consequently, geopolitical factors could affect capital markets despite the differences between countries.

Next, we uncovered the transmission mechanisms of geopolitical uncertainty on semiconductor stocks using AR-GARCH-M models with three different measures of uncertainty as exogenous variables. The results showed that investors expect an additional premium for geopolitical instability. Interestingly, for the Chinese market, an increase in geopolitical risk leads to a decrease in price uncertainty.

Fourth, our Granger causality analysis implied that geopolitics preceded uncertainty in the US market. In contrast, no such causality was found for the Chinese market. This finding may have important implications for investment strategies.

Finally, the analysis of the impulse response functions allows us to draw conclusions about the dynamics of the financial markets. Surprisingly, we find a relatively higher reaction in the geopolitical risk index than expected by the market.

Our study is a complex analysis of geopolitical risk and its transmission to the semiconductor sector. The proposed measures of uncertainty contribute to the broad literature on risk and uncertainty measures (Deng 2020), as we analyse it in three different dimensions. This makes our research a relatively broad examination of the semiconductor industry in the US and China.

Earlier studies have demonstrated the impact of geopolitics on the stock market (Khraiche, Boudreau, Chowdhury 2023; Chiang 2021; Das, Kannadhasan, Bhattaacharyya 2019; Singh, Roca 2022). In the case of this paper, we focus specifically on the semiconductor sector. As mentioned earlier, this sector turns out to be relatively competitive, which makes the conditions of analysis somewhat specific.

Last but not least, our study is a contribution to practice, helping investors to track the factors shaping market uncertainty, market synchronization and adjusting investing and hedging strategies to the geopolitical situation (Sohag, Vasilyeva et al. 2022).