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Does Geopolitical Risk Influence China’s Defence Sector Returns?

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Abstract: This study utilizes a rolling window Granger test to investigate how global geopolitical tension affects returns in China’s defence sector. The results reveal a highly dynamic and nonlinear relationship between geopolitical risk and the industry’s stock market performance. Notably, our findings suggest that geopolitical risk has recently become a significant predictor of the market return of the defence sector. These results contribute to the existing literature on the impact of geopolitical uncertainties on China’s financial markets and offer new insights into the relationship between international security and the stock market performance of defence contractors. We discuss the implications of this research at the end.

Keywords: China, defence sector, geopolitical risk, stock market, time series

JEL Classification: G10, C32, F50

1 Introduction

The impact of geopolitical factors on economic agents’ rational decision-making and subsequent financial behaviour has been a subject of interest for social scientists for several decades. In recent years, this field of study has gained renewed attention due to advancements in computer-assisted content analysis of media reports and the availability of high-frequency data on geopolitical tensions. Notably, the Geopolitical Risk (GPR) index (Caldara and Iacoviello 2022) has emerged as a widely used data source for assessing the geopolitical impact.

Contributions from regional experts on China have added to the growing body of empirical literature on the impact of geopolitics on financial markets. For instance,
Chiang (2021) analyzed the effect of GPR on returns in China’s bond, stock, and commodity markets, while Rawat and Arif (2018) focused on China’s equity market returns. Lee and Wang (2021) examined how GPR influences Chinese companies’ cash holdings, and Jiang et al. (2022) discovered the adverse effects of GPR on the stock returns of China’s tourism sector. Other researchers, such as Wang, Su, and Umar (2021) and Gong et al. (2022), have explored GPR’s influence on Chinese oil companies’ market strategy.

This study aims to contribute to the existing literature by investigating the link between global geopolitical tension and the market return of the defence sector. Theoretical considerations suggest that when geopolitical risk increases, governments tend to increase military spending, leading investors to view the defence industry as an attractive option for investment. This is based on the assumption that a significant portion of the budget will be allocated to global defence contractors for new equipment and services. Additionally, rational economic agents may withdraw their investment from sectors likely to suffer from a worsening international security environment, such as tourism, and reallocate their money to safer industries, such as defence. Consequently, the rational behaviour and calculus of investors contribute to the higher return of the defence sector. Conversely, when geopolitical risk is lower, the defence sector becomes less attractive for investment, leading to lower returns. Early research shows a positive impact of security events on the returns of defence companies (Apergis and Apergis 2016). However, a more recent study fails to deliver a positive effect of GPR on defence contractors’ returns based on an analysis of 24 global defence firms from the U.S. and U.K. (Apergis et al. 2018).

China currently has the second-largest number of global top-100 defence companies, only after the U.S. Nevertheless, there is no research on the relationship between GPR and the returns of China’s defence industry. This study thus aims to fill this gap.

2 Data and Method

To measure the final market performance of China’s defence sector, we employ the monthly data of the National Defence Index, which was developed by Shenwan Hongyuan, a prominent securities firm in China. The index encompasses Chinese defence companies publicly listed on the Shanghai or Shenzhen Stock Exchange. It covers a period from January 2000 onward, providing us with the most extensive and comprehensive coverage of China’s defence sector. The data is collected from the Wind Financial Terminal (Wind Information Co. 2023). Figure 1A and B in tandem depict the index’s monthly price and log price, while Table 1 presents their descriptive statistics. Both series have an upward trend and are non-normally distributed. The monthly return of the index is calculated by taking the first
difference of the log close prices in the first and last trading days for each month. The calculation is automated by quantmod, an R package developed by Ryan et al. (2015).

Geopolitical tension is measured by the GPR index developed by Caldara and Iacoviello (2022). It provides monthly measures of security-related risk due to military or terrorist threats based on computer-assisted content analysis of 11 leading international newspapers. The data cover the period from January 1985 onward and

**Figure 1:** National Defence Index.

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**Table 1:** Summary of National Defence Index.

<table>
<thead>
<tr>
<th></th>
<th>Price</th>
<th>Log price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>279</td>
<td>279</td>
</tr>
<tr>
<td>Minimum</td>
<td>136</td>
<td>4.91</td>
</tr>
<tr>
<td>Maximum</td>
<td>2988</td>
<td>8.00</td>
</tr>
<tr>
<td>Mean</td>
<td>928</td>
<td>6.61</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>546</td>
<td>0.74</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.404</td>
<td>−0.595</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>−0.271</td>
<td>−0.827</td>
</tr>
<tr>
<td>Jarque–Bera</td>
<td>8.46**</td>
<td>24.41**</td>
</tr>
</tbody>
</table>

*Significance at 0.1. **Significance at 0.05.
are updated regularly by the authors on a dedicated website (Caldara and Iacoviello 2023). This index has gained significant popularity due to its ability to capture the dynamic nature of geopolitical risks.

To investigate the possible influence of geopolitical risk on the monthly return of the Chinese defence sector, we first conduct a Vector Autoregression (VAR) analysis (Sims 1980), followed by a Granger non-causality test as proposed by Granger (1969). A reduced-form bivariate VAR with no exogenous variables, as specified in Equation (1), generates an equation for each endogenous variable. This equation explains the current value of an endogenous variable based on its past values and the past values of the other endogenous variable at a selected lag order of $k$.

$$
\begin{bmatrix}
    y_{1t} \\
    y_{2t}
\end{bmatrix} =
\begin{bmatrix}
    \phi_{10} \\
    \phi_{20}
\end{bmatrix} + \begin{bmatrix}
    \phi_{11}(L^k) & \phi_{12}(L^k) \\
    \phi_{21}(L^k) & \phi_{22}(L^k)
\end{bmatrix} \begin{bmatrix}
    y_{1t} \\
    y_{2t}
\end{bmatrix} + \begin{bmatrix}
    \epsilon_{1t} \\
    \epsilon_{2t}
\end{bmatrix}, \quad t = 1, 2, ..., T
$$

(1)

In our case, $y_{1t}$ and $y_{2t}$ indicate the monthly return and GPR, respectively. $\phi_{ij}(L^k) = \sum_{k} \phi_{ijk} L^k$ and $L$ is a lag operator defined as $L^k x_t = x_{t-k}$. In this setting, the null hypothesis that GPR does not Granger cause the monthly return can be tested by imposing the joint zero restrictions as follows

$$
H_0 : \phi_{12,1} = \phi_{12,2} = \cdots = \phi_{12,k} = 0
$$

(2)

When the assumption of a time-invariant relationship is violated, the test results are misleading for their inability to catch nonlinear connections between time series. To address this nonlinearity issue, data-driven recursive algorithms can be used for Granger non-causality tests. In this study, we apply the Wald test to the data with a rolling window approach (Arora and Shi 2016; Balcilar, Ozdemir, and Shahbaz 2019; Swanson 1998). This method involves sliding a fixed-size window through the data to generate consecutive test statistics from overlapping subsamples, and critical values are obtained through bootstrapping. According to Shi, Phillips, and Hurn (2018, 2020), the rolling window algorithm is the best-performing method for detecting the nonlinear Granger effect, followed immediately by the recursive rolling algorithm. Thus, we present the results based on the rolling window method in this study.

3 Empirical Results

Figure 2A and B display the monthly return of the National Defence Index and GPR, respectively. To analyze the relationship between GPR and the monthly return of China’s defence sector, we use the post-millennium data starting from January 2000, the earliest date of data availability. According to Figure 2A, the returns show the typical features of financial series, such as non-normality and stationarity,
confirmed in the statistical tests below. As illustrated in Figure 2B, GPR exhibits the highest volatility in the periods before 2005 and after 2021. The former period coincides with the rise of the global terrorist threat after the 9/11 attack and the subsequent security uncertainties arising from the U.S. invasion of Afghanistan and Iraq. The latter period is associated primarily with the Russian invasion of Ukraine.

Table 2 presents the descriptive statistics and unit root tests for both series. From January 2000 to March 2023, we have a total of 279 data points. The Jarque–Bera test shows that neither the monthly return nor the geopolitical risk follows a normal distribution. According to the Augmented Dickey–Fuller test (Dickey and Fuller 1979) and the Phillips–Perron test (Phillips and Perron 1988), we can reject the null hypothesis of a unit root for both series at the 0.05 level. Since both series are $I(0)$ processes, there is no need to operate a cointegration analysis.

According to the Akaike information criterion (Akaike 1969), we selected the lag number to be two. We presented the resulting estimates for the VAR(2) model and the outcomes of the Granger test in Table 3. We found that the lagged values of geopolitical risk did not significantly affect the return equation. Thus, we could not reject the null hypothesis that geopolitical risk does not Granger cause the monthly return of the National Defence Index. It is worth noting that the standard Granger non-causality test assumes a time-invariant relationship and, therefore, cannot capture

Figure 2: Monthly return of the defence sector and geopolitical risk index.
Table 2: Descriptive statistics and unit root tests.

<table>
<thead>
<tr>
<th></th>
<th>Return</th>
<th>GPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>279</td>
<td>279</td>
</tr>
<tr>
<td>Minimum</td>
<td>−0.346</td>
<td>0.451</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.439</td>
<td>512</td>
</tr>
<tr>
<td>Mean</td>
<td>0.006</td>
<td>105</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.130</td>
<td>52.60</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.039</td>
<td>4.308</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>1.812</td>
<td>25.95</td>
</tr>
<tr>
<td>Jarque–Bera</td>
<td>38.25**</td>
<td>8692**</td>
</tr>
<tr>
<td>Augmented Dickey–Fuller test</td>
<td>−10.78**</td>
<td>−2.76**</td>
</tr>
<tr>
<td>Phillips–Perron test</td>
<td>−15.14**</td>
<td>−6.31**</td>
</tr>
</tbody>
</table>

*Significance at 0.1. **Significance at 0.05.

Table 3: Vector autoregression and Granger non-causality test.

<table>
<thead>
<tr>
<th></th>
<th>Return equation (standard error)</th>
<th>GPR equation (standard error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return L.1</td>
<td>0.101* (0.06)</td>
<td>1.27 (20.60)</td>
</tr>
<tr>
<td>Return L.2</td>
<td>0.02 (0.06)</td>
<td>−25.84 (20.59)</td>
</tr>
<tr>
<td>GPR L.1</td>
<td>−0.0002 (0.0002)</td>
<td>0.86** (0.06)</td>
</tr>
<tr>
<td>GPR L.2</td>
<td>0.0001 (0.0002)</td>
<td>−0.18** (0.06)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.018 (0.015)</td>
<td>32.90** (5.04)</td>
</tr>
<tr>
<td>Granger non-causality test</td>
<td>0.797</td>
<td>0.790</td>
</tr>
</tbody>
</table>

*Significance at 0.1. **Significance at 0.05.

Table 4: BDS test.

<table>
<thead>
<tr>
<th></th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAR(2)</td>
<td>1.27</td>
<td>2.24**</td>
<td>2.99**</td>
<td>3.74**</td>
<td>4.49**</td>
</tr>
</tbody>
</table>

*Significance at 0.1. **Significance at 0.05.

nonlinear connections between variables. To test the existence of nonlinearity, we conducted the BDS test (Brock et al. 1996) for the residuals from the return equation of the VAR(2) model and presented the results in Table 4. This test revealed a time-variant relationship between GPR and the monthly return of the National Defence Index when the embedment dimensions are above two. Thus, the issue of nonlinearity exists in the relationship, and a solution is needed.

Figure 3 displays the outcomes of the rolling window Granger test conducted with the STATA package TVGC, developed by Baum, Hurn and Otero (2021, 2022). The
fixed window size for the analysis was 54 months, approximately 20% of the data, as recommended by the authors. The bootstrapped 10% and 5% critical values based on 5000 replications are indicated by the long and short dash lines. The graph illustrates the highly dynamic relationship between GPR and the defence sector’s return. For a significant amount of time, geopolitical risks did not impact the market return of China’s defence sector. A highly notable change, however, came in 2015. In that year, China began to implement the strategy of military-civilian integration. On the one hand, it emphasizes the importance of exploring the potential civil benefits of technologies initially developed for military purposes. The Beidou navigation system, a Chinese version of GPS, is a well-known example in this regard. On the other hand, it also encourages civil technologies, management experiences, and capital to be involved in producing military equipment. For example, the rapid development of military drones in China benefits tremendously from this policy change known as the ‘Civil-involved Military.’ The increased competition pushes China’s defence-related firms to pay particular attention to the overseas market for opportunities. Local investors in the defence sector must have begun to build their portfolios according to the global geopolitical risks. Since 2021, the predictive power of GPR over defence return has almost become a new norm, implying a transition has been finalized. Because the connection between GPR and the defence sector return is
highly dynamic and was firmly established only recently, it is unsurprising that the standard Granger test measuring the average effect within a time-invariant context failed to detect it.

4 Conclusions

This study employs a time-varying Granger non-causality test with a rolling window algorithm to demonstrate the highly dynamic relationship between global geopolitical tension and the stock market return of China’s defence industry. Although GPR did not Granger cause the return for a long time, it eventually displayed its power of prophecy over the return series.

The implications of this research are threefold. Firstly, unlike similar research on defence contractors from the U.S. and U.K., this study shows a significant impact of GPR on the returns of Chinese defence companies. The difference may lie in the fact that stock markets in developed economies are more efficient and therefore absorb geopolitical information quickly. Consequently, we cannot detect GPR’s impact on the returns of defence companies with data at the monthly frequency. China’s markets are younger and less developed, so they absorb such information more slowly. The second implication, therefore, is for investors. Given the inefficiency of China’s stock markets, investors in China’s defence sector may profit by closely following the dynamics of global geopolitical risks and building their portfolios accordingly. Thirdly, this study indicates that implementing the military-civilian integration policy has far-reaching consequences for China’s economy. However, rigorous research in this area is still limited, making it a valuable direction for future research.

References


