Research proposal: Utilizing the synthetic control method to investigate the causal impact of Brexit on the UK's scientific performance through publication records.
The steps of the research are as follows:

1. **Research Objective**:
    - Investigate how Brexit has affected the UK's scientific performance, specifically through changes in publication output and quality before and after Brexit.

2. **Literature Review**
    - Summary of the existing literature on the impact of political events on scientific output.
    - Discussion on the synthetic control method as per Abadie et al. (2010) and its applications in policy analysis.
3. **Methodology**:
    - Description of the data: publication records before and after Brexit.
    - Apply the synthetic control method to create a synthetic UK as a comparison group, using data from countries similar to the UK but unaffected by Brexit.
    - Collect pre- and post-Brexit publication records as the main dataset, ensuring that data covers a significant period before and after Brexit to capture long-term effects.
4. **Variables**:
    - **Dependent Variables**: Scientific output measures (number of publications, citation impact, research collaboration networks).
    - **Independent Variables**: Time (pre- and post-Brexit), Research and Development (R&D) expenditure, researcher mobility.
5. **Validation**:
    - Employ permutation tests to validate the synthetic control model, assessing the distribution of the test statistic under the null hypothesis of no treatment effect (Brexit).
    - Analyze potential size distortion of permutation tests through Monte Carlo simulations, as discussed in the literature provided.
6. **Research Hypotheses**:
    - Null Hypothesis (H0): Brexit has no impact on the UK's scientific performance.
    - Alternative Hypothesis (H1): Brexit has a significant impact on the UK's scientific performance.
7. **Data Analysis**:
    - Estimate treatment effects by comparing the actual UK's scientific performance to that of the synthetic UK post-Brexit.
    - Assess the impact by examining changes in the dependent variables relative to the synthetic control.
8. **Validation of Synthetic Control**:
    - Undertake robustness checks and sensitivity analyses to ensure the credibility of the synthetic control.

- Consider alternative methods of inference, if necessary, based on findings from Monte Carlo simulations and the properties of permutation tests.

9. **Expected Outcomes**:
    - Detailed quantification of Brexit's impact on scientific performance.
    - Policy recommendations based on findings to mitigate adverse effects or enhance positive outcomes.
10. **Limitations**:
    - Acknowledge potential biases and limitations of the synthetic control method and data availability.
11. **Further Research**:
    - Suggest areas where further studies could explore deeper or broader impacts of Brexit, possibly using other econometric techniques or longer-term data.

This research will include visualizations, such as graphs or charts, to demonstrate the synthetic control model and its findings effectively. It will be presented in a clear, structured manner that articulates the research problem, the synthetic control methodology, and its implications in the context of Brexit and scientific research.