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PROJECT NAME:
"Assessing the Impact of EU Import Tariffs on Chinese Electric Vehicles: European *vis-a-vis* Chinese Consumer Perspectives – A Near-Term forecast guiding Long-term Projections"

DISCLAIMER: The authors understand that some of the methods they have chosen to employ fall only marginally into the scope of the class, yet, given their shared interest in the research question, have decided to delve as deep as reasonably deep into the field of policy evaluation, specifically, this project might act as a rough guide for future quantitative methods in policy evaluation, depending on the quality of the results obtained. It is not intended to be read as a white-paper, more rather, as a final draft of one.

KEY WORDS: Synthetic Control Group; Demand Forecast; Policy Evaluation;

ABSTRACT: This paper proposes the application of synthetic control groups, to forecast the demand of electric vehicle sales in Germany, against a counterfactual that implies the absence of the most recent set of tariffs imposed on the import of Chinese electric vehicles. It outlines a possible quantitative approach to policy evaluation, that is mostly model-driven, in a information scarce environment.

###################### Below is a road-map to achieve the research goal ######################

Step's 1-3: PREPARATION

1. Define Objective

The objective is twofold,:

- 1. demonstrate the plausibility of a quantitative approach to policy evaluation, when there arise the issues of timeliness and information scarcity
- 2. **(if 1. then)** prescribe a course of action given the EU Counsel's deadline regarding the status of current tariff on Chinese EV imports – changing from preliminary to permanent.

2. Collect Data

Note: pre-policy period [Jan, 2022: Jun 2024], post-policy period [Jul, 2022: Set 2024]

Thus far we have collected pre- and post- policy sales data on EV in all major countries, on a monthly granularity, as well as most financial indicators for all countries used in this study.

3. Select Control Countries

Identify countries without the policy that are similar in characteristics, that have not had the treatment in question.

Step 4-6: Model Development
- **4. Train Forecast Model**:
  Use ensemble model (SVR-based) on pre-policy data for all countries.
- **5. Train MLRM Model**:
  Fit MLRM using vehicle sales as dependent variable with selected predictors.
- **6. Evaluate Model Performance**:

Assess R^2 and MASE for both ensemble and MLRM models.

Step 7-10: Synthetic Control Construction
- **7. Pre-Policy Trend Matching**:
  Adjust control countries' weights to match the treated country’s trends.
- **8. Optimize Weights**:
  Use algorithms to find optimal country weights in synthetic control.
- **9. Validate Weight Fit**:
  Ensure pre-policy sales in synthetic control closely follow the treated country.
- **10. Verify Assumptions**:
  Check comparability and parallel trends of control countries.

Step 11-14: Forecasting and Benchmarking
- **11. Generate Forecasts (Both Models)**:
  Forecast post-policy sales with both synthetic control and MLRM.
- **12. Compare Actual vs Predicted**:
  Compare actual sales to synthetic control and MLRM predictions.
- **13. Evaluate Predictive Accuracy**:
  Use metrics like RMSE and MAE to compare accuracy of both models.
- **14. Test Statistical Significance**:
  Use statistical tests (e.g., Diebold-Mariano) to check if one model outperforms.

Step 15-18: Interpretation and Validation
- **15. Calculate Policy Impact (Both Models)**:
  Estimate the policy's effect by comparing actual to forecasted sales.
- **16. Evaluate Robustness**:
  Ensure stability of results through sensitivity tests in both models.
- **17. Time and Complexity Analysis**:
  Assess the time efficiency and complexity of synthetic control vs MLRM.
- **18. Acknowledge Limitations**:
  Note constraints of limited post-policy data and potential model biases.

Step 19-20: Final Review and Presentation
- **19. Benchmark Summary**:
  Summarize differences in performance, speed, and accuracy between the models.
- **20. Refine Recommendations**:
  Adjust policy recommendations based on model performance and stakeholder feedback.