# Exploring the New Coach Effect with Data

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# Research Question

- To evaluate whether the change of coach has a statistically and practically significant effect on team performance, using model-based inference and standardized metrics.
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# Data Preparation

- Scraped all Bundesliga match data (2017–2025)using the package`worldfootballR`
- 30 teams, total 4876 matches (only `ForAgainst = For` rows kept)
- Matched coaches to each team
- Calculated Elo ratings for each team and opponent
- Computed key performance indicators (KPIs):
  - Match result points (3/1/0)
  - Efficiency: `eff = GF - xG_Expected`

# Coach Change Events

- Identified coach change points and assigned `event_id`
- Created windows before/after the change
- Constructed:
  - `relative_time` (time index relative to change)
  - `post` (binary: pre/post change)
  - `time_post` (time since change)

# Hetergeneity

# Visualization

- Plotted average points over time by `relative_time`
- Compared pre- and post-change trends
- Goal: visually assess changes in team performance after coaching switches

# Interrupted Time Series Model (ITS)

We model team performance using the following regression:

$$y_{it} = \alpha_i + \beta_1 t + \beta_2 \cdot \text{post}_{it} + \beta_3 \cdot \text{time\_post}_{it} + \beta_4 \cdot \text{home}_{it} + \beta_5 \cdot \text{elo}_{it} + \varepsilon_{it}$$

where $\alpha_i$ corresponds to C(Team) or heter— the fixed effect for each team.

example or graph explaination

# Poisson Regression Model

We model count-type outcomes (e.g., goals or points) as:

$$y_{it} \sim \text{Poisson}(\lambda_{it})$$

with the log link function:

$$\log(\lambda_{it}) = \alpha_i + \beta_1 t + \beta_2 \cdot \text{post}_{it} + \beta_3 \cdot \text{time\_post}_{it} + \beta_4 \cdot \text{home}_{it} + \beta_5 \cdot \text{elo}_{it}$$

# Further Perspective: Tactical Efficiency

- Define `eff = GF - xG_Expected`
- If post-change `eff > 0` and significant $\rightarrow$ better tactical efficiency
- If `xG_Expected` $\uparrow$ but `eff` $\not> 0 \rightarrow$ chances created but not converted