# Trilogy

<table>
<thead>
<tr>
<th>BAE</th>
<th>CSE</th>
<th>DiD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Identifying assumption</strong></td>
<td>( E(\text{Y}_0\mid D=1) = E(\text{Y}_0\mid D=0) )</td>
<td>( E(\text{Y}_0\mid D=1) = E(\text{Y}_0\mid D=0) )</td>
</tr>
<tr>
<td>assumes that the outcome before treatment equals the outcome had they not received the treatment</td>
<td>assumes that the outcome of the treatment group had they not been treated (counterfactual) equals the outcome of the control group</td>
<td>assumes that biases are the same on average in different time periods in both groups</td>
</tr>
<tr>
<td><strong>Data requirements</strong></td>
<td>only data from treatment group needed</td>
<td>data from treatment group and control group needed</td>
</tr>
<tr>
<td></td>
<td>data before and after treatment</td>
<td>only data after treatment</td>
</tr>
<tr>
<td><strong>Estimator</strong></td>
<td>( \Delta^{\text{BAE}}_{\text{ATT}} = E(\text{Y}_1\mid D=1) - E(\text{Y}_0\mid D=1) )</td>
<td>( \Delta^{\text{CSE}}_{\text{ATT}} = E(\text{Y}_1\mid D=1) - E(\text{Y}_0\mid D=0) )</td>
</tr>
</tbody>
</table>

## Notation

- \( t \) after treatment
- \( t' \) before treatment
- \( D = 1 \) treatment group
- \( D = 0 \) control group
- \( \text{Y}_1t \) post-treatment outcome of a person who receives the treatment
- \( \text{Y}_0t' \) pre-treatment outcome of the person