**Directions**. Use the following tables (also available in excel “Calculating DiD.xls”) to answer these questions. This is simply for us to feel more comfortable as a class with the ATT formula, the DiD equation and the parallel trends assumption.

Table 1: Two groups of units. Group 1 is treated in 1986 to 1990. Group 2 is never treated. Y1 is potential outcome in a world where units are treated and y0 is potential outcome in a world where units are not treated. Y is the observed outcome selected by the switching equation.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **year** | **group** | **y1** | **y0** | **y** | **D** |
| 1980 | 1 |  | 3.58 | 3.58 | 0 |
| 1981 | 1 |  | 4.52 | 4.52 | 0 |
| 1982 | 1 |  | 5.57 | 5.57 | 0 |
| 1983 | 1 |  | 6.53 | 6.53 | 0 |
| 1984 | 1 |  | 7.57 | 7.57 | 0 |
| 1985 | 1 |  | 8.56 | 8.56 | 0 |
| 1986 | 1 | 19.55 | **9.56** | 19.55 | 1 |
| 1987 | 1 | 30.59 | **10.59** | 30.59 | 1 |
| 1988 | 1 | 41.55 | **11.53** | 41.55 | 1 |
| 1989 | 1 | 52.57 | **12.58** | 52.57 | 1 |
| 1990 | 1 | 63.56 | **13.56** | 63.56 | 1 |
| 1980 | 2 |  | 3.59 | 3.59 | 0 |
| 1981 | 2 |  | 4.56 | 4.56 | 0 |
| 1982 | 2 |  | 5.59 | 5.59 | 0 |
| 1983 | 2 |  | 6.54 | 6.54 | 0 |
| 1984 | 2 |  | 7.55 | 7.55 | 0 |
| 1985 | 2 |  | 8.58 | 8.58 | 0 |
| 1986 | 2 |  | 9.58 | 9.58 | 0 |
| 1987 | 2 |  | 10.58 | 10.58 | 0 |
| 1988 | 2 |  | 11.62 | 11.62 | 0 |
| 1989 | 2 |  | 12.58 | 12.58 | 0 |
| 1990 | 2 |  | 13.58 | 13.58 | 0 |

**Causal parameters and estimation**

1. Why does Y equal Y1 for group 1 from 1986-1990 but Y0 everywhere else?
2. Calculate the ATT for group 1 from 1986 to 1990.
3. Fill in the following table with group averages for pre and post-treatment. Use these four numbers to estimate the ATT using the DiD equation and compare your estimate to the true ATT.

Table : Group means before and after treatment

|  |  |  |
| --- | --- | --- |
|  | **Group 1** | **Group 2** |
| **Pre** |  |  |
| **Post** |  |  |

**Checking trends**

1. Do group 1 and group 2 have similar pre-treatment trends? How might you show it?
2. Do group 1 and group 2 have similar Y0 trends for the pre to post period (“parallel trends”)?
3. What data would you need to calculate parallel trends in the real world? Could you do this ordinarily then?

Table 2: Same data, but different column y0.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **year** | **group** | **y1** | **y0** | **y** | **D** |
| 1980 | 1 |  | 3.58 | 3.58 | 0 |
| 1981 | 1 |  | 4.52 | 4.52 | 0 |
| 1982 | 1 |  | 5.57 | 5.57 | 0 |
| 1983 | 1 |  | 6.53 | 6.53 | 0 |
| 1984 | 1 |  | 7.57 | 7.57 | 0 |
| 1985 | 1 |  | 8.56 | 8.56 | 0 |
| 1986 | 1 | 19.55 | **15.00** | 19.55 | 1 |
| 1987 | 1 | 30.59 | **25.00** | 30.59 | 1 |
| 1988 | 1 | 41.55 | **35.00** | 41.55 | 1 |
| 1989 | 1 | 52.57 | **48.00** | 52.57 | 1 |
| 1990 | 1 | 63.56 | **60.00** | 63.56 | 1 |
| 1980 | 2 |  | 3.59 | 3.59 | 0 |
| 1981 | 2 |  | 4.56 | 4.56 | 0 |
| 1982 | 2 |  | 5.59 | 5.59 | 0 |
| 1983 | 2 |  | 6.54 | 6.54 | 0 |
| 1984 | 2 |  | 7.55 | 7.55 | 0 |
| 1985 | 2 |  | 8.58 | 8.58 | 0 |
| 1986 | 2 |  | 9.58 | 9.58 | 0 |
| 1987 | 2 |  | 10.58 | 10.58 | 0 |
| 1988 | 2 |  | 11.62 | 11.62 | 0 |
| 1989 | 2 |  | 12.58 | 12.58 | 0 |
| 1990 | 2 |  | 13.58 | 13.58 | 0 |

**Repeating previous questions**

1. Calculate the ATT for group 1 from 1986 to 1990.
2. Fill in the following table with group averages for pre and post-treatment. Use these four numbers to estimate the ATT using the DiD equation and compare your estimate to the true ATT.

Table 1: Group means before and after treatment

|  |  |  |
| --- | --- | --- |
|  | **Group 1** | **Group 2** |
| **Pre** |  |  |
| **Post** |  |  |

1. Do group 1 and group 2 have similar Y0 trends for the pre to post period (“parallel trends”)?

Discussion questions:

* What is the difference between the ATT and the DiD equation?
* What is the difference between “pre-trends” and “parallel trends”?
* Why was the first estimate so accurate but the second was so inaccurate?
* We found pre-trends to be so similar, but in the second example, parallel trends didn’t hold. Can you explain how that’s possible?
* When would we expect pre-trends to hold but parallel trends to not hold?