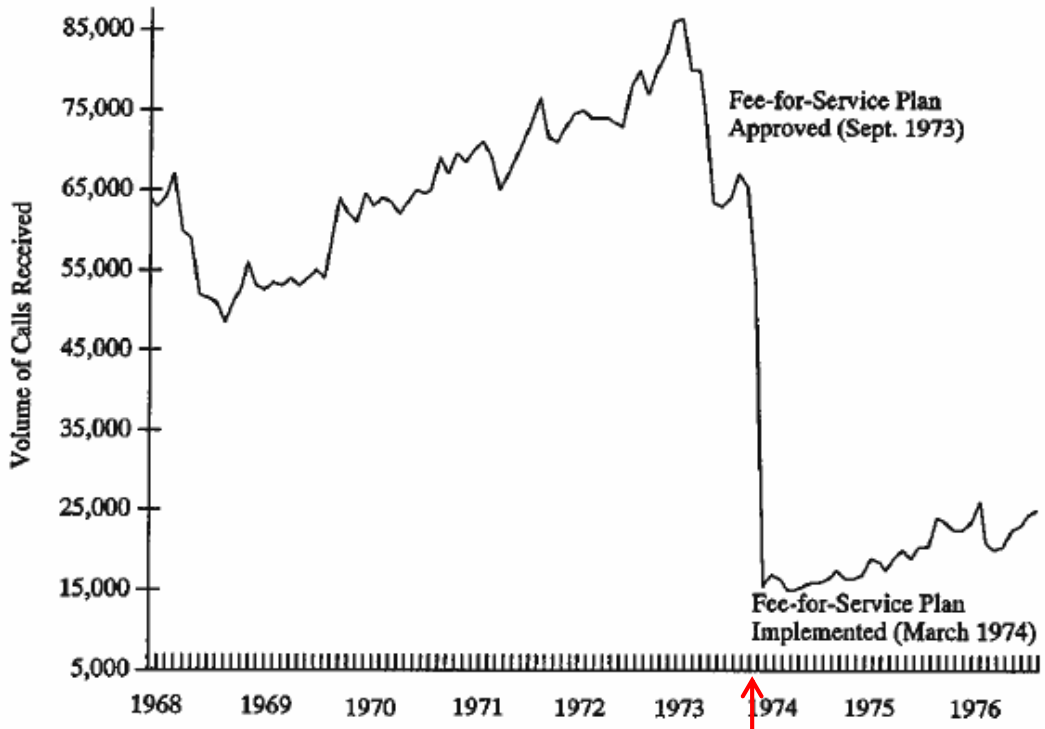
ITS NOTES:

INTERRUPTED TIME SERIES

Figure 7.1. Single Group Interrupted Time Series Data:
Volume of Calls Received by Cincinnati Bell's Local Directory Assistance: 1968–1976.

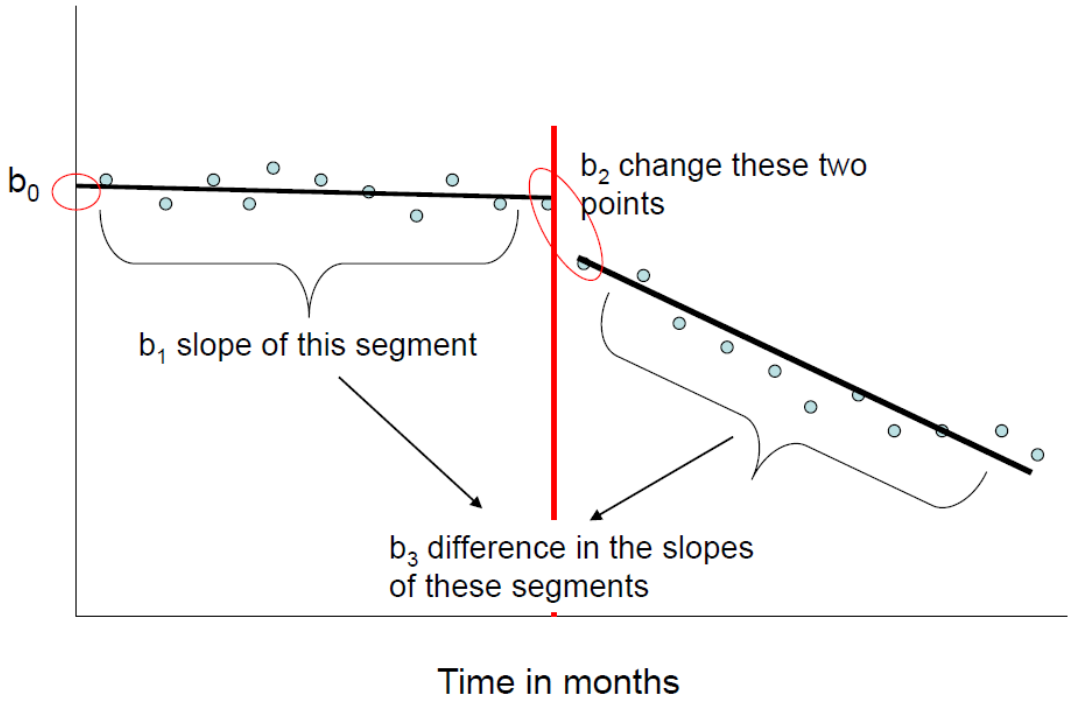


Source: Adapted from McSweeny, 1978, from data provided by John McSweeny.

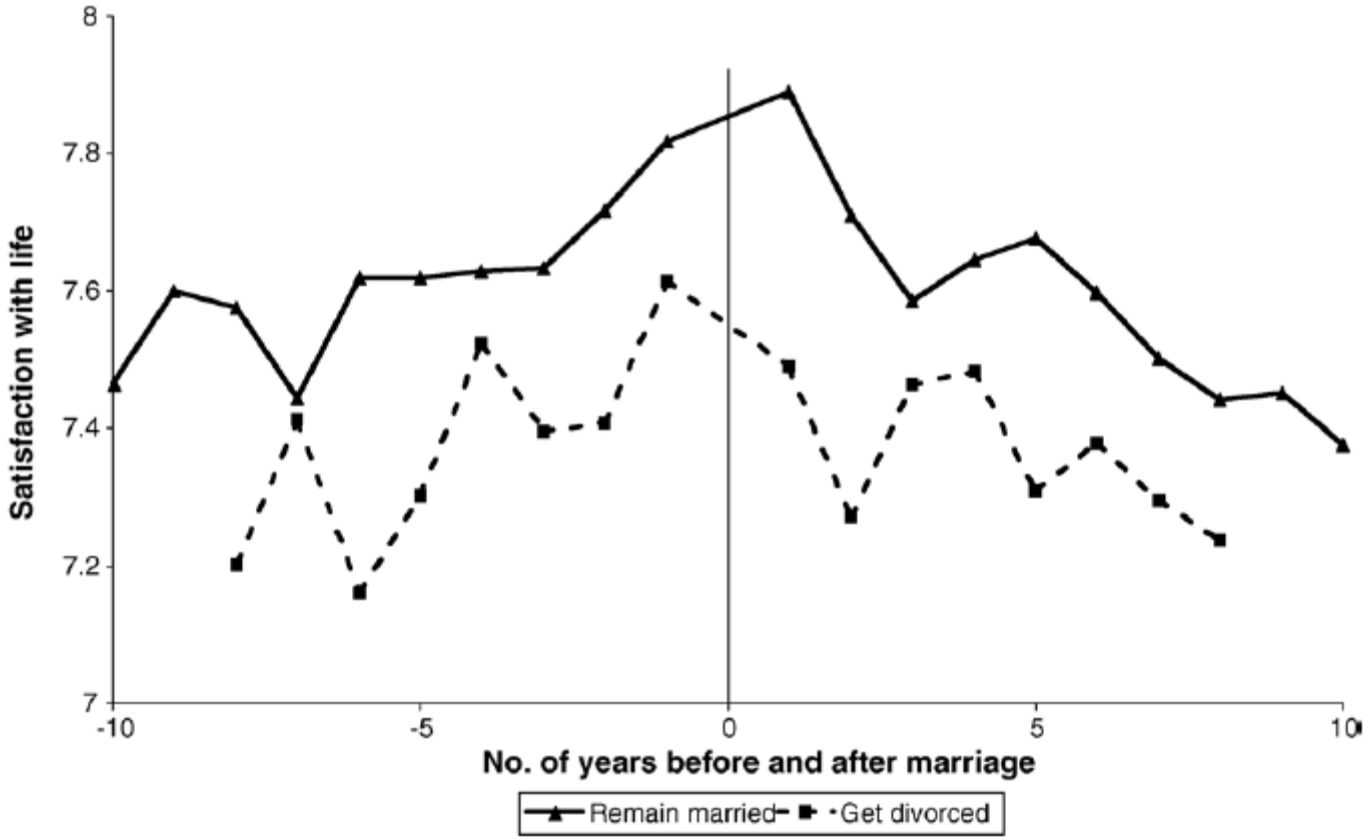
Interrupted Time Series Regression Models:

$$Y = b_0 + b_1T + b_2D + b_3P + e$$

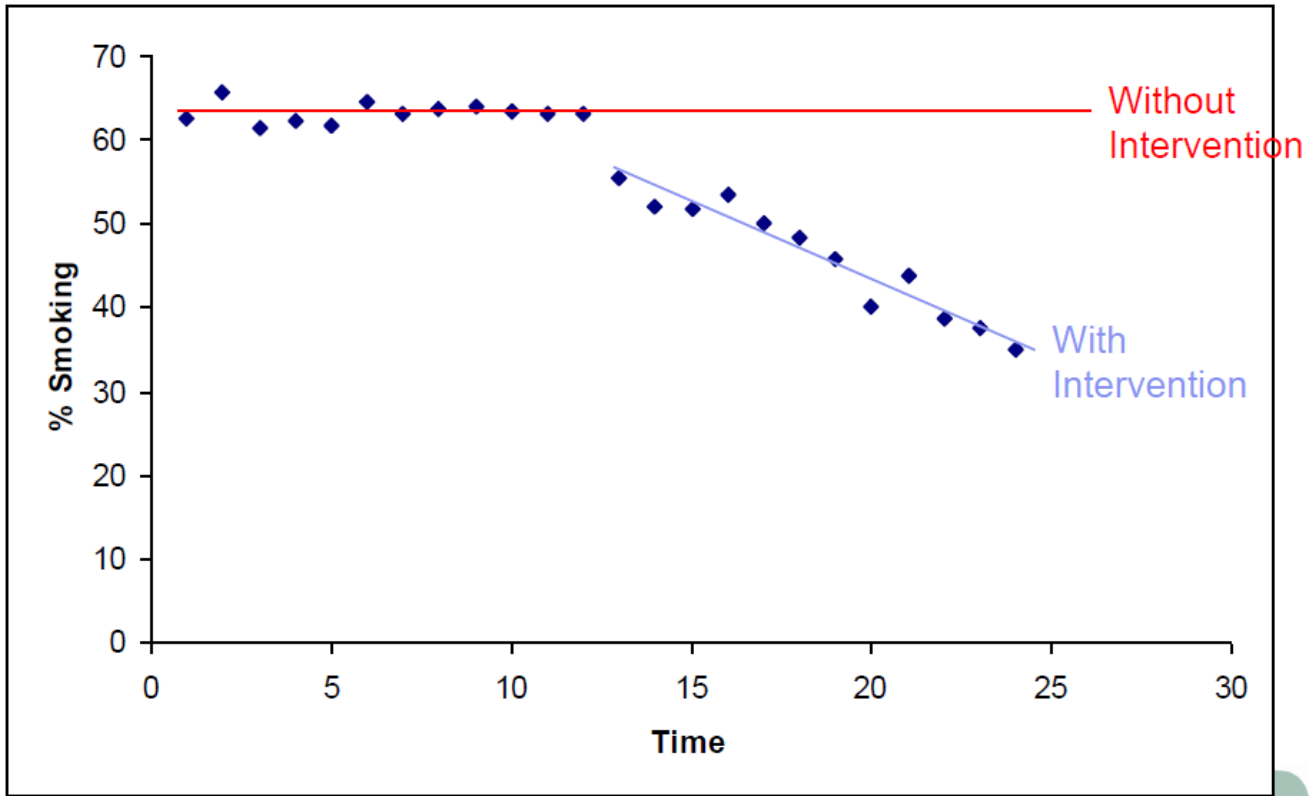
Y	T	D	P
17	1	0	0
19	2	0	0
22	3	0	0
24	4	1	1
27	5	1	2
27	6	1	3
30	7	1	4



Time can be relative:



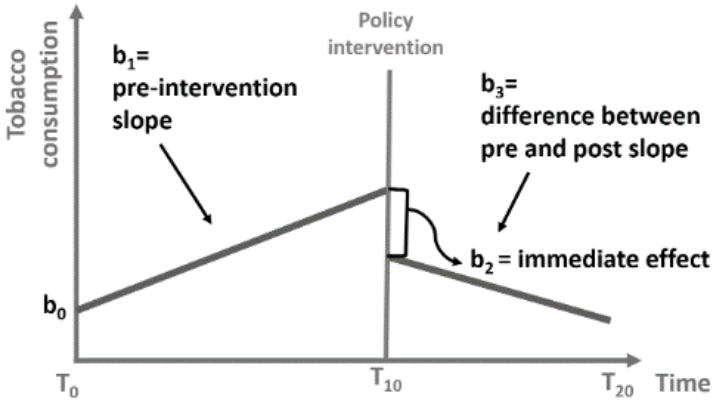
How do you define “effect size”?



EFFECTS:

b2 = instantaneous effect
b3 = sustained effect

$$Y = b_0 + b_1 T + b_2 D + b_3 P + e$$

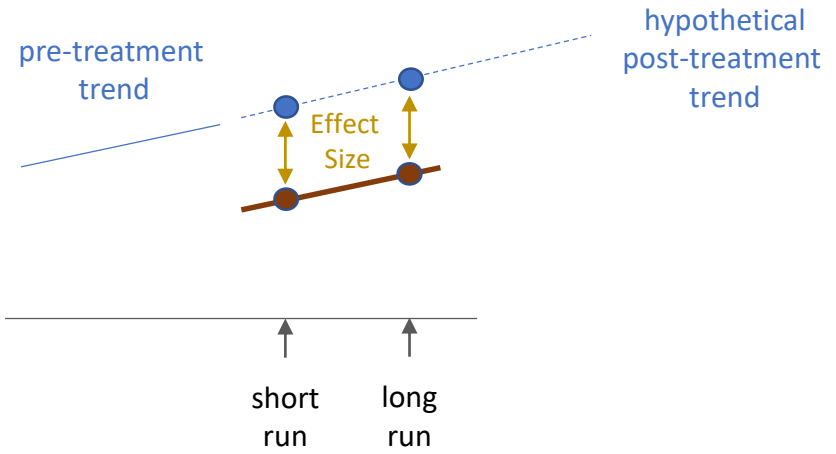


EFFECT SIZE:

$$\hat{y}_{TREATED \mid time=t} - \hat{y}_{CONTROL \mid time=t}$$

Note, it's a post-test only comparison!
Even though it's a reflexive research design

Y-HAT world without treatment
Y-HAT world with treatment
COUNTERFACTUAL

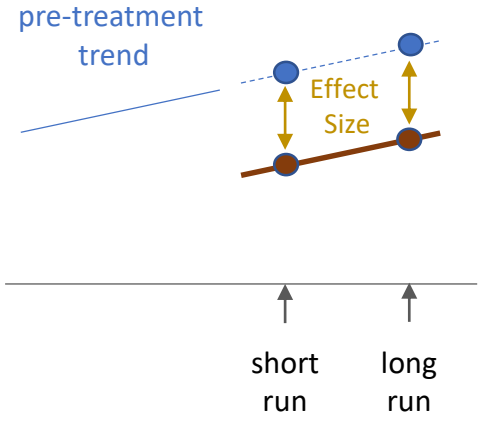


Y-HAT world without treatment

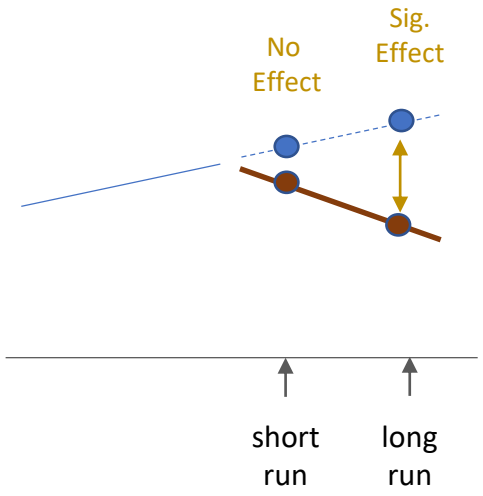
Y-HAT world with treatment

COUNTERFACTUALS

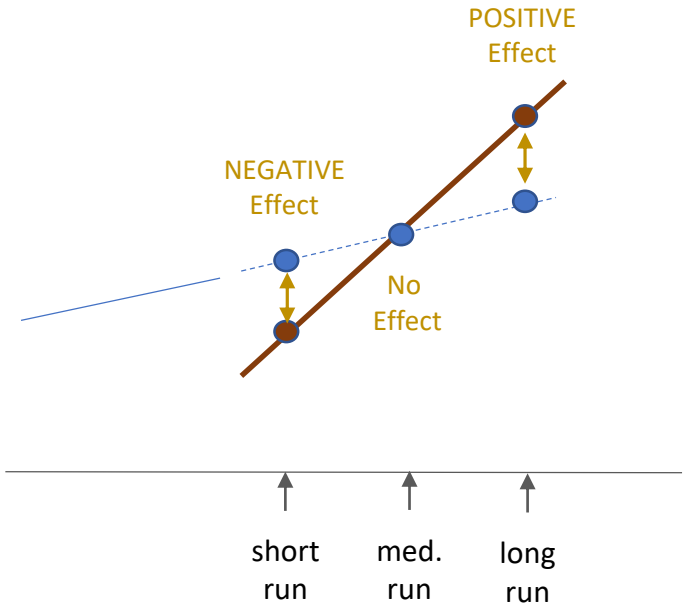
CHALLENGE: The effect goes from negative to zero to positive depending on where you measure it.



The effect size is the same no matter when measured.



CHALLENGE: The program looks ineffective at first, but the effect increases over time

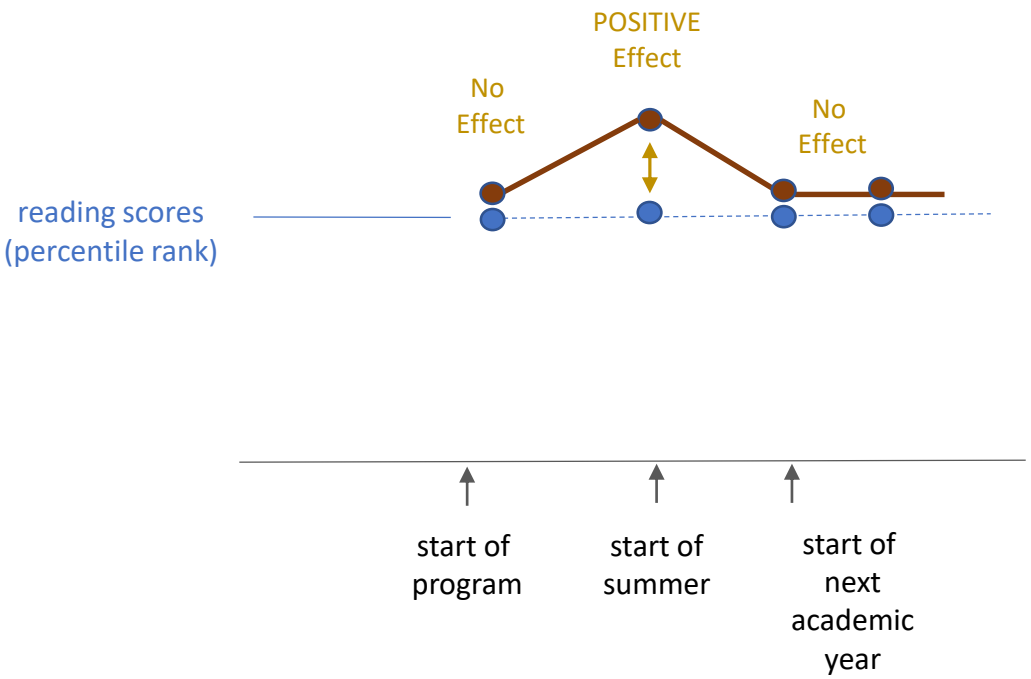


Example: enroll in job training to escape minimum-wage trap: (1) initial lost wages, (2) start of new job, (3) long-term higher pay.

See Heinrich, C., Mueser, P. R., Troske, K. R., Jeon, K. S., & Kahvecioglu, D. (2009). New estimates of public employment and training program net impacts: A nonexperimental evaluation of the Workforce Investment Act program.

REGRESSION TO THE MEAN

(e.g. low SES tutoring program without summer school)



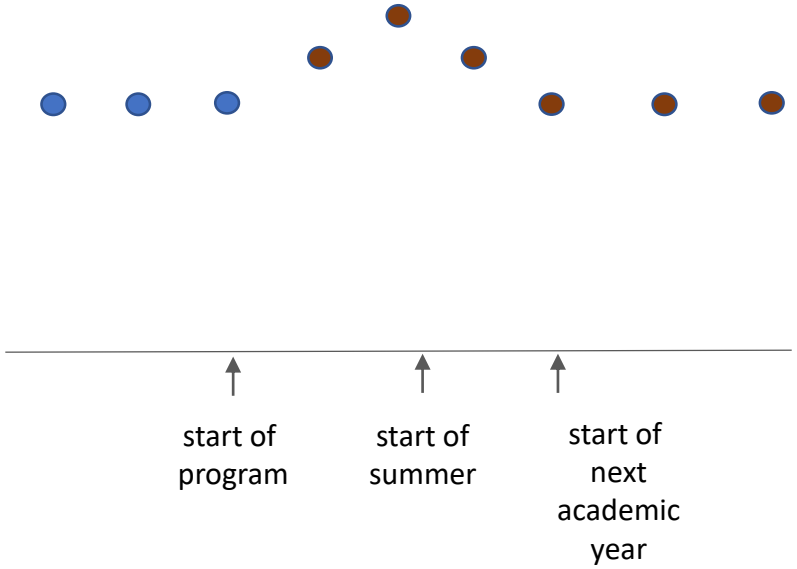
Gains made during the academic year are erased by lack of continued engagement over the summer.

Is this program effective?

REGRESSION TO THE MEAN

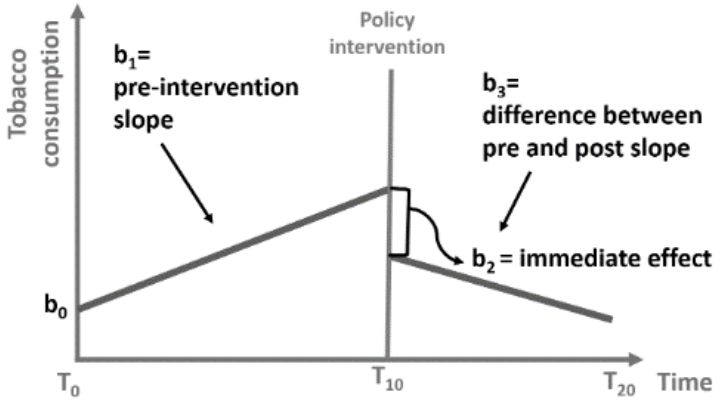
(e.g. low SES tutoring program without summer school)

$$Y = b_0 + b_1 T + b_2 D + b_3 P + e$$



SPECIFICATION PROBLEMS!

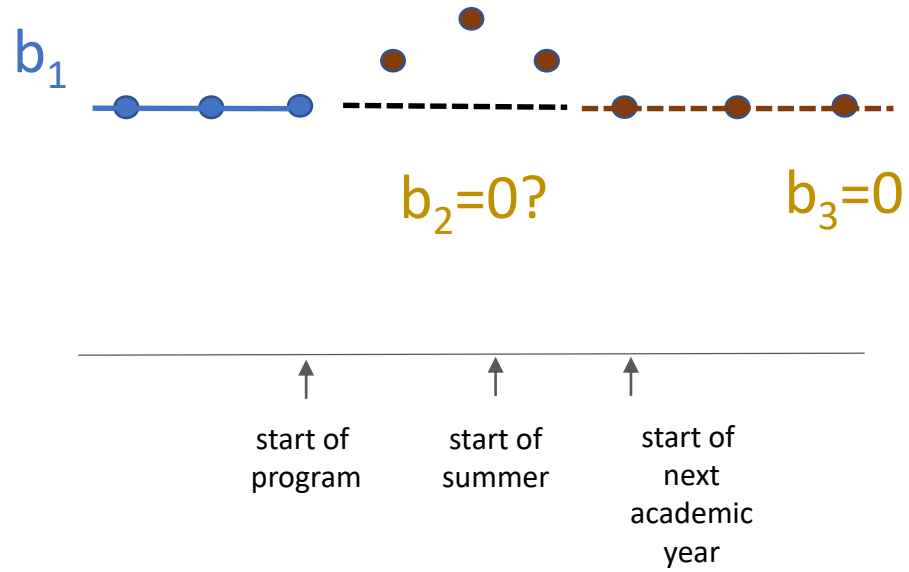
What are the lines of best fit here?



REGRESSION TO THE MEAN

(e.g. low SES tutoring program without summer school)

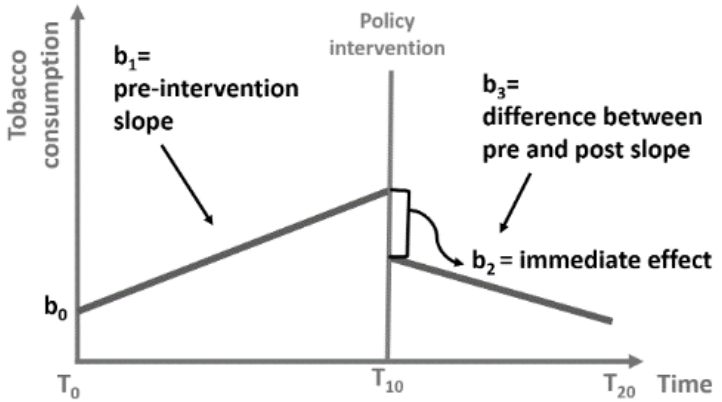
$$Y = b_0 + b_1 T + b_2 D + b_3 P + e$$



SPECIFICATION PROBLEMS!

What are the lines of best fit here?

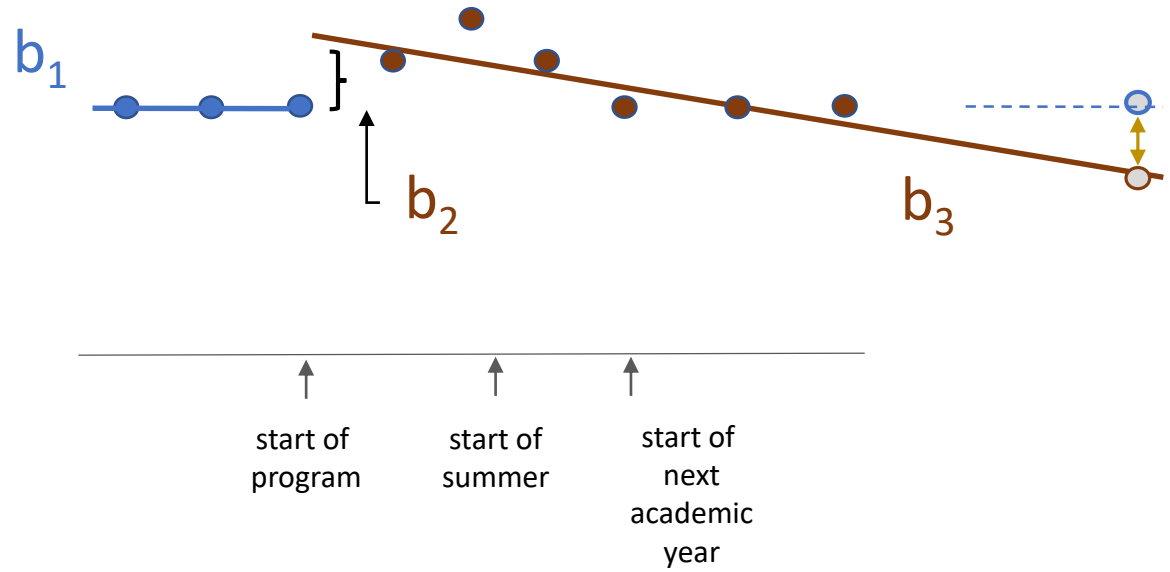
What accurate coefficients would look like



REGRESSION TO THE MEAN

(e.g. low SES tutoring program without summer school)

$$Y = b_0 + b_1 T + b_2 D + b_3 P + e$$



SPECIFICATION PROBLEMS!

What are the lines of best fit here?

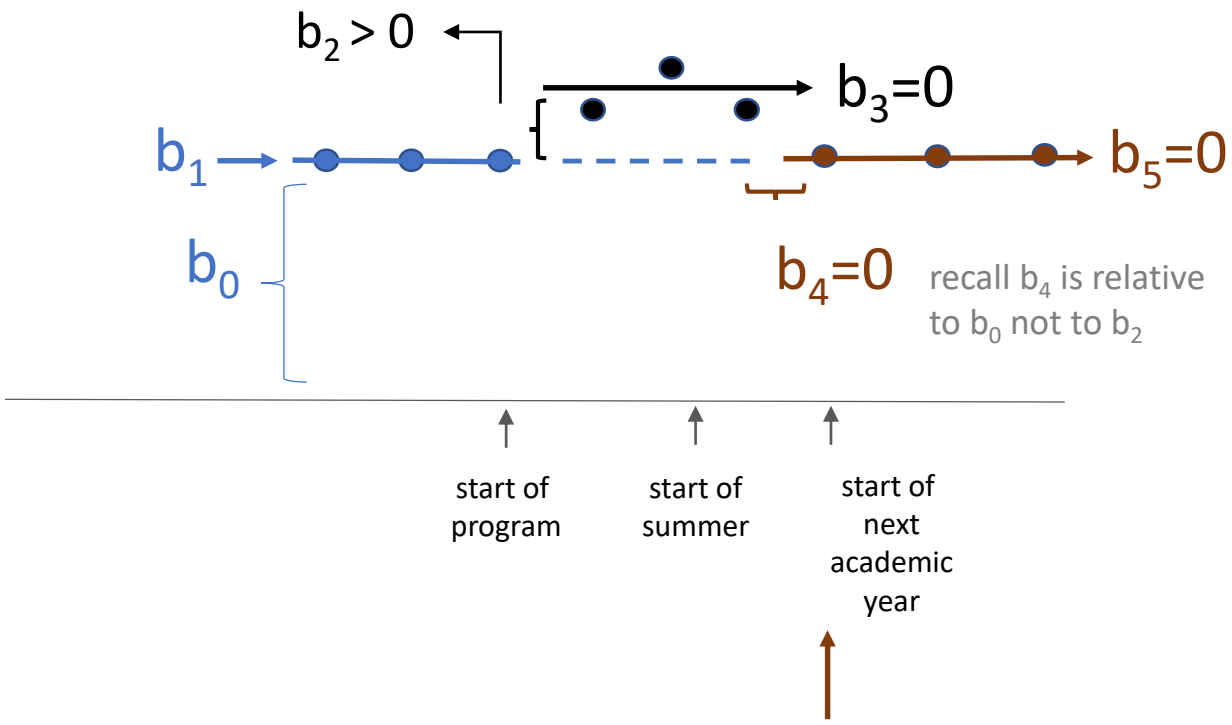
Program appears to be harmful over time

Actual coefficients:
(coefficients that minimize residuals)

REGRESSION TO THE MEAN

(e.g. low SES tutoring program without summer school)

$$Y = b_0 + b_1T + b_2D1 + b_3TS1 + b_4D2 + b_5TS2$$



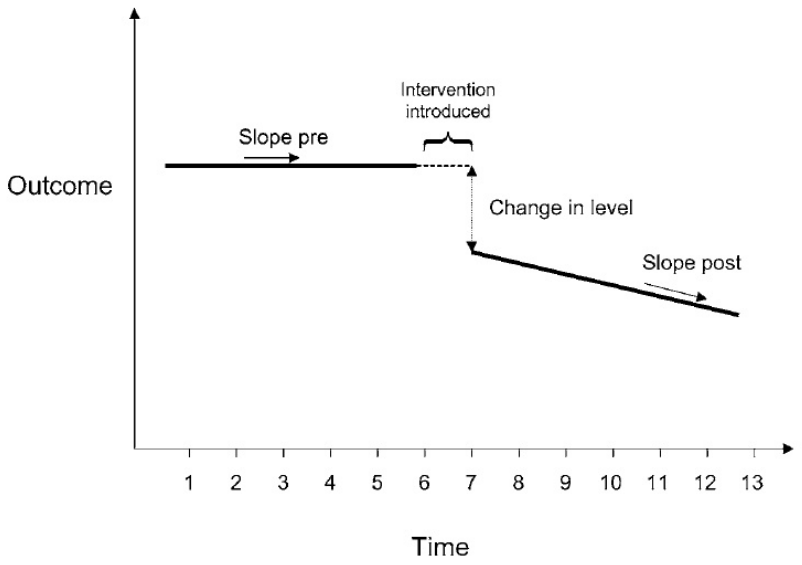
THE FIX:

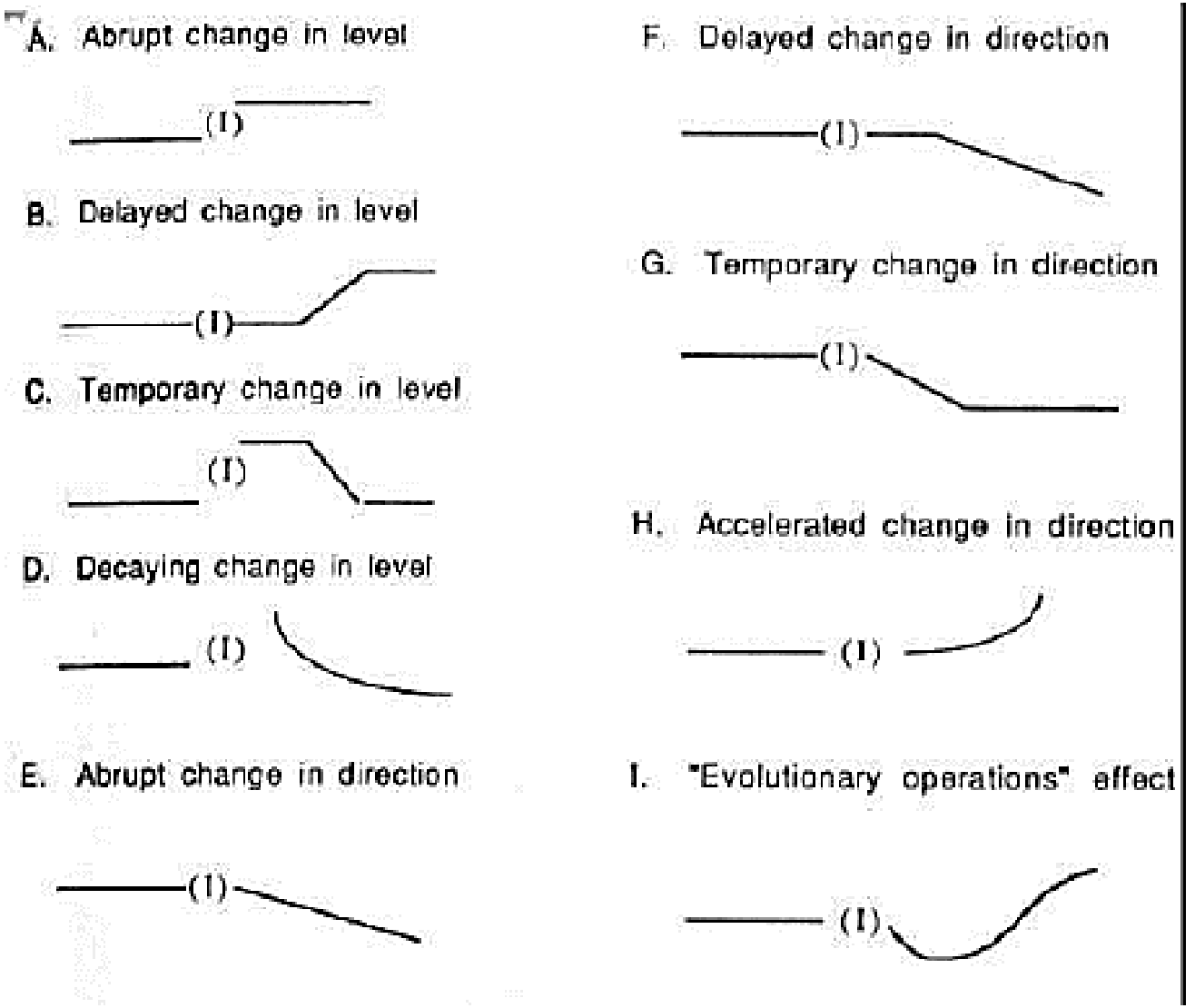
We need more degrees of freedom. Design matrix for more slopes and intercepts to allow the model to identify a regression to the mean if it exists.

b0	T	D1	TS1	D2	TS2
1	1	0	0	0	0
1	2	0	0	0	0
	…				
1	10	1	1	0	0
1	11	1	2	0	0
	…				
1	21	0	0	1	1
1	22	0	0	1	2

D2 and TS2 start at the point where you believe program effects fully regress back to the mean, but this is not an actual intervention point. Use theory to guide.

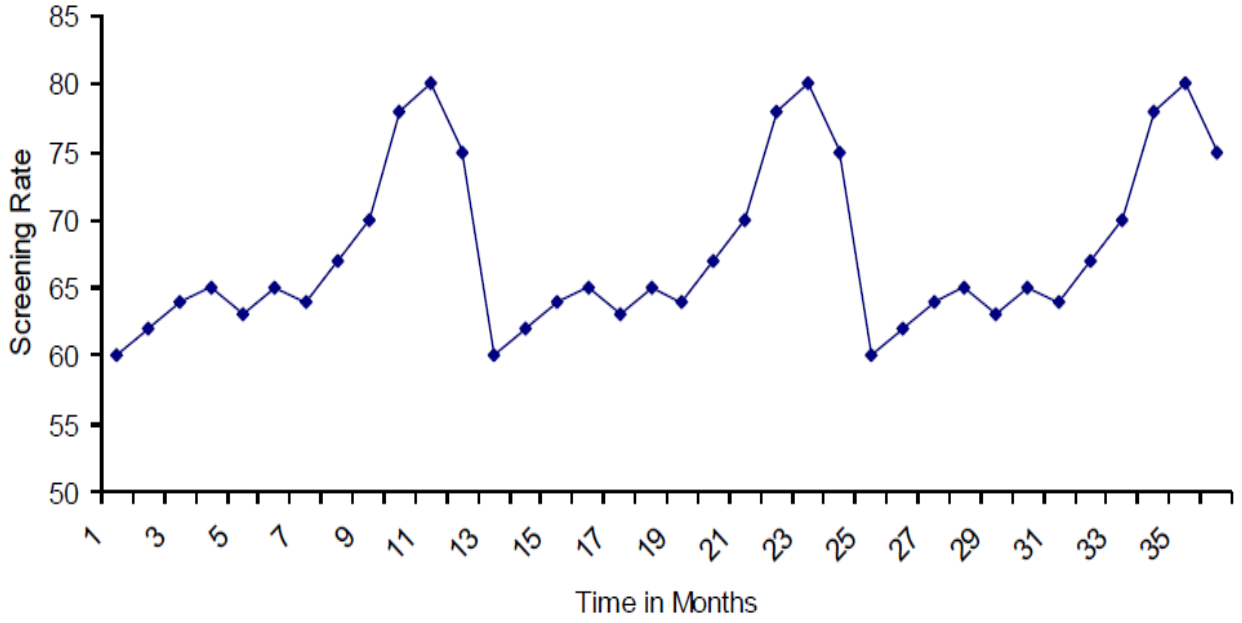
TREATMENT EFFECTS CAN BE NUANCED:





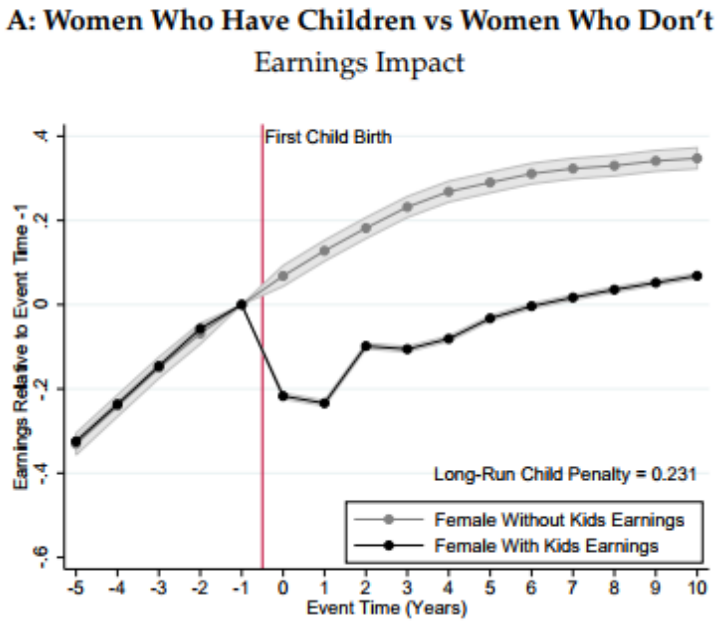
POSSIBLE ISSUES?

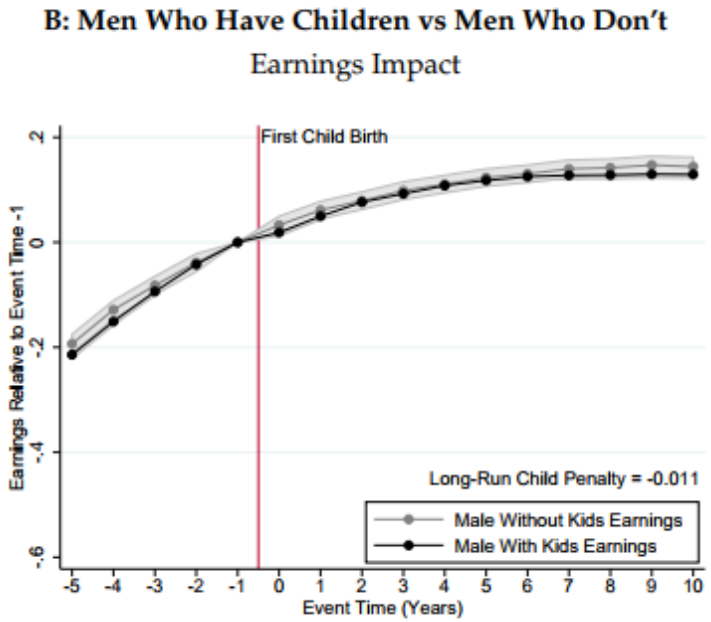
- History
- Contamination
- Attrition
- Seasonality



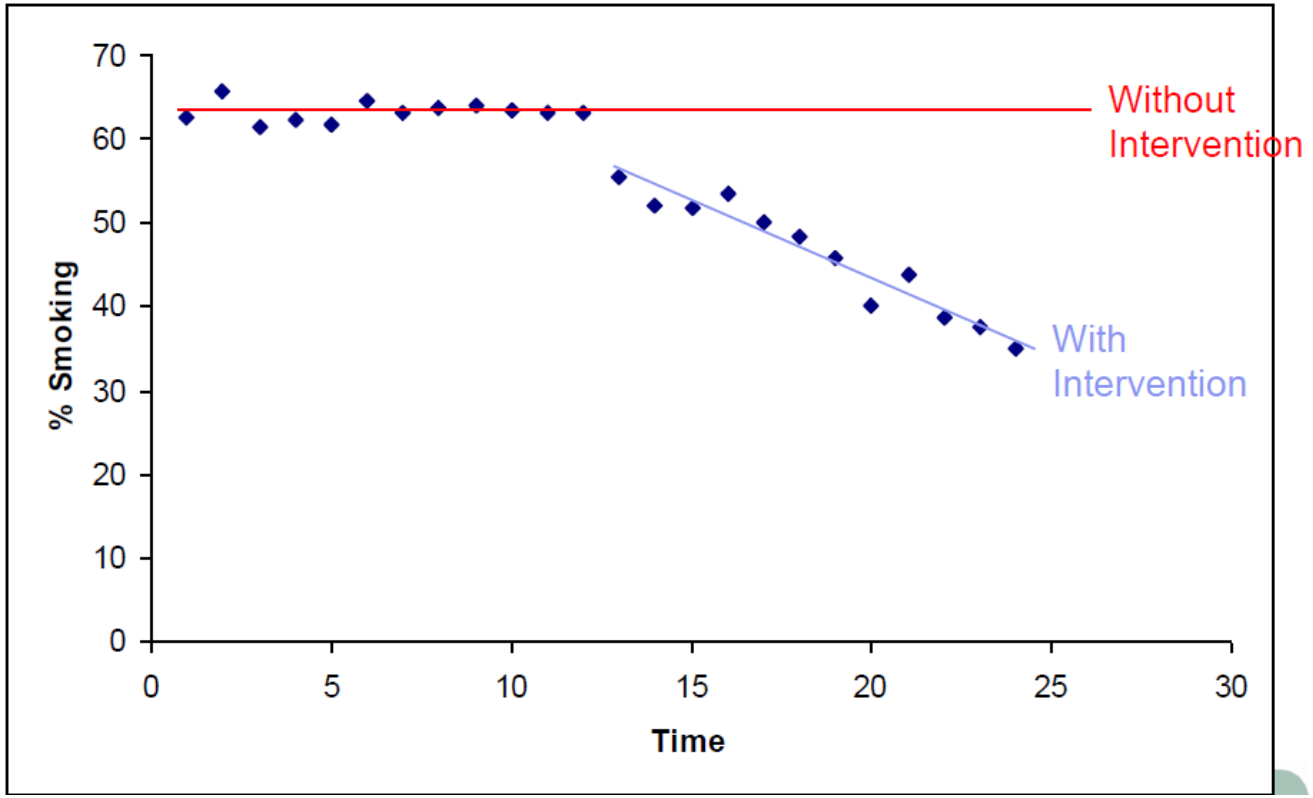
Kleven, H., Landais, C., & Søgaard, J. E. (2018). *Children and gender inequality: Evidence from Denmark* (No. w24219). National Bureau of Economic Research.

Figure 6: Impacts of Children in a Difference-in-Differences Event Study Design





Strengthening the design: adding a comparison group



Strengthening Design: Implementation Phases