

# **Difference-in-Differences**

# The Plan

- What are difference-in-differences
- How to implement it in R

# Common Problem

- Usually we try estimating causal effects by controlling for relevant confounders.
- The problem - We can't never be sure that we haven't missed any important one.
- Is there a way to control for variables without measuring them?

**Yes!** (Kinda...)

# Difference-in-Differences

(And fixed effects)

# Unemployment & Minimum Wage

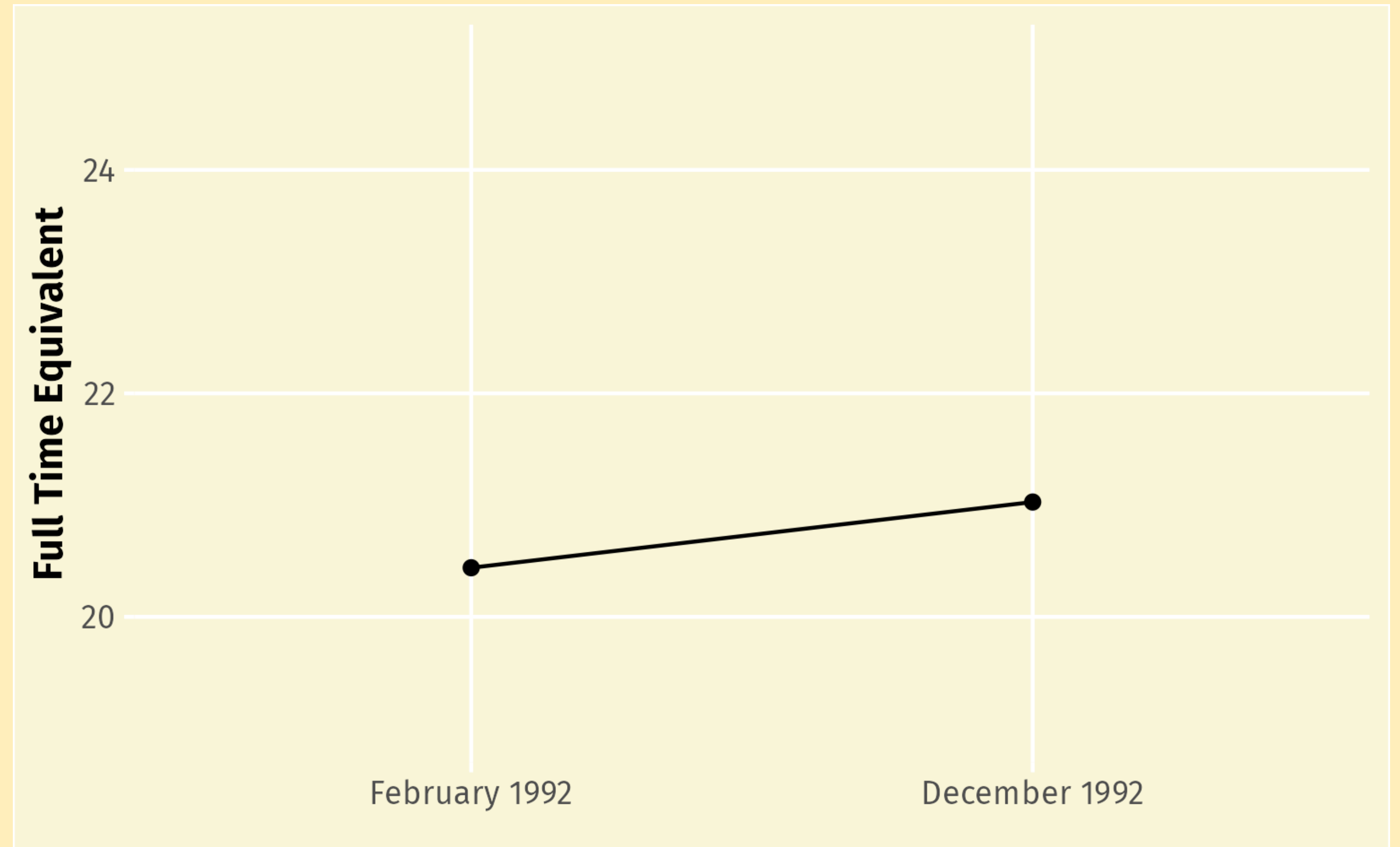
Card, D., & Krueger, A. B. (1993). *Minimum Wages and Employment: A Case Study of the Fast Food Industry in New Jersey and Pennsylvania* (Working Paper 4509). National Bureau of Economic Research. <https://doi.org/10.3386/w4509>

# Unemployment & Minimum Wage

- Does increasing minimum wage increases unemployment rate?
- Classical economics says yes.
- In January 1992, New Jersey increased min. wage from \$4.25 to \$5.05.
- What was the effect? How can we estimate it?

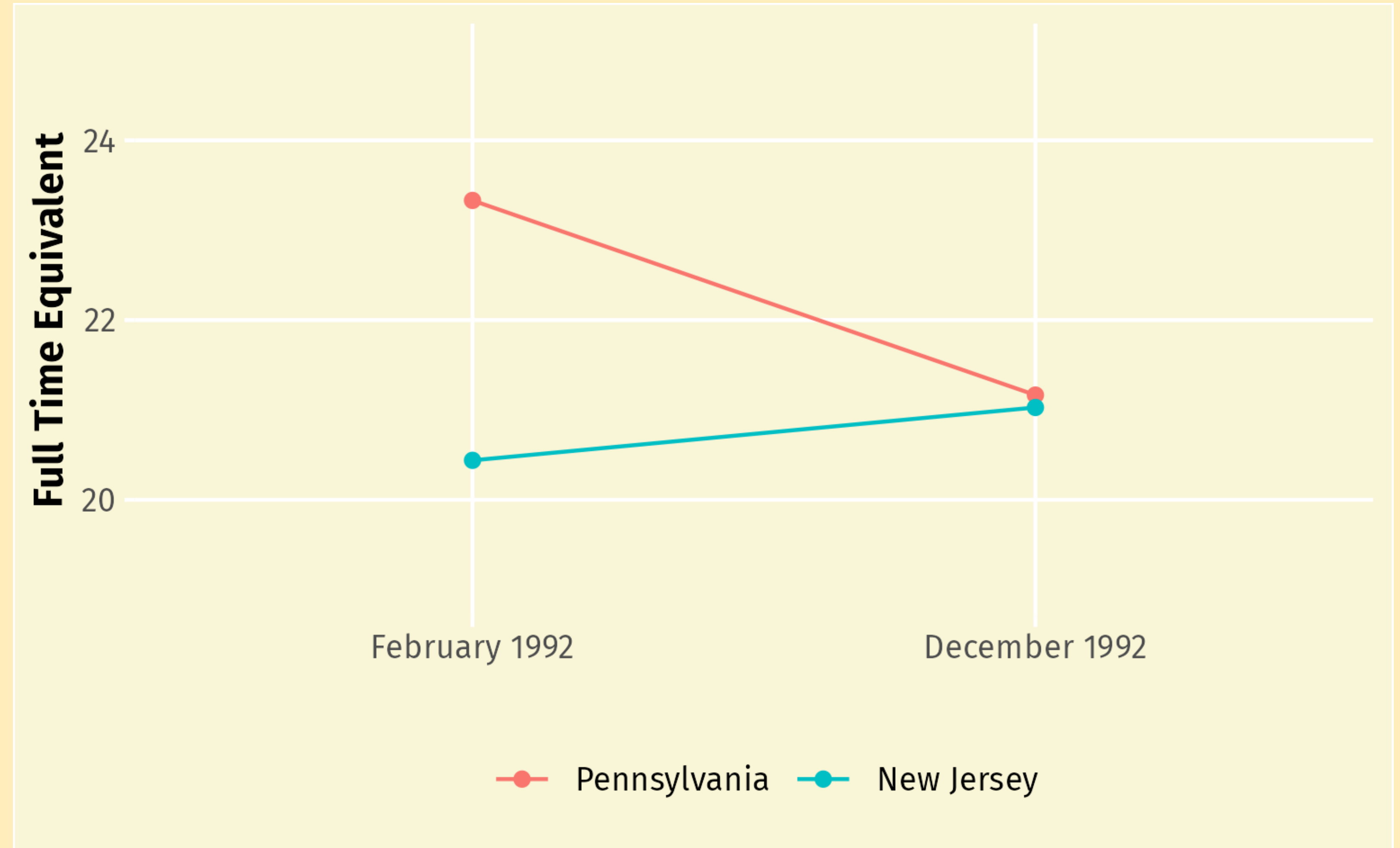
# Option 1: Before vs After

- We can compare FTE **before and after** min wage increase.
- Problem?



# Option 2: New Jersey vs Pennsylvania

- We can compare FTE of **New Jersey** and neighbouring state (**Pennsylvania**)
- Problem?

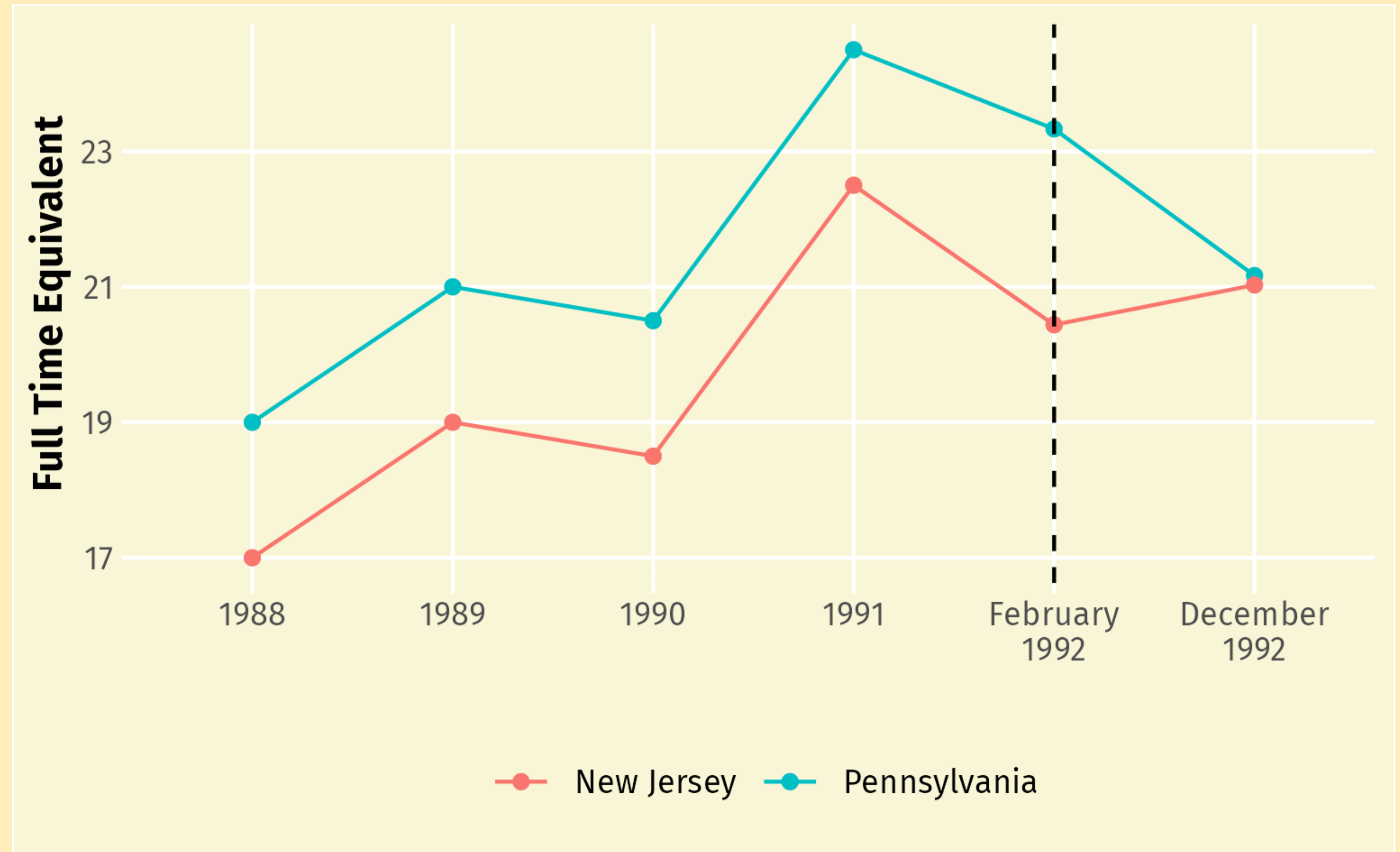




# Option 3: Difference-in-Differences

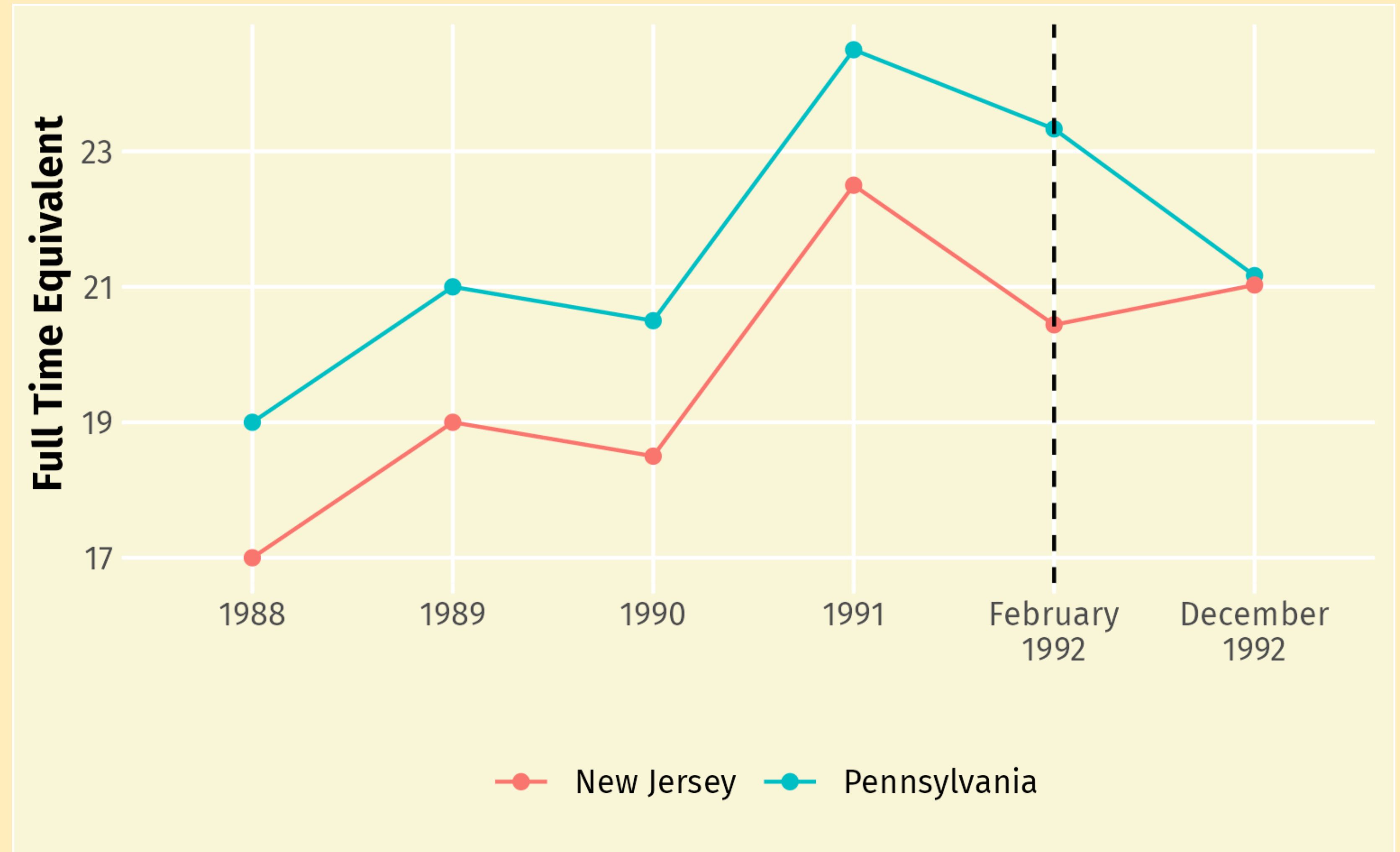
- What if we found a state, where FTE **changed at the same rate** as in New Jersey?

(Before treatment)



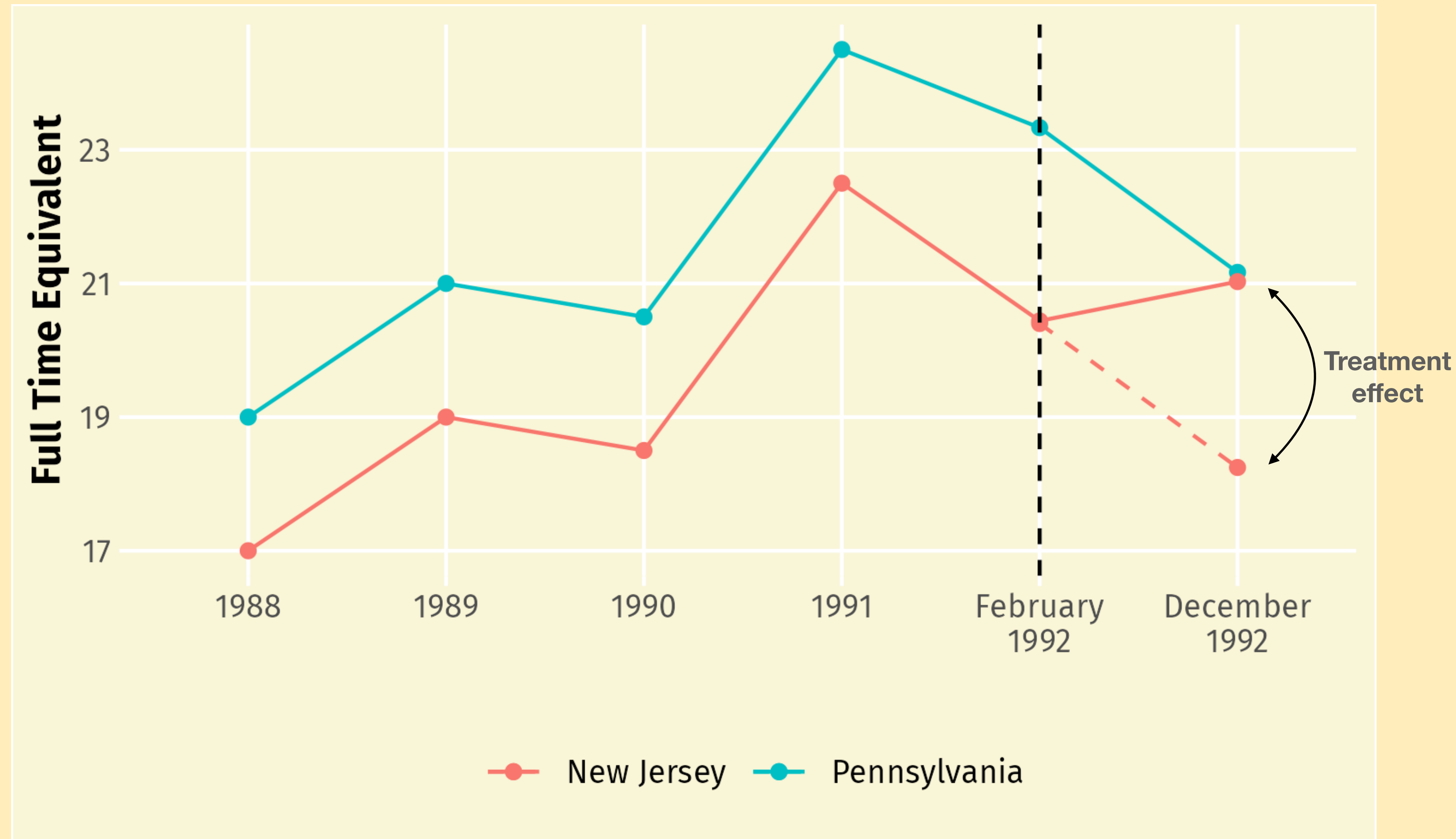
# Option 3: Difference-in-Differences

- If the two groups changed at the same rate before the treatment, we can assume this would still be the case if the treatment weren't given.



# Option 3: Difference-in-Differences

- We can use Pennsylvania to estimate, what would the FTE looked like, had New Jersey didn't raise min. wage.
- The estimate is **difference in differences!**



# Difference-in-Differences

- For two groups and the time points, the math is simple - just an **interaction**.
- We **don't need to control** (or know) for why the groups differ
- Main assumption is **parallel trends**
  - Both groups would change at the same rate, had the treatment were not given.
  - In practice, you can never be sure about this.

Questions?

InteRmezzo!