Quasi experimental methods: Difference in differences

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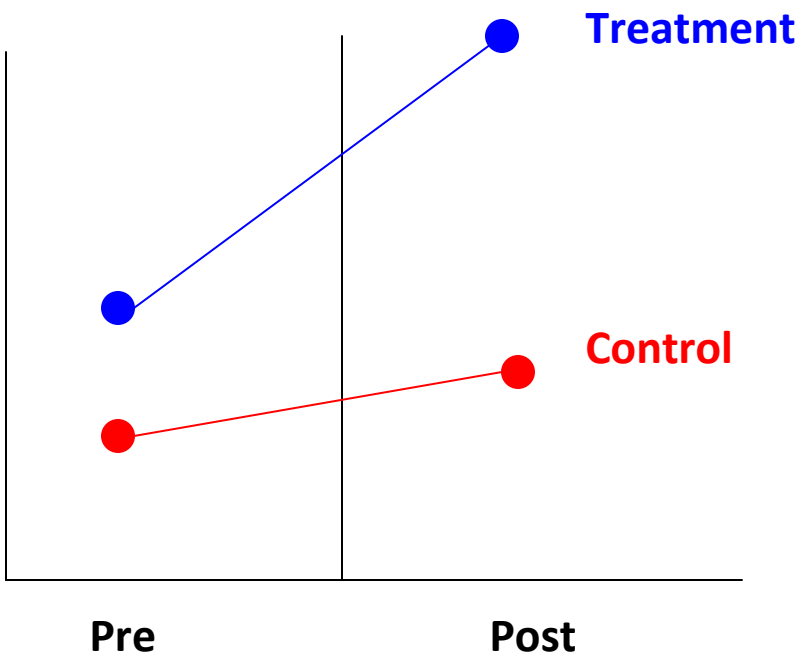
Material in this presentation developed from CEGA and World Bank materials.

Quick re-cap

1. While using non experimental data to infer causal relationships, we must think through sample selection and omitted variables bias
2. Comparing just pre-post or participant vs non-participant is not enough
3. This lecture is about *differencing* out the potential omitted variables bias

Difference-in-Differences, Graphically



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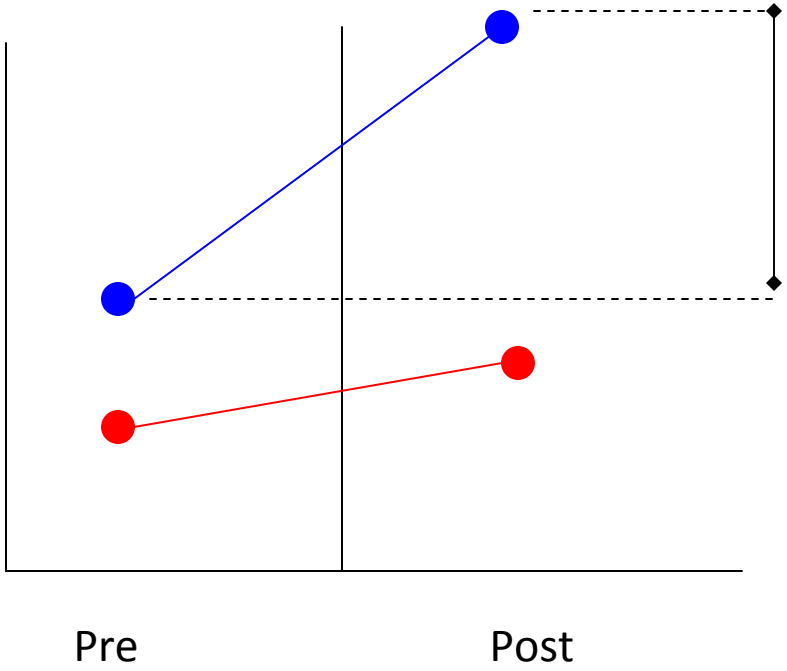
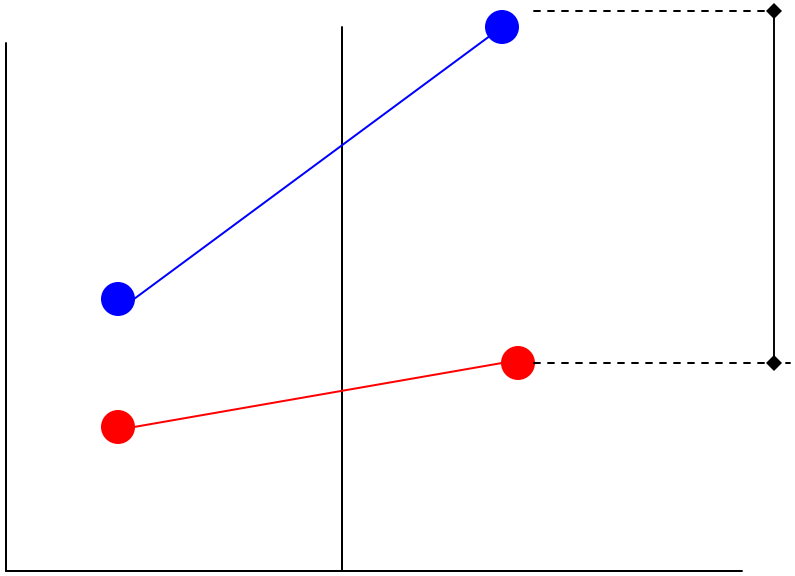


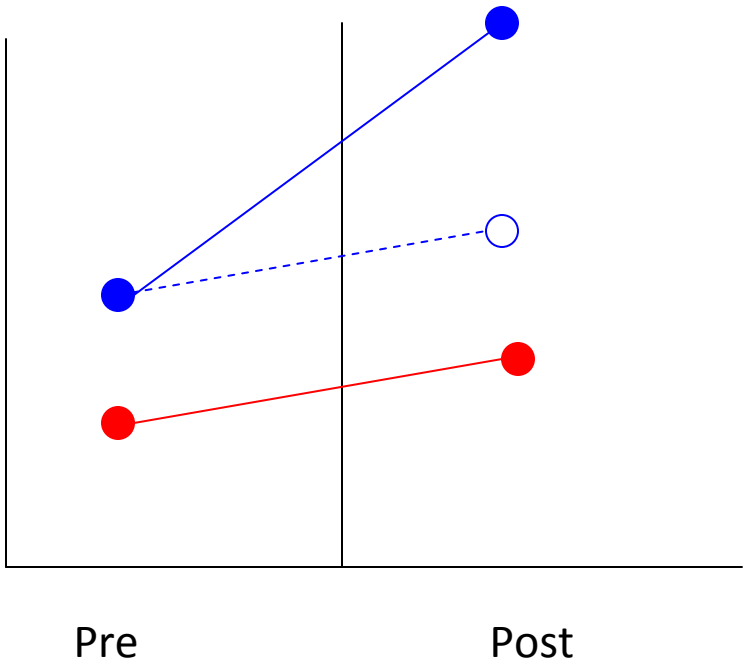
Effect of program using only pre- & post- data from T group (ignoring general time trend).

Difference-in-Differences, Graphically

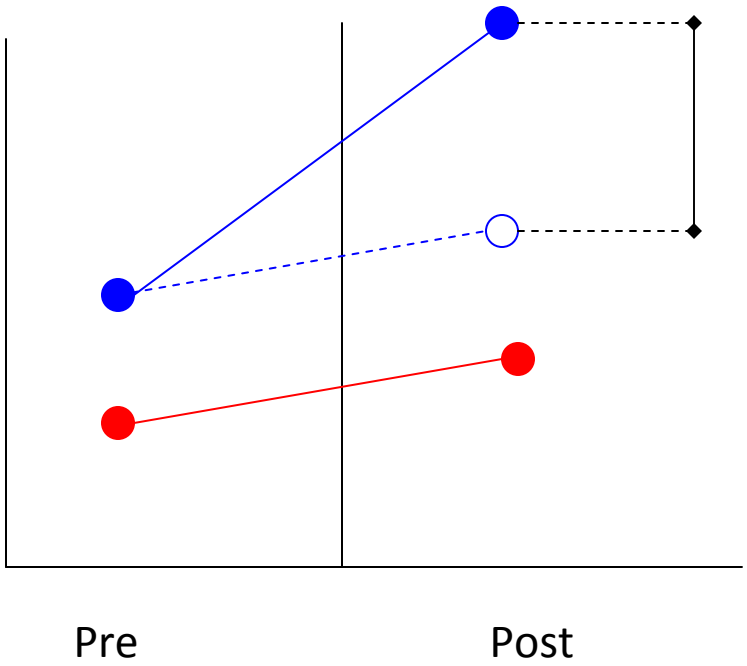


Effect of program using only T & C comparison from post-intervention (ignoring pre-existing differences between T & C groups).

Difference-in-Differences, Graphically



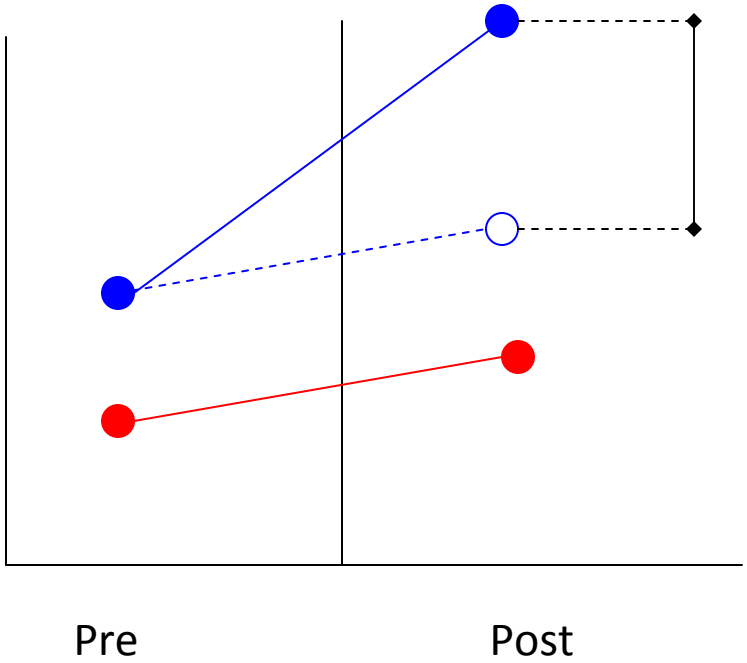
Difference-in-Differences, Graphically



Effect of program difference-in-difference (taking into account pre-existing differences between T & C and general time trend).

Identifying Assumption

- Whatever happened to the control group over time is what would have happened to the treatment group in the absence of the program.



Effect of program difference-in-difference (taking into account pre-existing differences between T & C and general time trend).

DD: Simple Example

	Pre	Post	Difference
Treatment	100	170	70
Control	65	100	35
Difference in Difference			**35**

Example: Change in marriage laws

1. In 1957 Mississippi amended its marriage law
    1. Raised minimum age for men and women
    2. Introduced parental consent laws
    3. Proof of age, blood tests, other restrictions

Impact of changes in marriage law

1. How can we figure out the impact of this marriage law on outcomes such as
    1. Marriages
    2. Fertility
    3. Education
2. Relevant for our context in terms of empowering women – does postponement of marriage empower women by delaying fertility and increasing education?

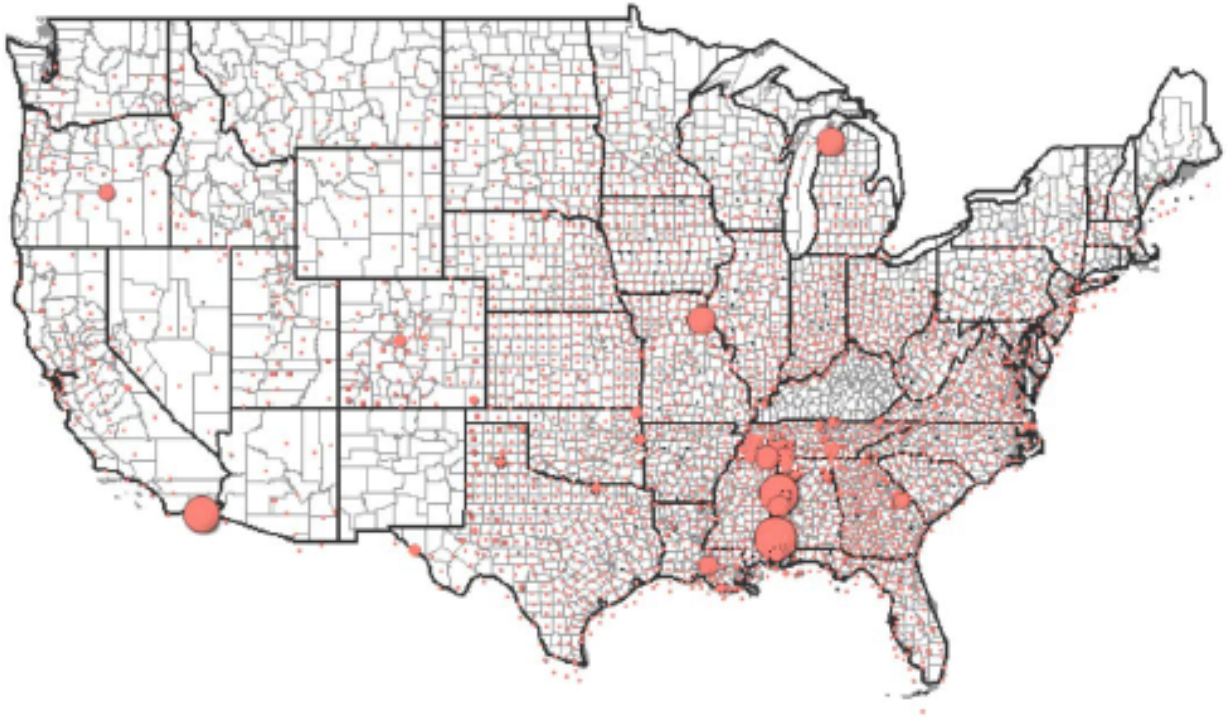
What happened after 1957?

DD in this context

1. Marriage law affected Mississippi residents and immediate neighbors (*treated* group)
2. But did other changes happen during this time that would affect marriage rates, fertility and education?
    1. Changes in other laws – compulsory schooling etc
    2. Changes in work opportunities for women
    3. Migration
    4. Pre 1957 trends in marriage?
3. Nearby states, counties are a potential *control* group

Pre and post marriage law

Figure 4 - Change in Marriages 1954-1960



Appropriate control groups

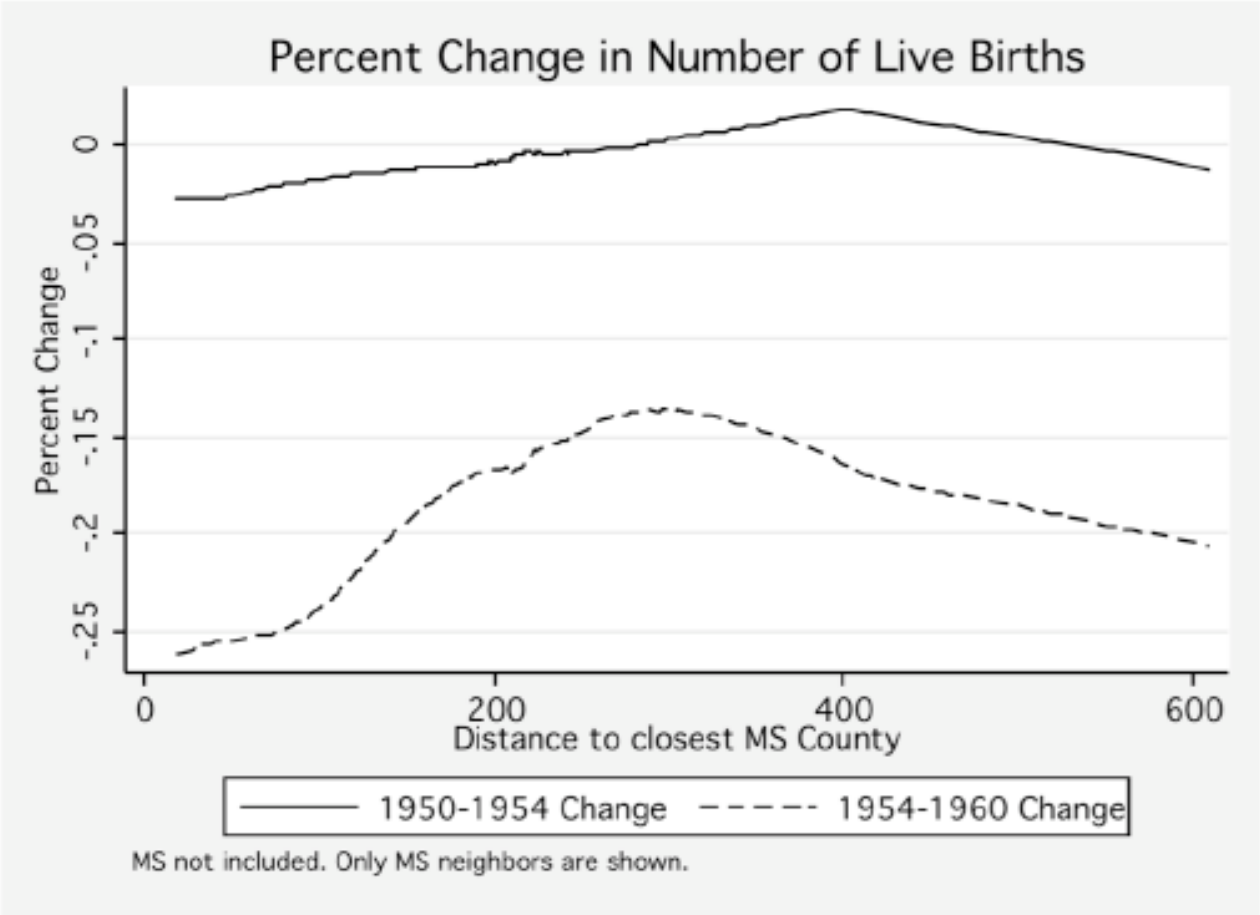
1. Counties next to Mississippi
2. Age groups not affected by the law
3. *Triple difference:* DD estimates for younger vs older age groups
    1. In the event of treatment specific trends affecting all age groups

Trends in treatment and control

Figure 2

Distance to Mississippi

Figure 6



Did other things change differentially

Table 6a: Checking for differential trends

	Manufacturing wage	Manufacturing Employment	% of Farms with tractors	Farms per 1000 in population
Treatment X Post	-0.131	1.017	0.528	-0.013
	[0.683]	[2.323]	[0.852]	[0.002]***
Treatment (1 if MS or border county, 0 ow)	1.101	9.582	13.864	-0.038
	[0.302]***	[1.658]***	[0.577]***	[0.001]***
Post (=1 if year ≥ 1957)	1.476	-9.029	0.468	0.015
	[3.785]	[5.650]	[2.347]	[0.008]*
R-squared	0.03	0.06	0.26	0.26
Observations	1149	1532	766	1532

* significant at 10%; ** significant at 5%; *** significant at 1%, robust std errors, clustered at the county level

Placebo assignment of law

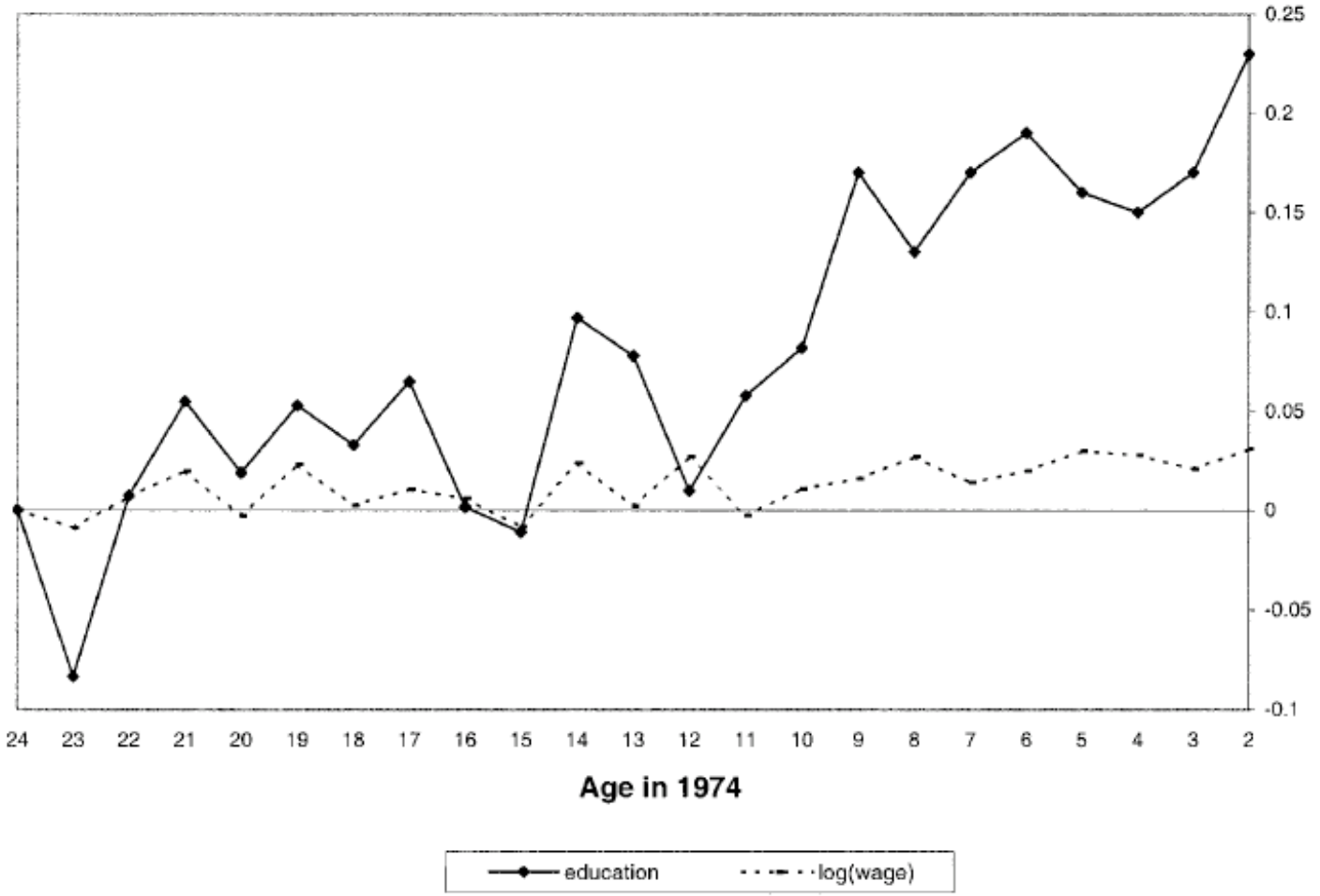
Table 6b: Random Assignment of Treatment Group

Random assignment of treatment group and 1000 repetitions	Marriages	Crude Birth Rate	School Enrollment
Average coefficient size under random assignment	-0.016	-0.048	0.033
True coefficient size	-13.389	-1.869	2.547

Impact of marriage law

1. Marriage decline
2. Immediate rates of fertility decline
    1. *Unintended effect:* Some evidence of increases in illegitimate childbearing
    2. No effect on completed fertility
3. Enrollment in school increases
    1. Overall high school completion rates higher

Indonesia Schooling (Duflo)



Duflo 2001

Conclusions

Difference in differences is a good non-experimental method for impact evaluation if:

1. Randomization is difficult or expensive
2. Control group is well defined
3. Assumption that trends in treatment and control in absence of treatment would have been the same is true