

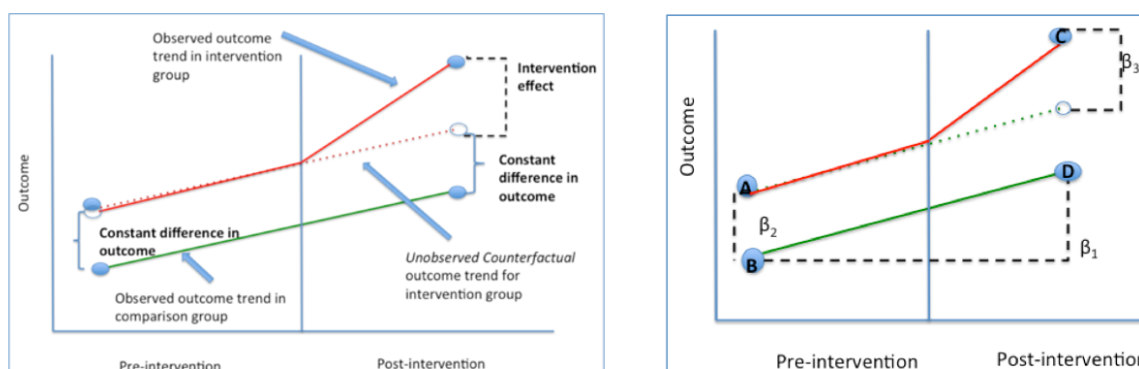
Basic idea of reverse diff-in-diff

In the standard diff-in-diff model (see illustration below), the treatment group and the control group have parallel trends in *pre-treatment periods*. The simplest diff-in-diff model is

$$Y_{it} = \beta_1 Treated_i + \beta_2 Post_t + \beta_3 Post_t \times Treated_i + e_{it} \quad (1)$$

β_3 estimated from the diff-in-diff model is the effect of treatment.

Standard DD: treatment and control groups have parallel trends in the pre-treatment period



$$DD \text{ estimate} = (C-A)-(D-B).$$

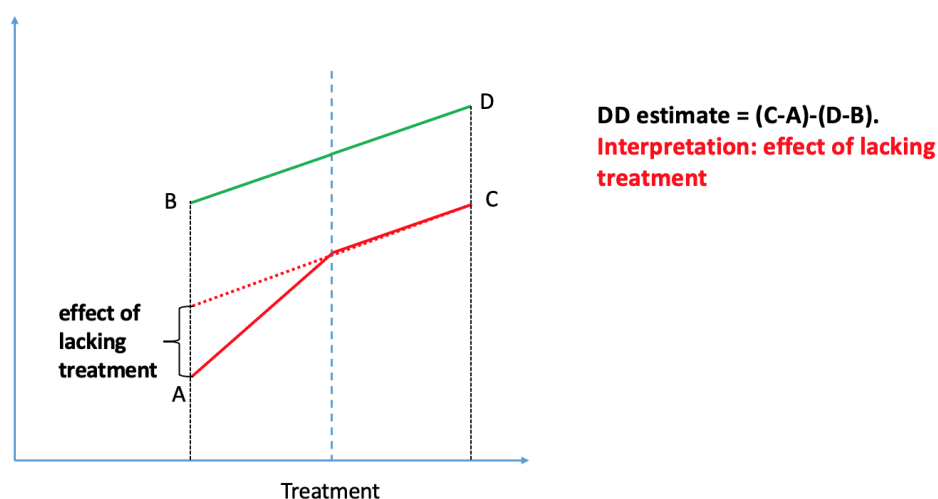
Interpretation: effect of treatment

In an unusual case like the 2014 QuickPay, the policy of interest first affects a subset of sample and then affects the entire sample. In this case, the treatment becomes *no policy*, the treatment group consist of obs. that are affected later, and the control group consist of obs. that are affected throughout the horizon. The parallel trend is observed in the *post-treatment periods*. We can run a diff-in-diff model "in reverse" as follows:

$$Y_{it} = \beta_1 Treated_i + \beta_2 Pre_t + \beta_3 Pre_t \times Treated_i + e_{it} \quad (2)$$

The question is: how do we interpret β_3 in the model?

Variant of DD: treatment and control groups have parallel trends in the post-treatment period



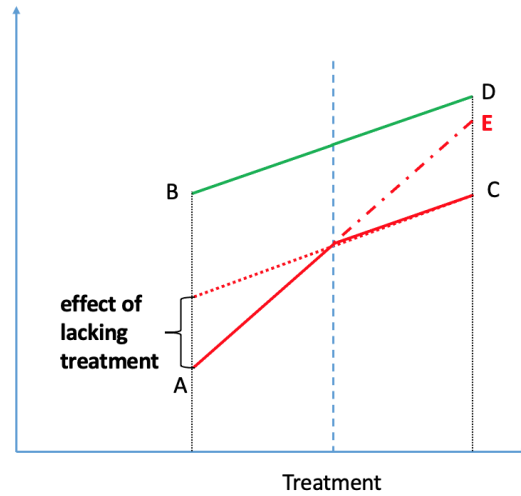
$$DD \text{ estimate} = (C-A)-(D-B).$$

Interpretation: effect of lacking treatment

Therefore, β_3 estimates the effect of no policy on the treatment group.

The following figure illustrates that **the estimate for the treatment effect on the treatment group is given by $-\beta_3$** .

Variant of DD: treatment and control groups have parallel trends in the post-treatment period



DD estimate = (C-A)-(D-B).
Interpretation: effect of lacking treatment

E: where the treated group would be if there were no treatment
C - E = effect of treatment
= -[(C-A)-(D-B)]
= -DD estimate

Chemin and Wasmer (2009) uses such an approach in their study.

Basic model for the 2014 QuickPay

We know that during Feb. 2013-- Aug. 2014, only small-business projects are affected by QuickPay. Starting Aug. 2014, all projects are affected by QuickPay.

As explained above, in this case:

- Treatment = no QuickPay
- Treated = non-small-business projects
- Control = small-business projects

Expanding model (2) above yields

$$Y_{it} = \beta_0 X_i + \beta_1 Treated_i + \beta_2 Pre_t \cdot Treated_i + \beta_3 Pre_t \cdot Z_i + \eta_t + e_{it} \quad (3)$$

where

- Y_{it} is the delay of project i in period t
- X_i is a vector of project-level characteristics such as company fixed-effects, PSC codes, etc. We don't have project-level fixed effects in the model so we still have the $Treated_i$ term in the model.
- $Treated_i = 1$ if project i is a non-small-business project
- $Pre_t = 1$ if period t is prior to QuickPay implementation in Aug. 2014
- Z_i is a vector of project-level characteristics and may be different from Y_i
- η_t is time fixed-effects (due to the inclusion of η_t , we no longer have Pre_t term in the model)

Model (3) is the basic model without considering the effect of e.g. financing on the effect of QuickPay.

Parameter of interest

Effect of QuickPay on non-small-business projects: $-\beta_2$

- $\beta_2 > 0$ implies that expedition in payment, i.e., QuickPay, leads to expedition of non-small-business projects.

Model with contract financing

We can enrich model (3) by allowing the treatment effect to differ based on whether a large-business project receives contract financing (CF). We can use the following model:

$$Y_{it} = \beta_0 X_i + \beta_1 Treated_i + \beta_2 CF_i + \beta_3 Treated_i \cdot CF_i + \beta_4 Pre_t \cdot Treated_i + \beta_5 Pre_t \cdot Treated_i \cdot CF_i + \beta_6 Pre_t \cdot CF_i + \beta_7 Pre_t \cdot Z_i + \eta_t + e_{it} \quad (4)$$

where

- $CF_i = 1$ if project i receives contract financing

Parameter of interest

Effect of QuickPay on large-business projects

- $-\beta_4$: Effect of QuickPay on large-business projects that do not receive CF. $\beta_4 > 0$ implies that expedition in payment, i.e., QuickPay, leads to expedition of non-small-business projects.
- $-\beta_5$: Effect of QuickPay on large-business projects that receive CF relative to large-business projects that do not receive CF. $\beta_5 < 0$ implies that a project that receives CF expedites *less* than a project that does not receive CF when the payment is expedited.