

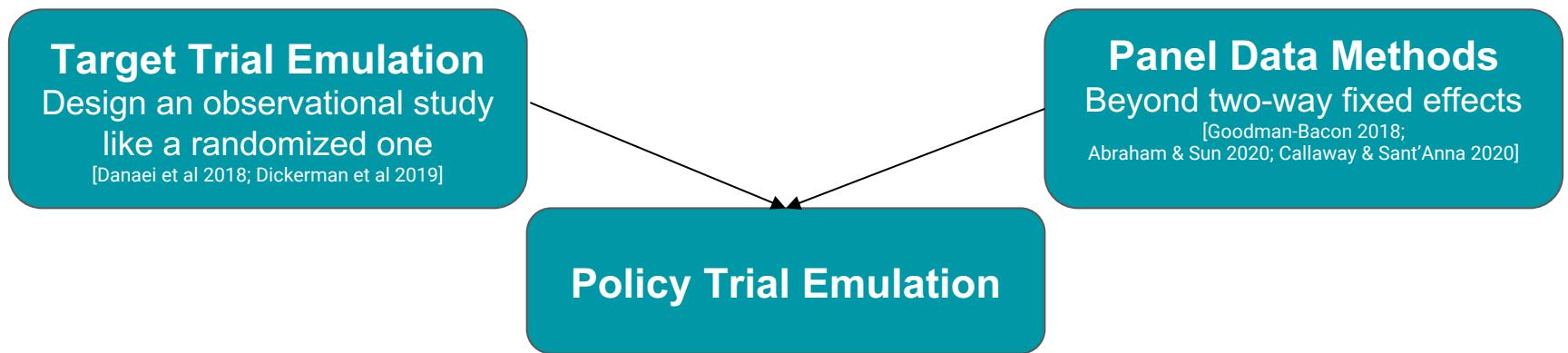
A trial emulation approach for policy evaluations with group-level longitudinal data

Eli Ben-Michael, Avi Feller, & Elizabeth Stuart
(UC Berkeley and Johns Hopkins)
APPAM 2020

Evaluating non-pharmaceutical interventions is hard

State governments passed extraordinary NPIs in spring 2020

→ Important to evaluate impact, but many methodological challenges



A **stylized** analysis:

- Measure the effect of stay-at-home orders on the course of the pandemic
- Data from the NYT tracker

The elements of “policy trial emulation”

Several steps, none of them straightforward!

Units and exposures

- Multiple types of stay at home orders
- Limited effect of orders
- Spillovers and contagion

Causal contrasts

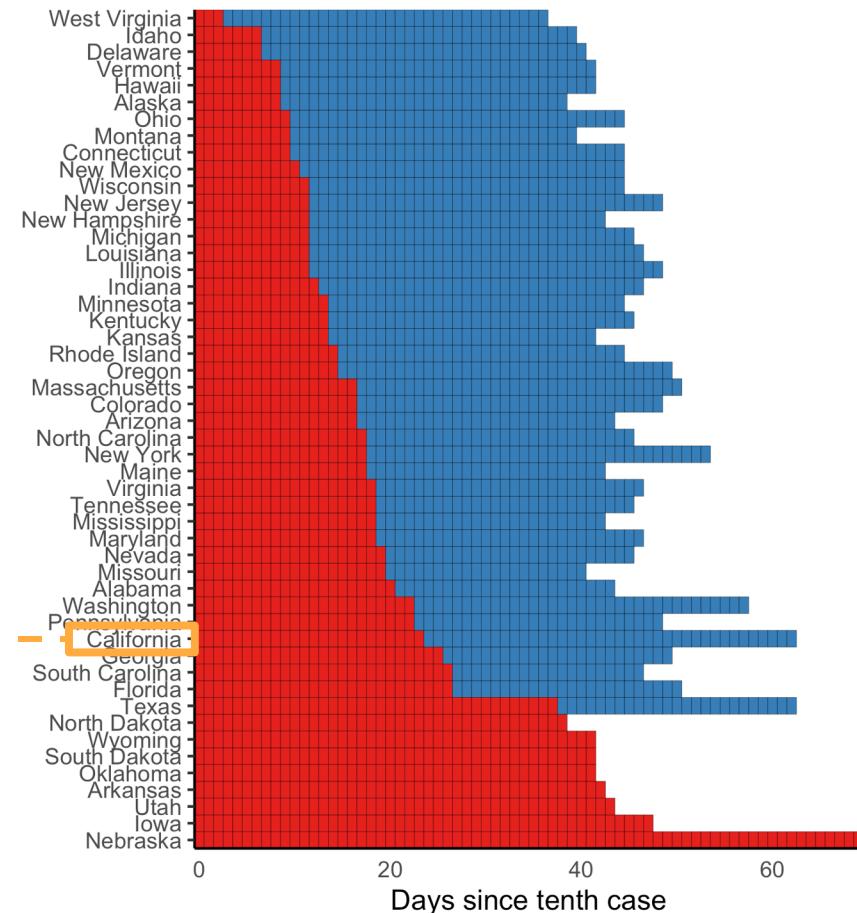
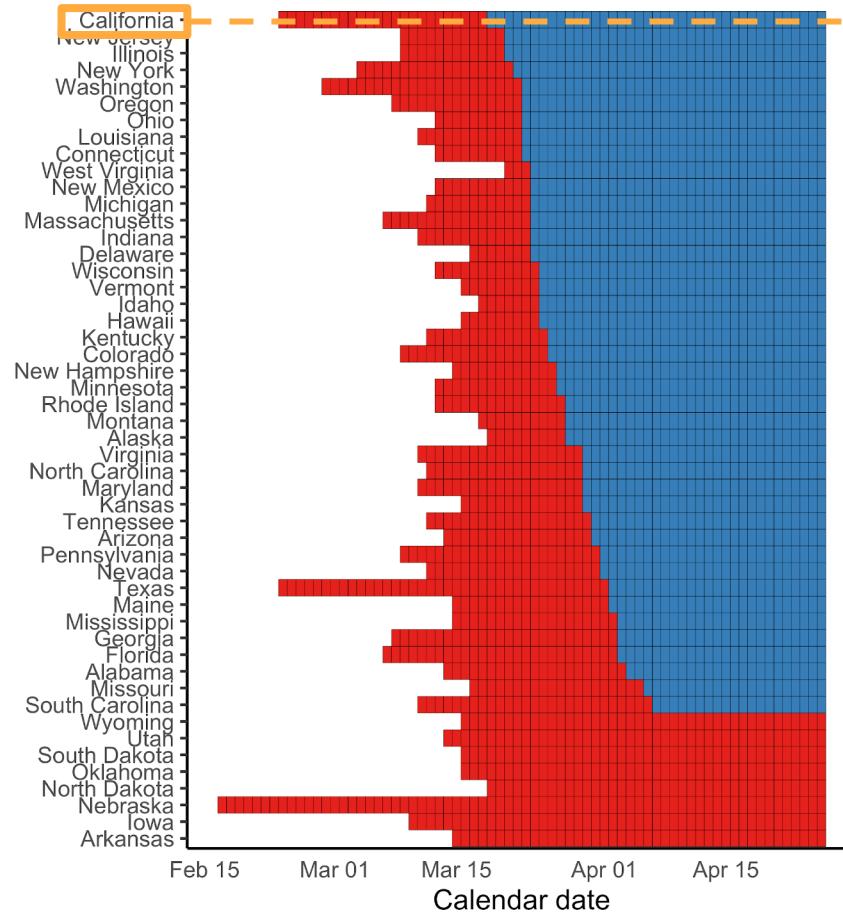
- Intent to treat
- Orders can start and stop
- Focus on policies “turning on”

Outcomes

- Important for parallel trends
- Cumulative effect?
- Day-to-day changes?
- Data quality?

Time zero

- What is “pre-treatment”
- What is “post-treatment”
- Can add as much bias as confounding!



A single target trial

Focus on a single *cohort* of states

- 5 states that passed stay at home orders on March 23rd

Length of follow up

- Only 19 days between first and last adopters
- Expect effects to be delayed

Compare to 8 *never treated* states

Dynamic comparison groups?

- Need to assess parallel trends for all groups
- Are changes in effects just changes in comparison group?

Differences in Differences

	Stay-at-Home Order		<i>Difference</i>
	Pre	Post	
March 23 Cohort	0.31 (37%)	0.09 (10%)	-0.22 (-20%)
Never Treated Cohort	0.24 (27%)	0.10 (11%)	-0.14 (-12%)
<i>Difference</i>	+0.07 (+10%)	-0.01 (-1%)	-0.08 (-8%)

Key assumption: parallel trends!

Violated by

1. Anticipation

Did behavior change before the order?

[Goolsbee & Syverson 2020]

1. Time varying confounding

Were orders a response to *trends* in cases?

From single to nested target trials

2x2 DiD is blunt

- Averages over entire post-period

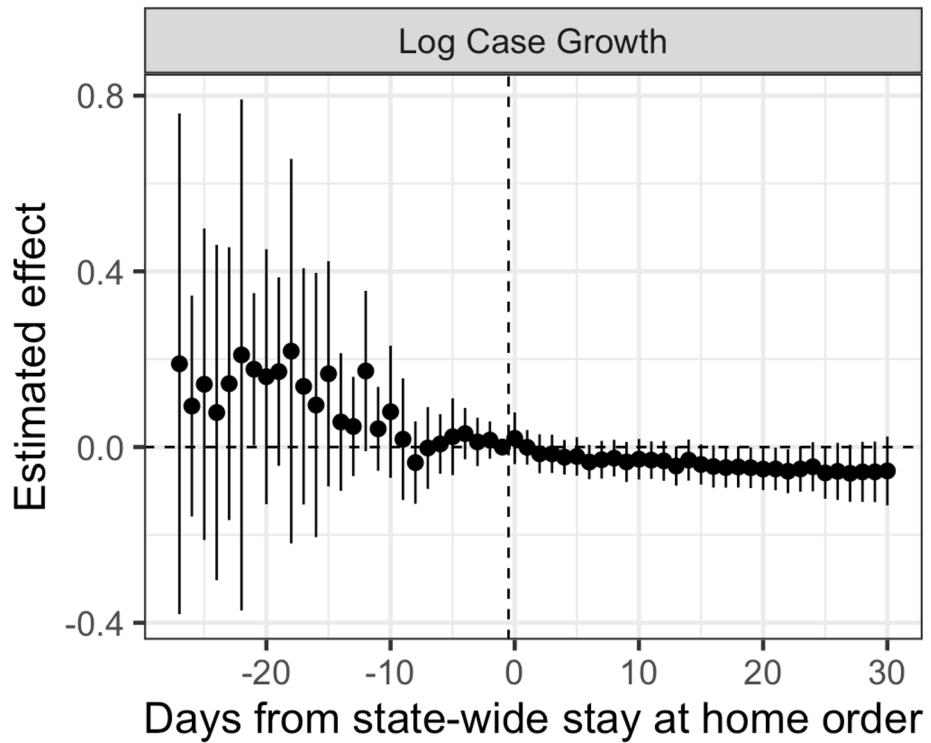
Dynamic DiD

- Use a reference date as “pre” for all other “post” dates

Nested target trials combine target trials

- Different starting points, follow-up length
[Hernán et al 2016]
- Aggregate across cohorts by days since treatment
- AKA “Stacking”

[Abraham & Sun 2020; Callaway & Sant'Anna 2020]



Recap

The elements of policy trial emulation

1. Define units and exposures
2. Define causal contrasts of interest
3. Define outcomes
4. Define time zero

Nested target trials and DiD

- Begin with a single cohort
- Aggregate across cohorts over event time

Thank you!

ebenmichael.github.io

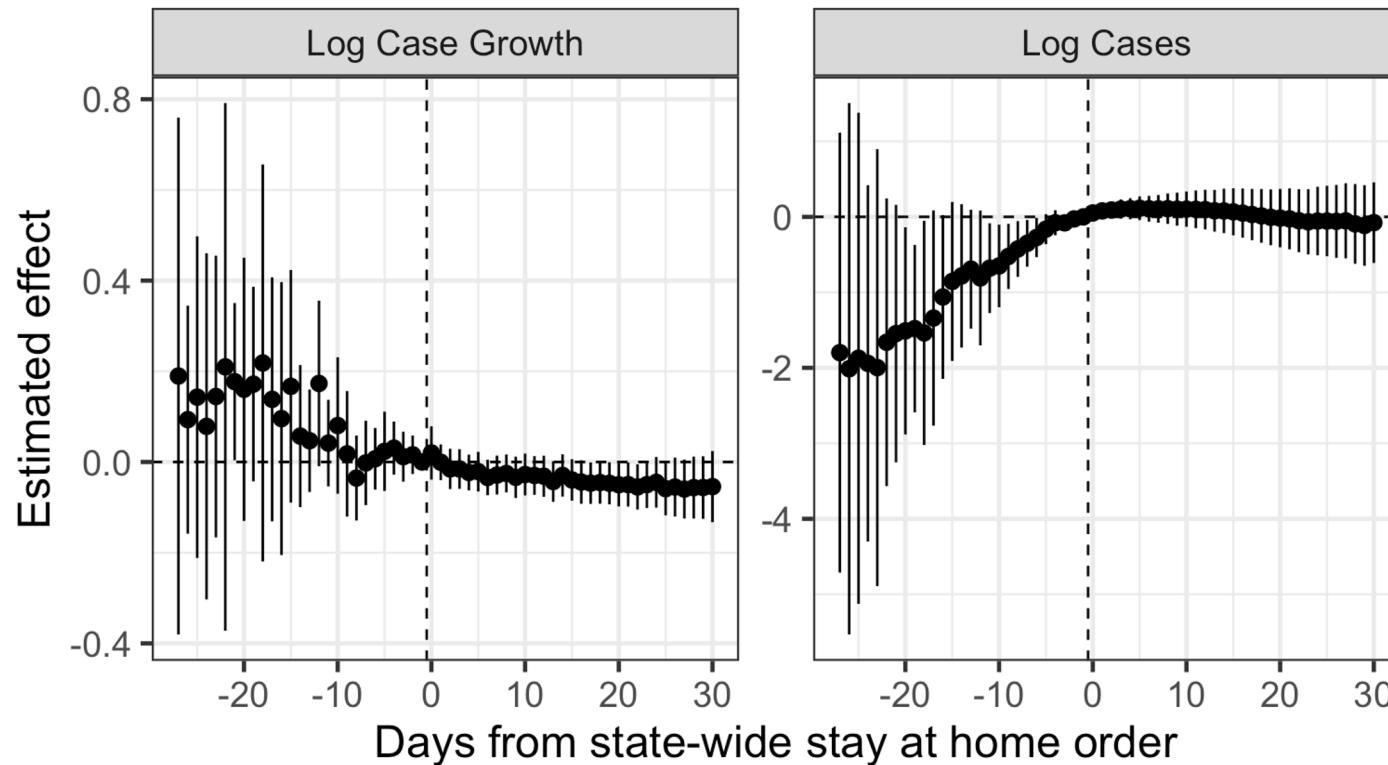
Paper forthcoming at *Epidemiology*

On arXiv now

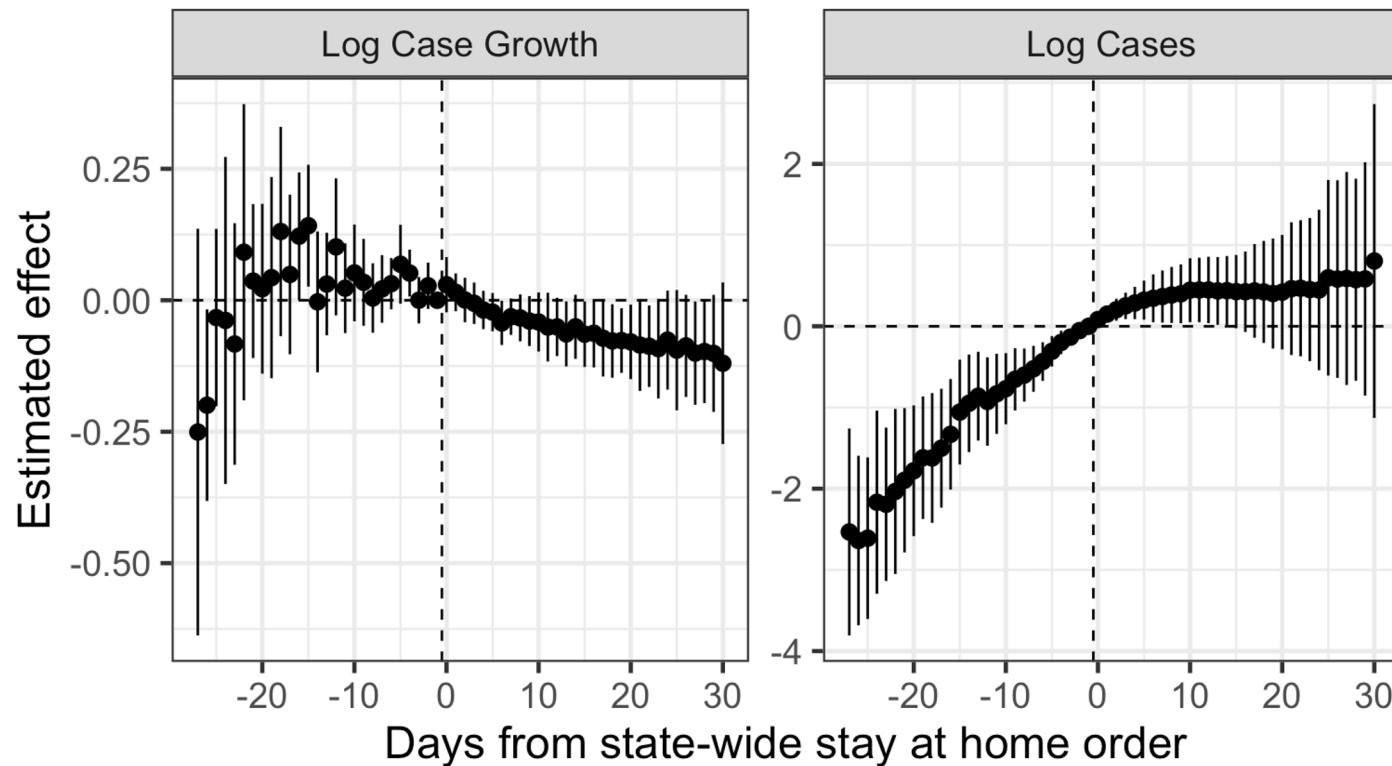


Additional Figures

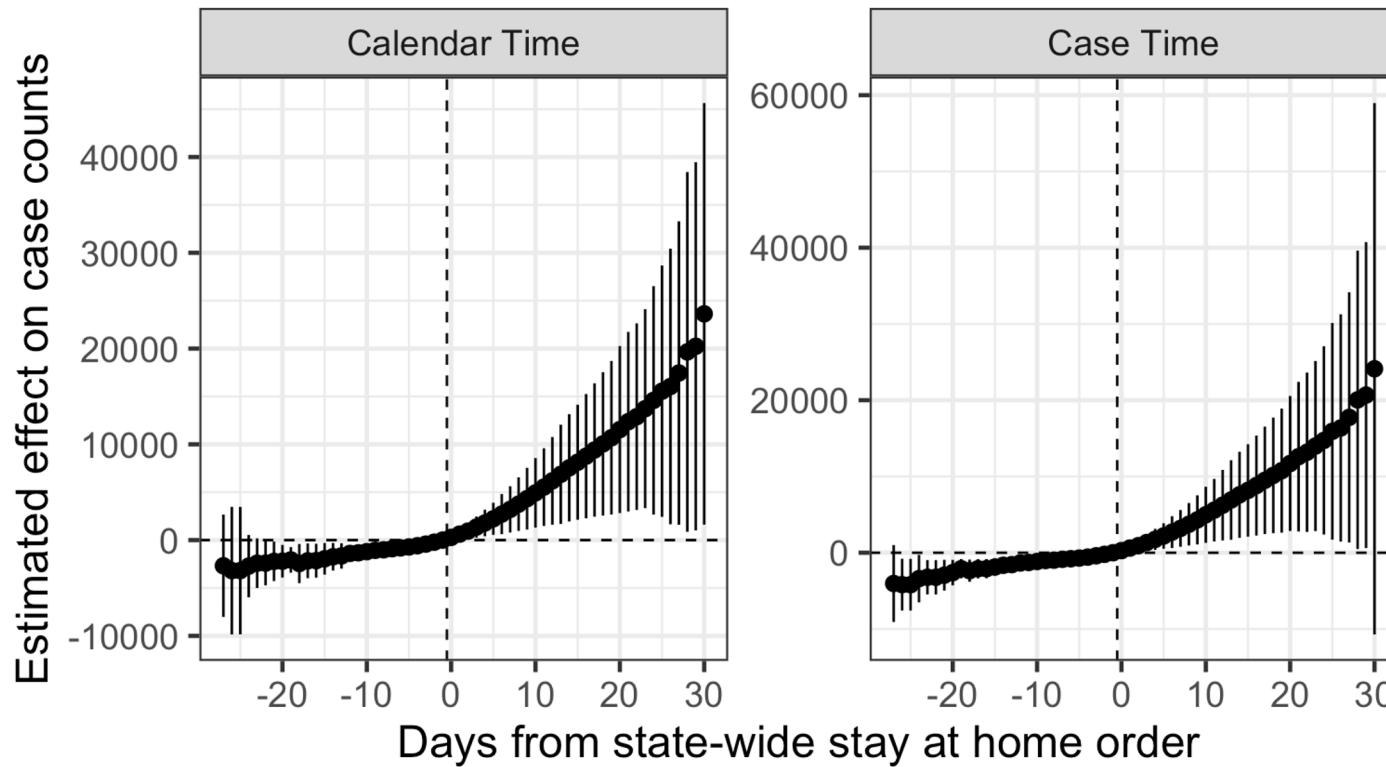
Calendar time estimates



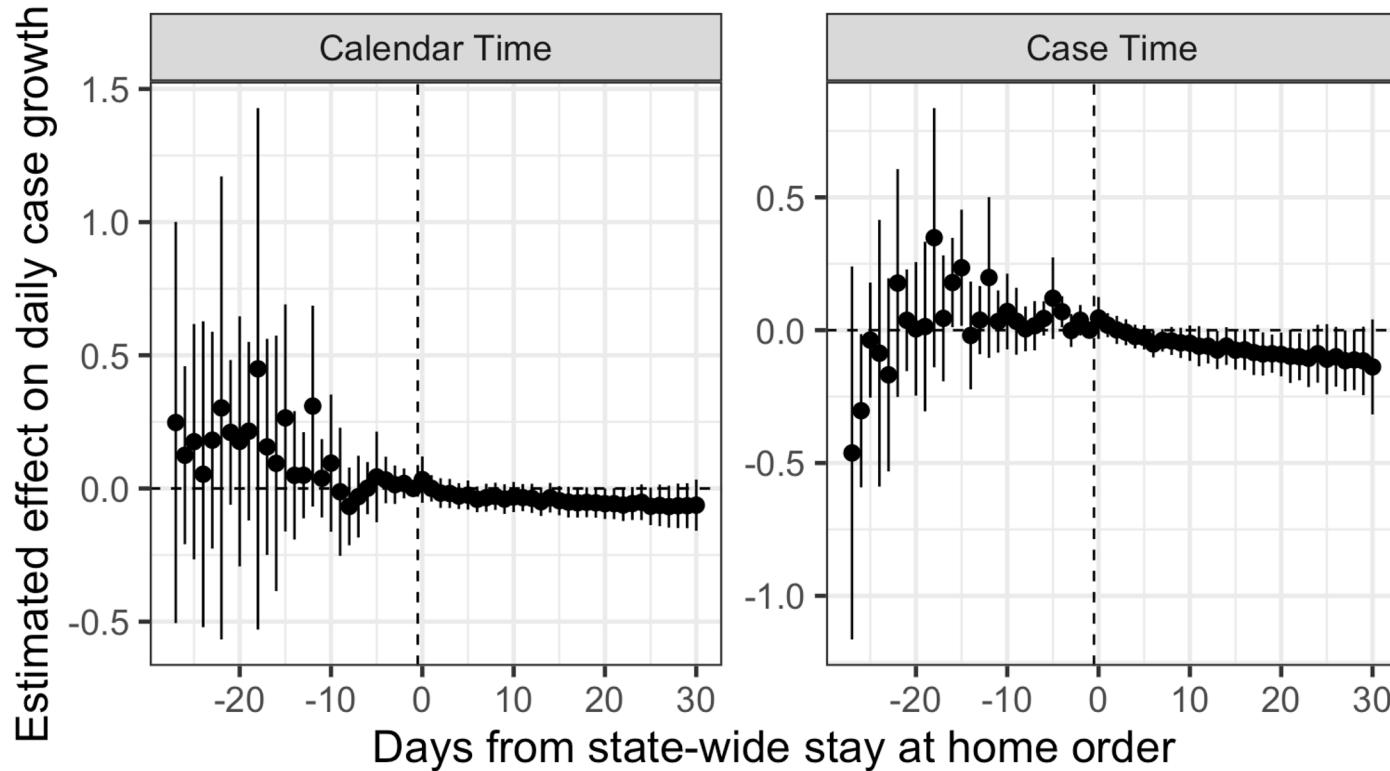
Case time estimates



Effect on raw case counts



Effect on raw case growth



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