Do Environmental Markets Cause Environmental Injustice? Evidence from California's Carbon Market

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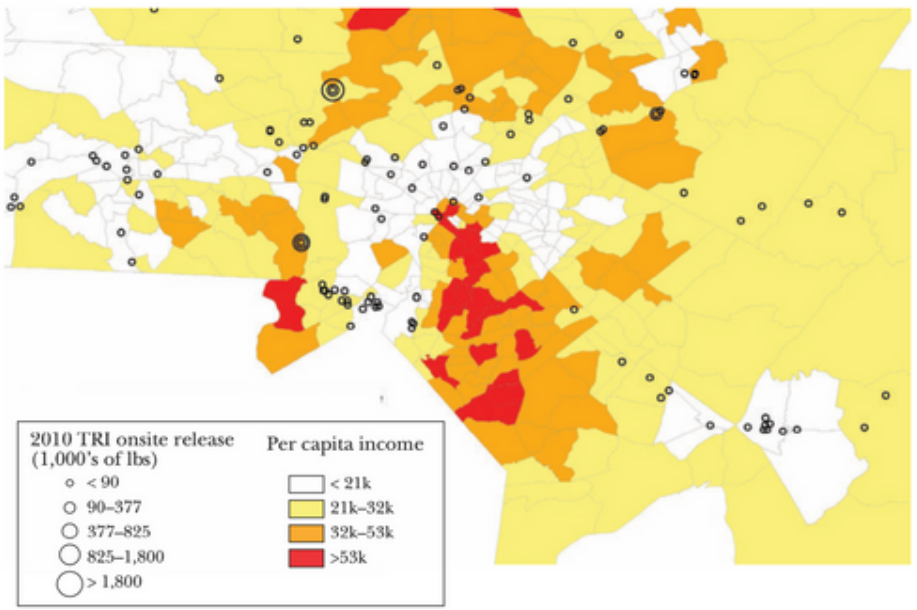
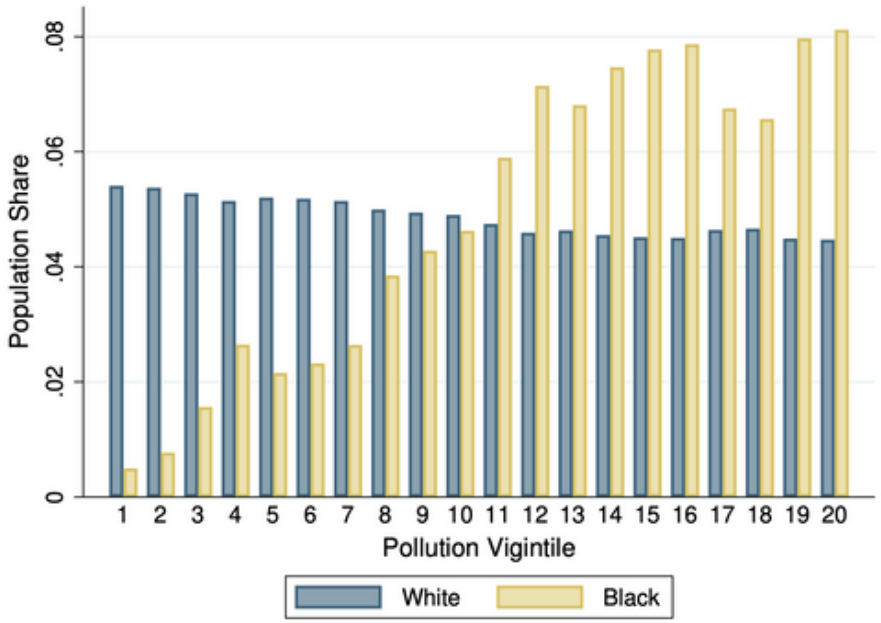
Environmental justice (EJ) concerns

Well-documented that polluted places are also:

- poorer
- have more minorities

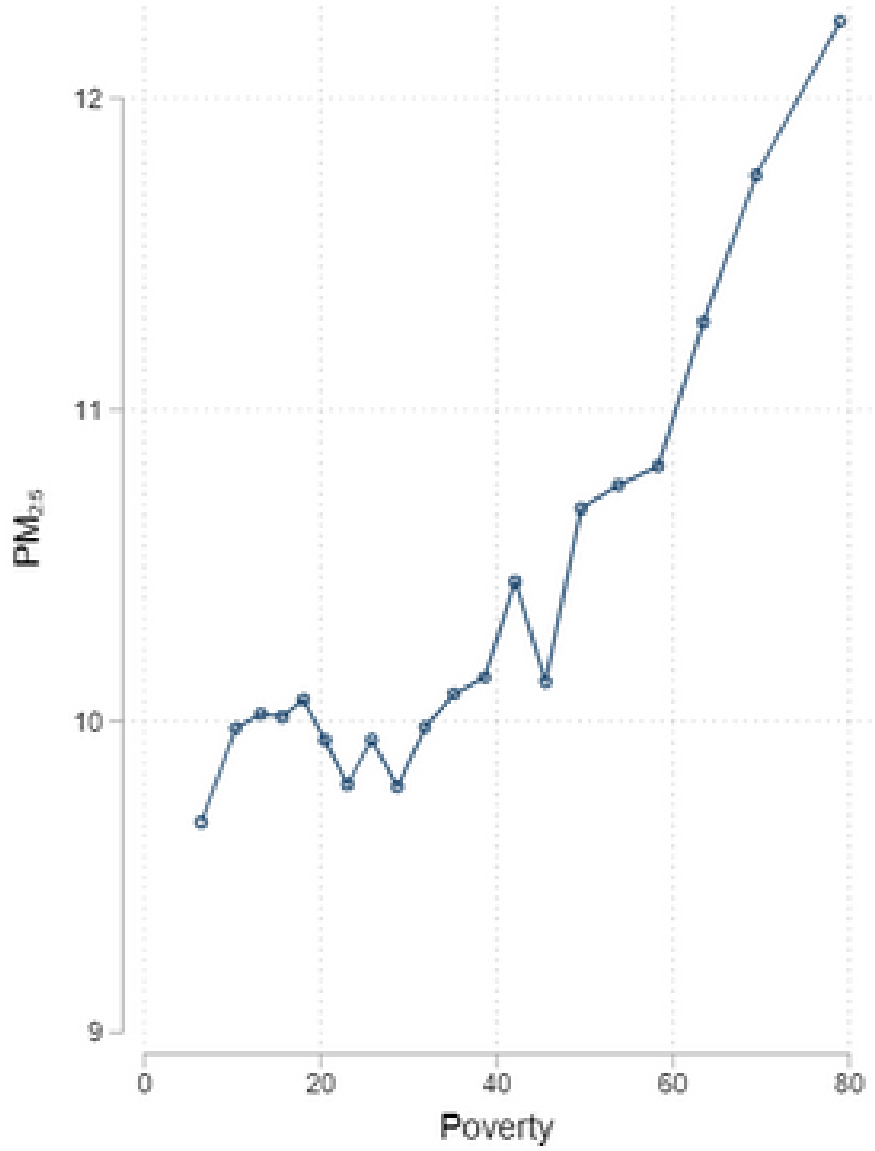


Banzhaf, Ma, and Timmins (2019)



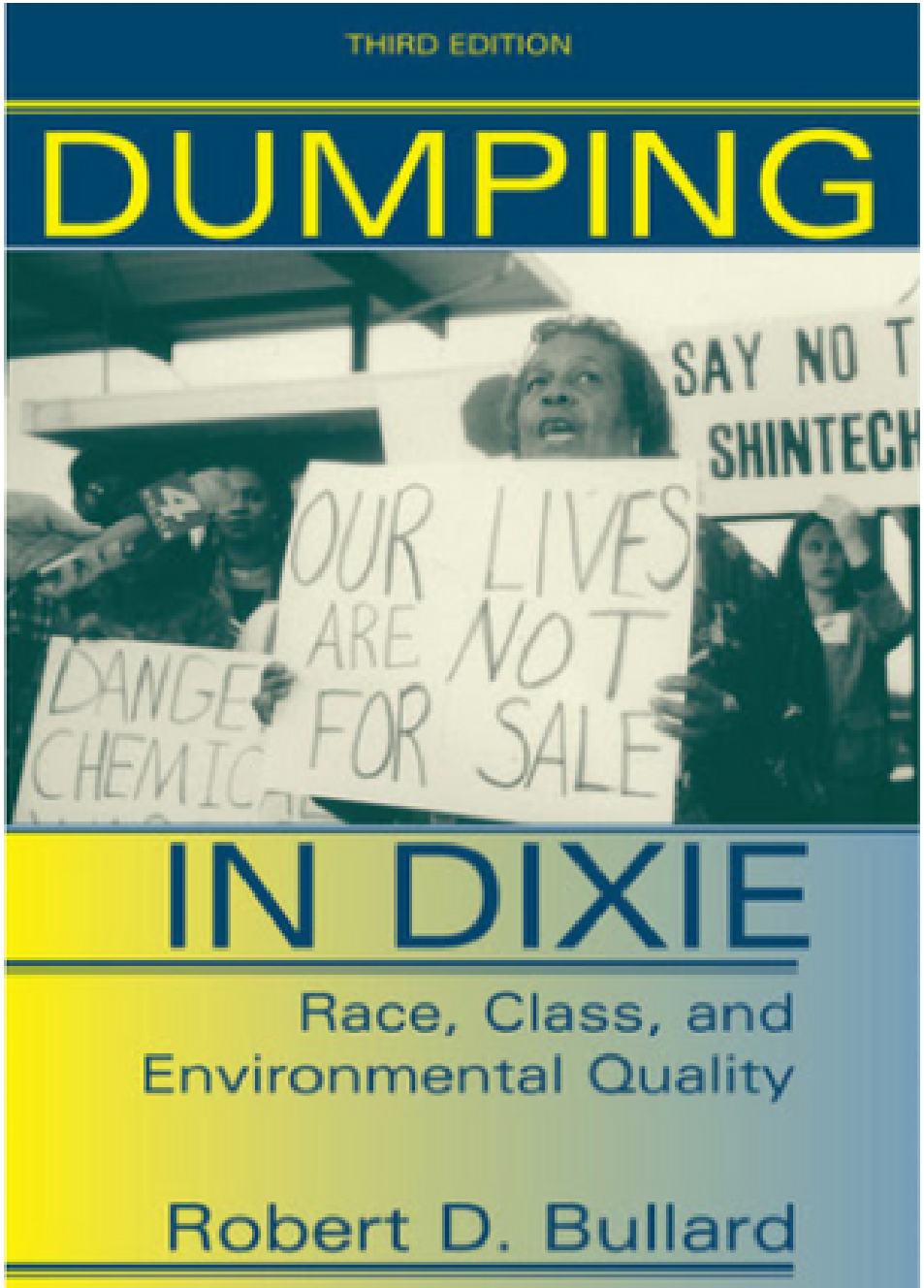
Currie, Voorheis, and Walker (2020)

Environmental justice (EJ) concerns



Source: Authors' estimates using CES 3.0

None of this is new…



What is Environmental Justice?

"Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." -Environmental Protection Agency

Environmental justice is achieved when no group experiences a **disproportionate** share of a policy's negative **environmental consequences.**

How did we get here? [And how do we get out?]

Do environmental inequities arise because…

- Polluters get away with locating near disadvantaged households
- Disadvantaged households face unequal opportunities and public services
- Pollution policies disproportionately affect disadvantaged households

At the aggregate level, likely all these forces are happening

But can we study the consequences of specific policies to shed light on solutions?

Environmental markets and environmental justice

Market-based policies increasingly used to address environmental problems

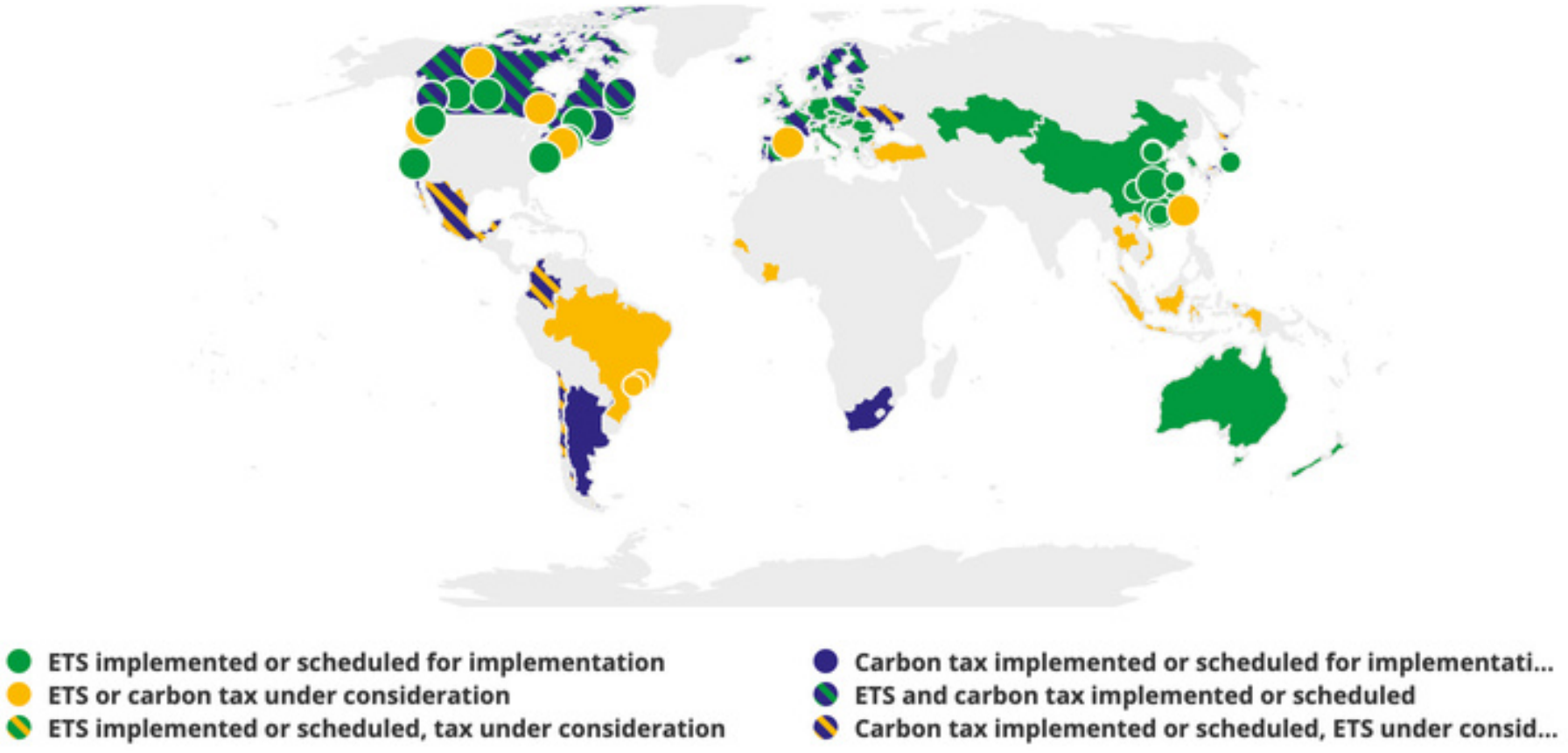
- 30% of global fisheries (Costello et al., 2016)
- $36 billion in ecosystem service payments (Salzman et al., 2018)
- 20% of global carbon emissions, could double under Paris Accord (WB, 2019)

Key feature: market forces spatially reallocates pollution

- Lowers overall cost of meeting an environmental objective
- But could lead to relatively greater pollution exposure for disadvantaged communities

Central tension: the same market forces that lowers regulation costs can also alter inequities in pollution exposure

Environmental markets and greenhouse gases (GHG)



Environmental markets and environmental justice

EJ concerns over market-based policies

- Renewal of EU-ETS in 2013
- Washington state carbon tax in 2016
- Oregon state climate policy in 2019

California's GHG cap-and-trade (C&T) program

- Baseline: Disadvantaged communities (DAC) exposed to relatively more local air pollution on average (i.e., positive "EJ gap")
- AB 32: establishes world's 2nd largest GHG C&T program, beginning 2013
- EJ concern: GHG C&T would widen the EJ gap
- Influential during program development in 2011 and renewal efforts in 2017

What happened to the EJ gap following C&T?

Our research question:

Did the local air pollution exposure gap between disadvantaged and other communities (i.e., EJ gap) change following the introduction of the GHG C&T program?

Key (ambiguous) relationship: If steeper MAC polluters are upwind of

... disadvantaged communities → C&T widens EJ gap

... other communities → C&T narrows EJ gap

For climate policy, EJ effect depends on local pollution/GHG co-production

Challenge 1: Estimating C&T effect on emissions

Separate effects of C&T on pollution emissions from confounding influence of

- macroeconomic trends
- other California climate policies

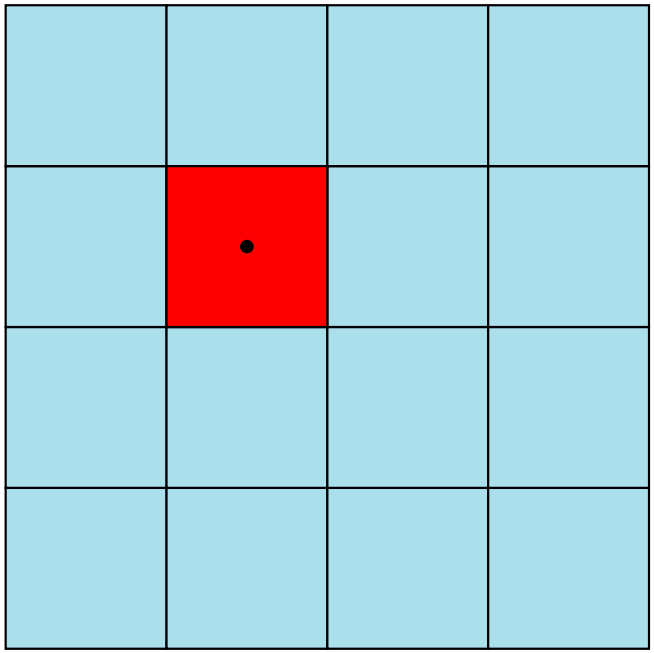
Our solution:

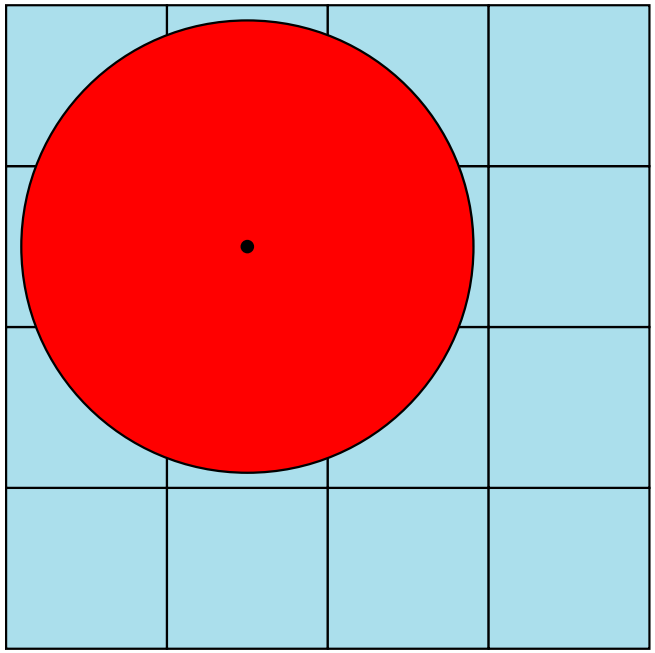
- Employ a “quasi-experimental” research design
- Compare the difference in GHG and criteria air pollution emissions between regulated and non-regulated facilities following C&T introduction

Challenge 2: modeling where pollution goes

Understanding env. policy impacts requires mapping pollution sources to sinks

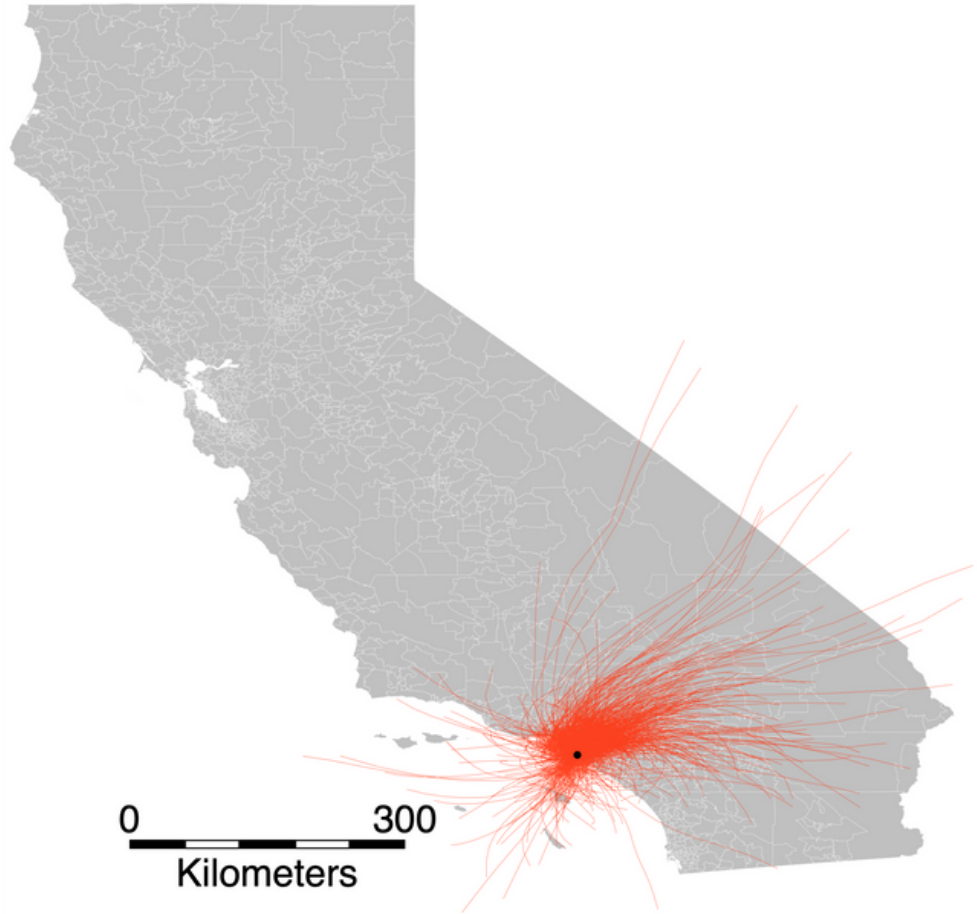
Two prevailing approaches for assigning pollution concentrations





New computational tools...

Actual transport far more complicated...



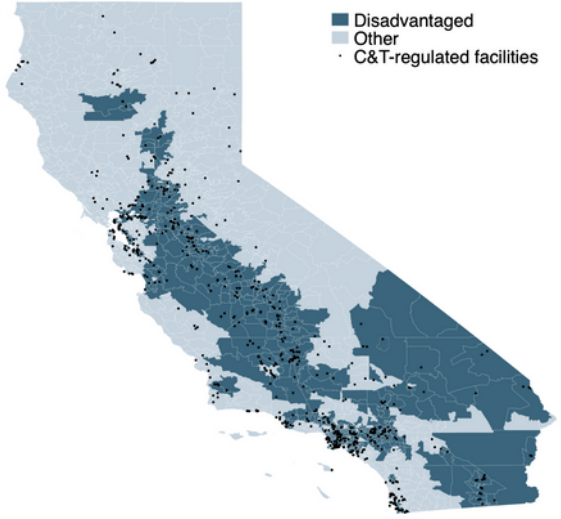
Our solution:

- Embed pollution dispersal model into statistical framework
- > 2 million trajectories: 24 hours w/ 1K parallelized nodes on HPC

Our approach

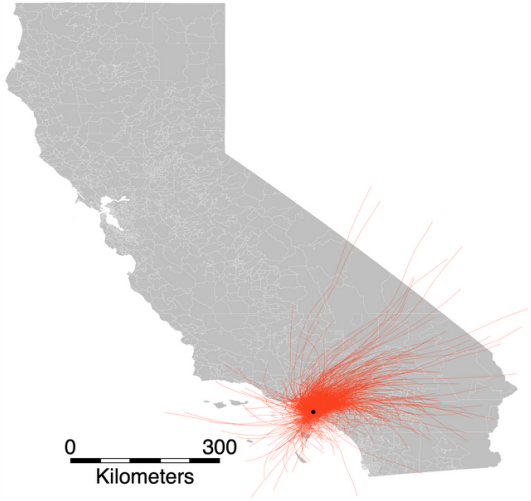
Step 1:

Isolate C&T-driven emissions



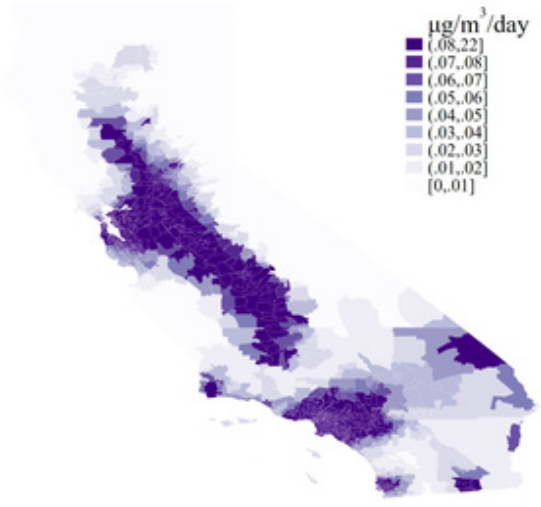
Step 2:

Model transport of emissions to exposure



Step 3:

Estimate change in EJ exposure gap



California's GHG cap-and-trade program

Background

- AB 32: state-wide GHG emissions at 1990 levels by 2020, passed in 2006
- Establishes world's 2nd largest GHG cap-and-trade (C&T) program
- Covers 85% of state-wide emissions from stationary point sources

Key institutional features

- C&T facility eligibility: stationary facilities >25 ktons CO_2e/yr
- C&T begins in 2013

Data

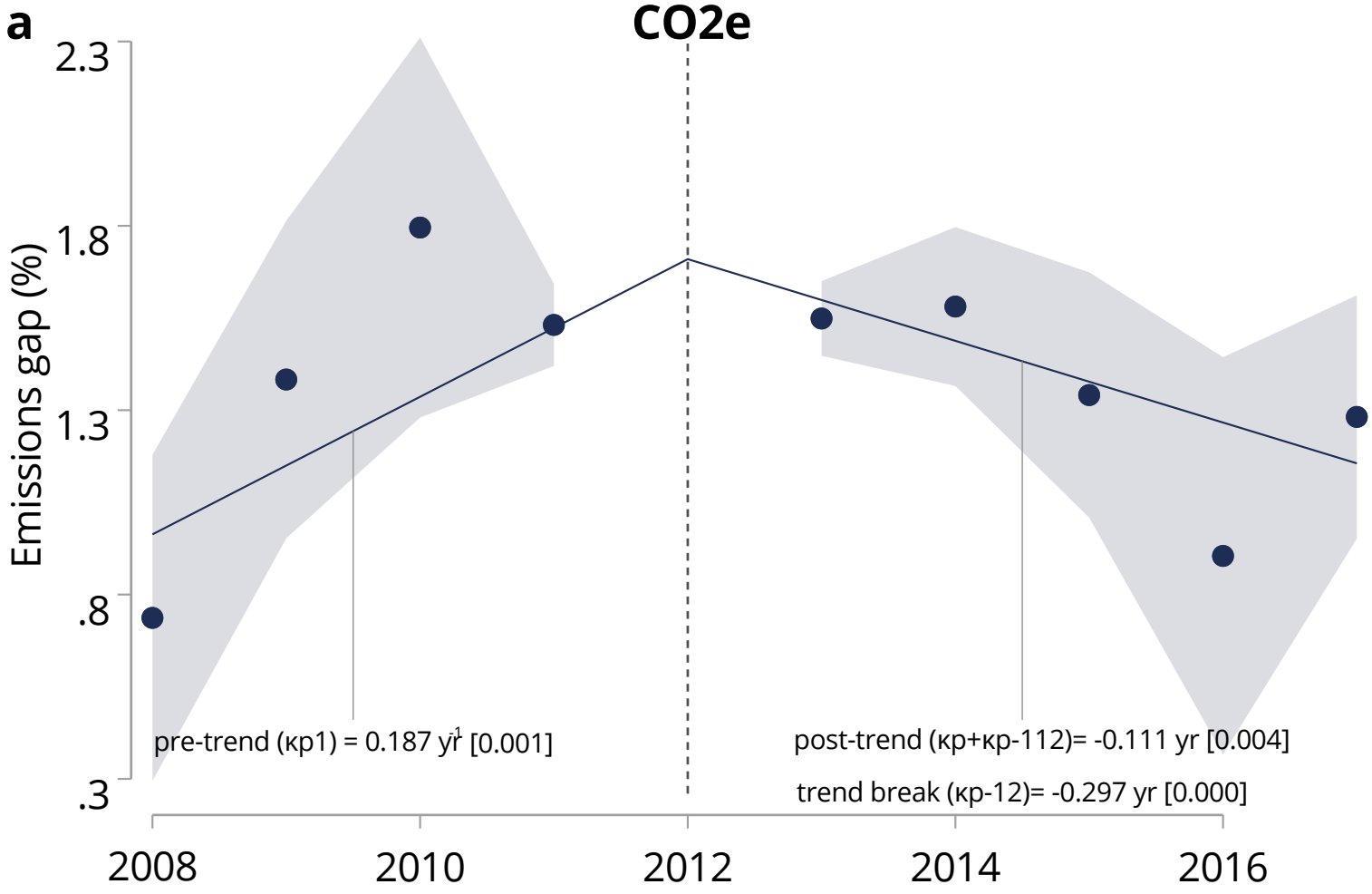
CARB facility-by-year emissions (2008-2017):

- CO2e, PM2.5, PM10, NOx, SOx
- Characteristics of regulated and unregulated facilities

CalEPA "disadvantaged" zip code

- Legal definition from SB 535
- Basis for EJ auction revenue spending
- "Disadvantaged" zip code contains all or part of a census tract with a CalEnviroScreen score >25th percentile

Step 1: Estimating C&T effect on emissions



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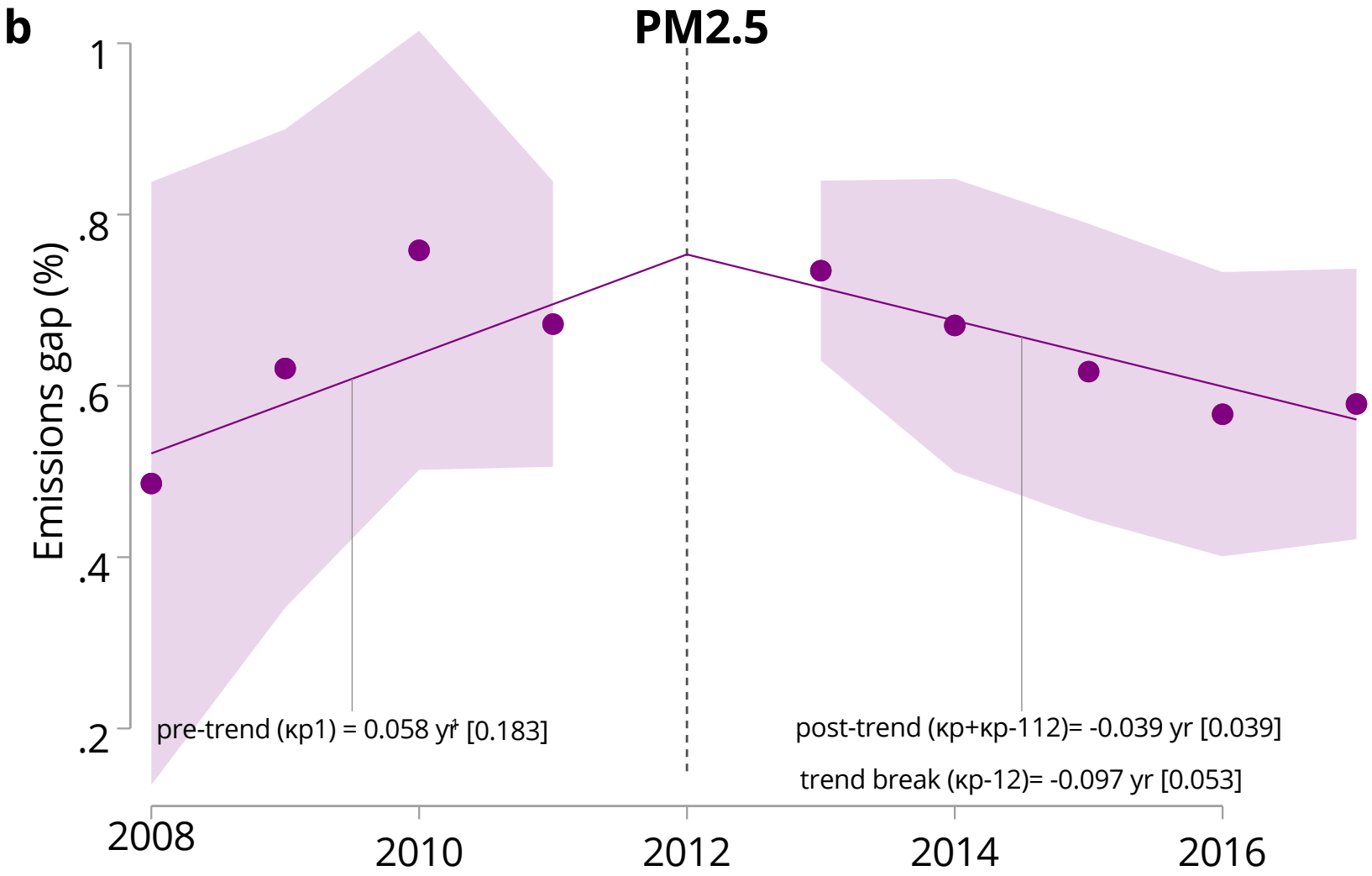

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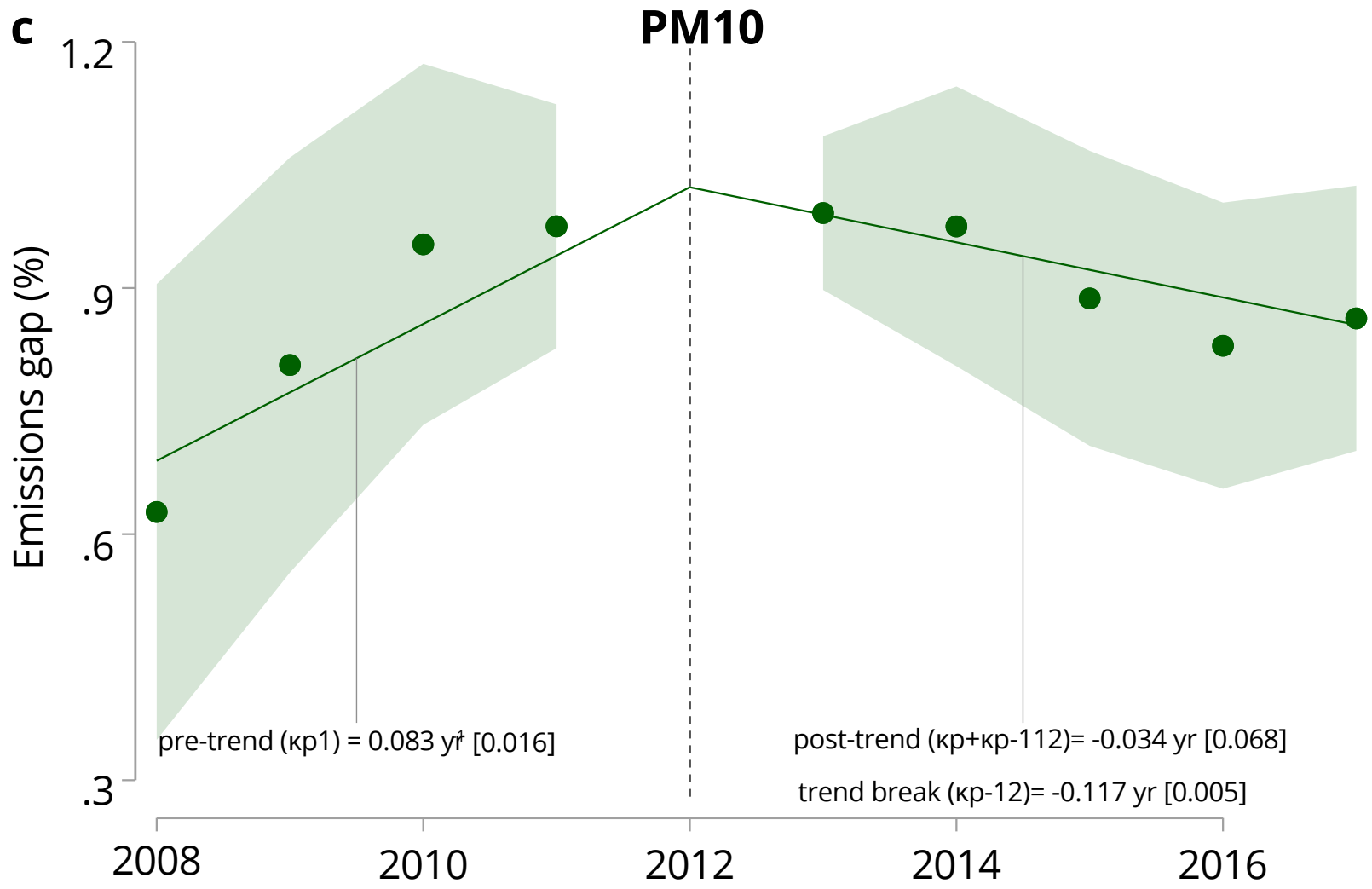

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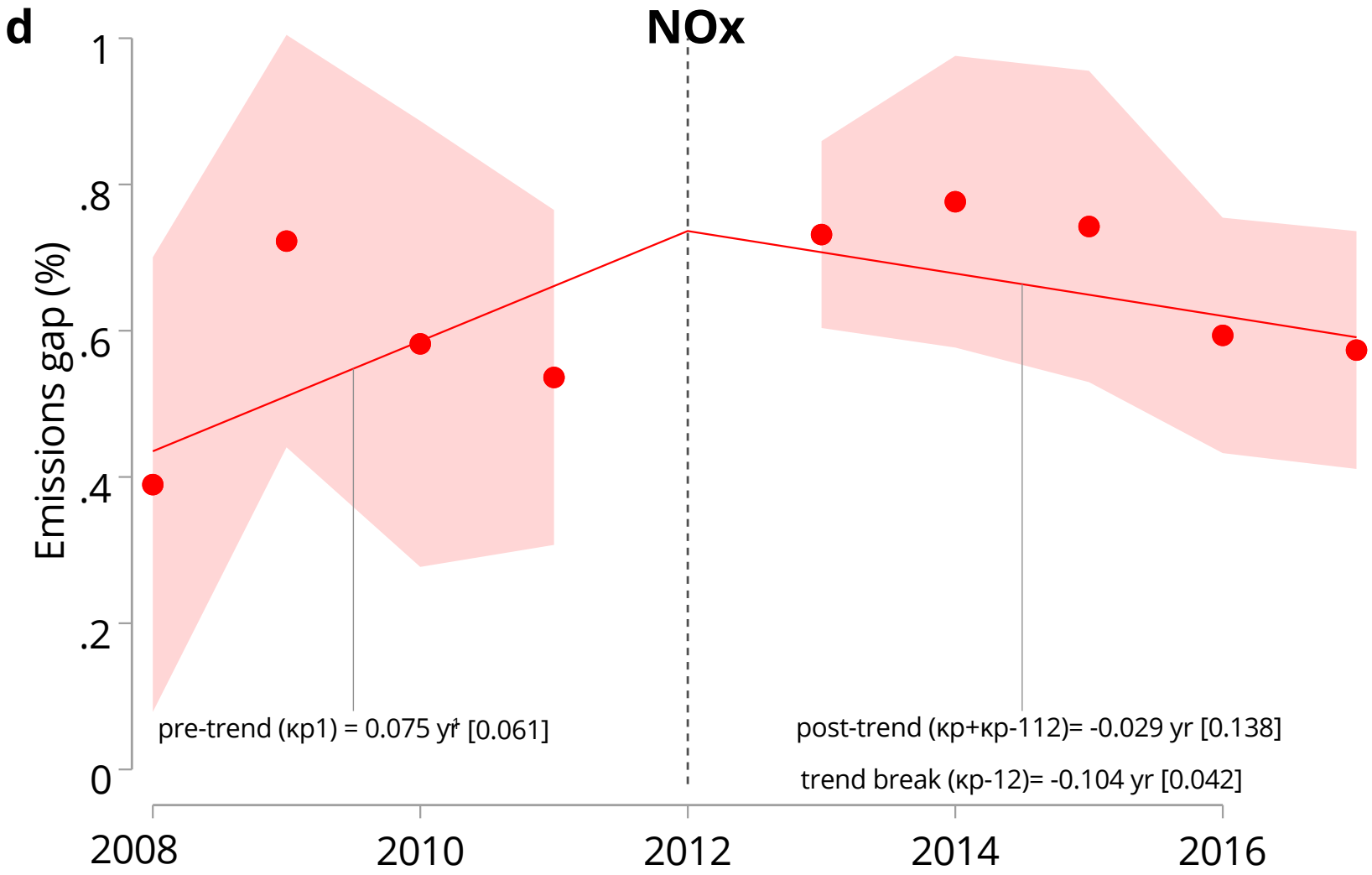

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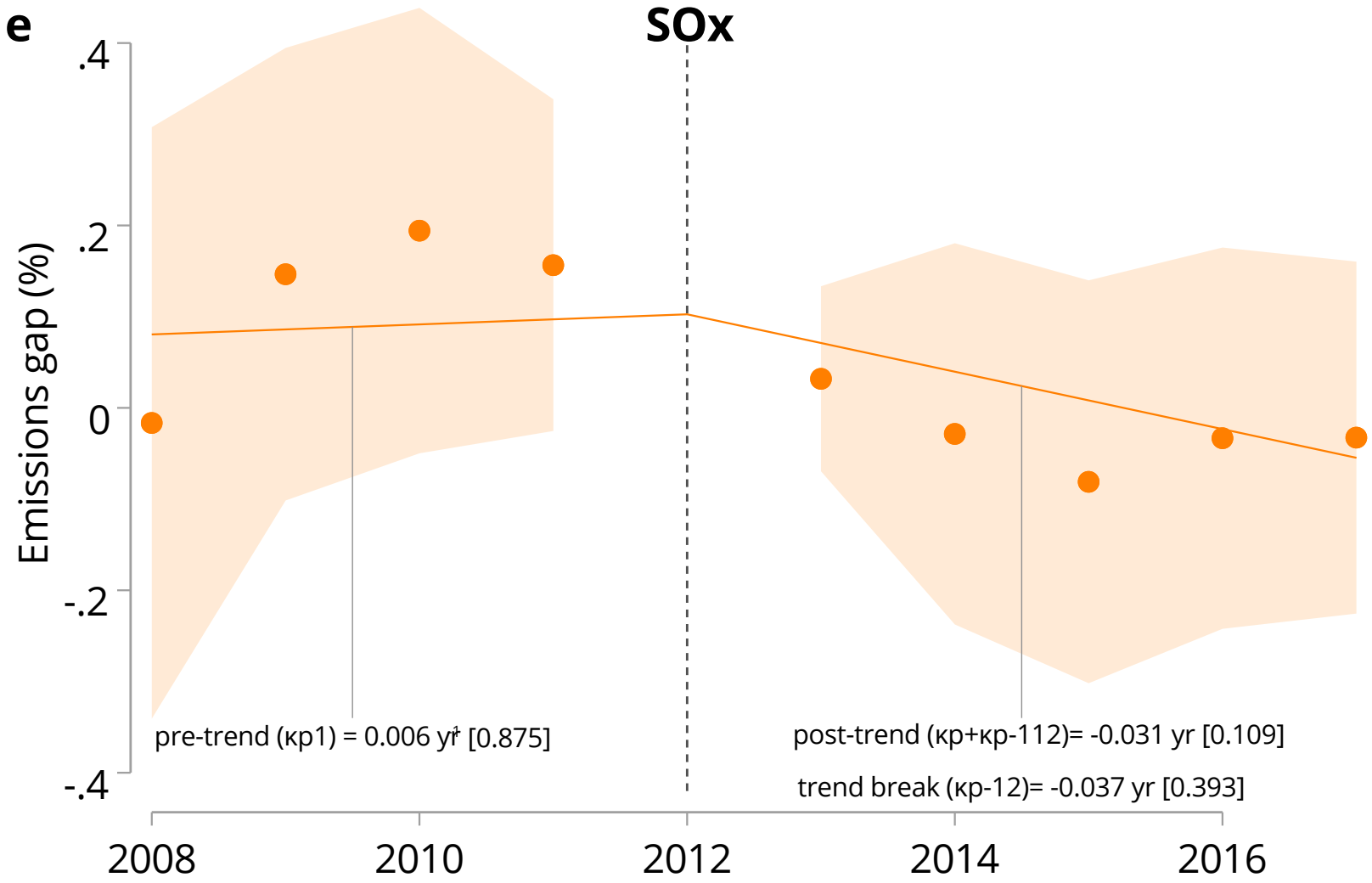
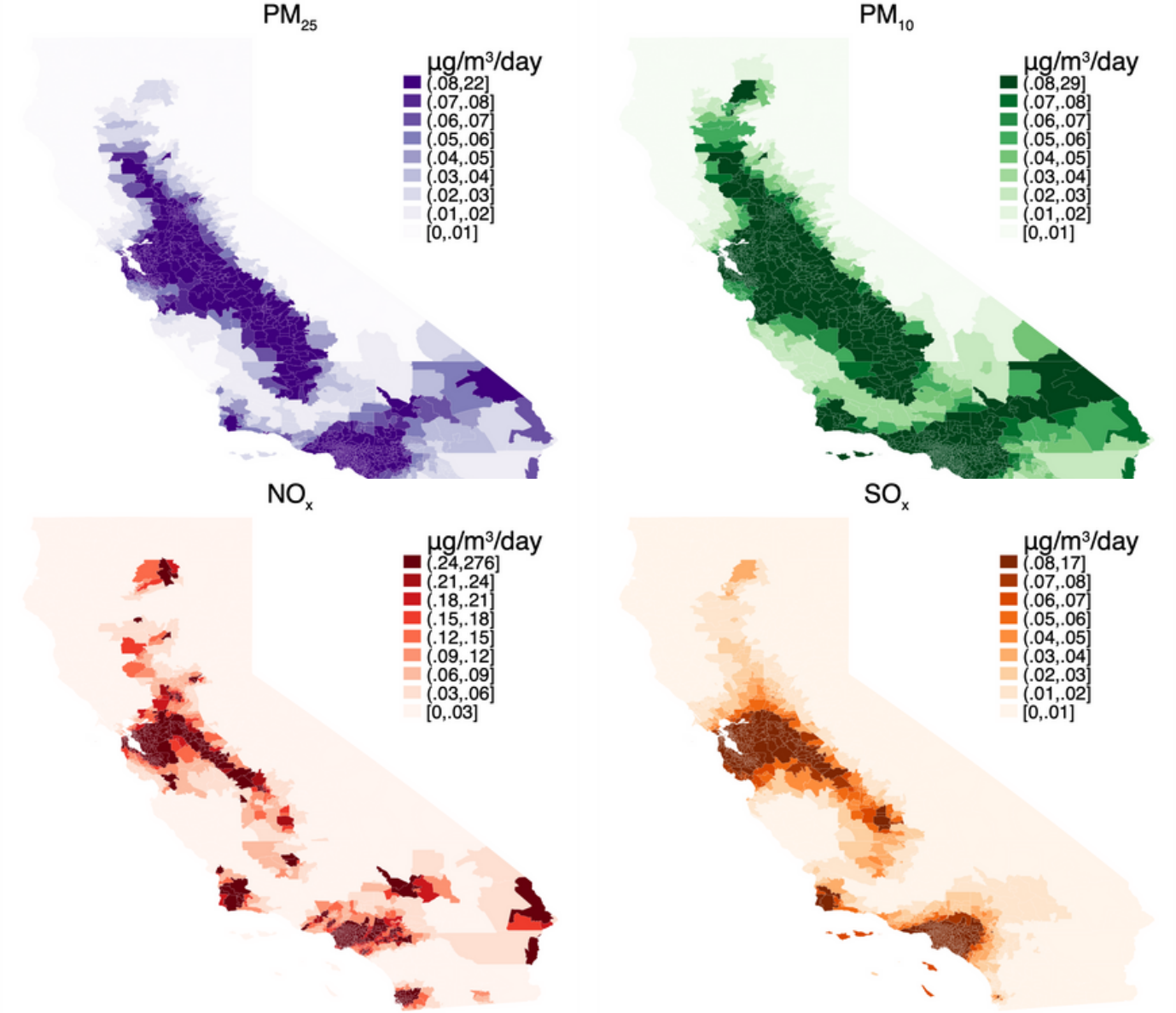
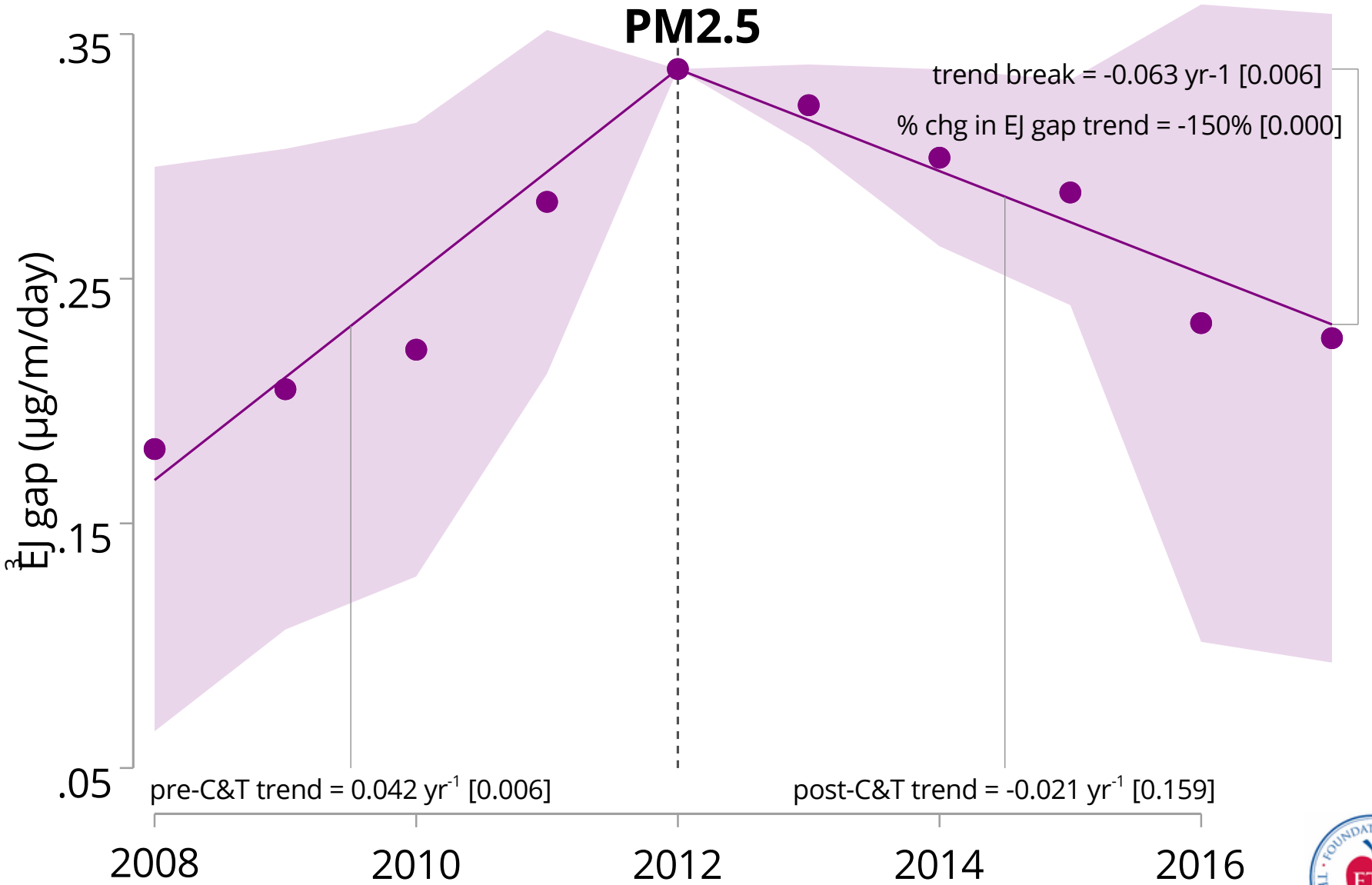


Step 2: HYSPLIT-driven concentrations



Step 3: Cap-and-trade effect on the EJ gap



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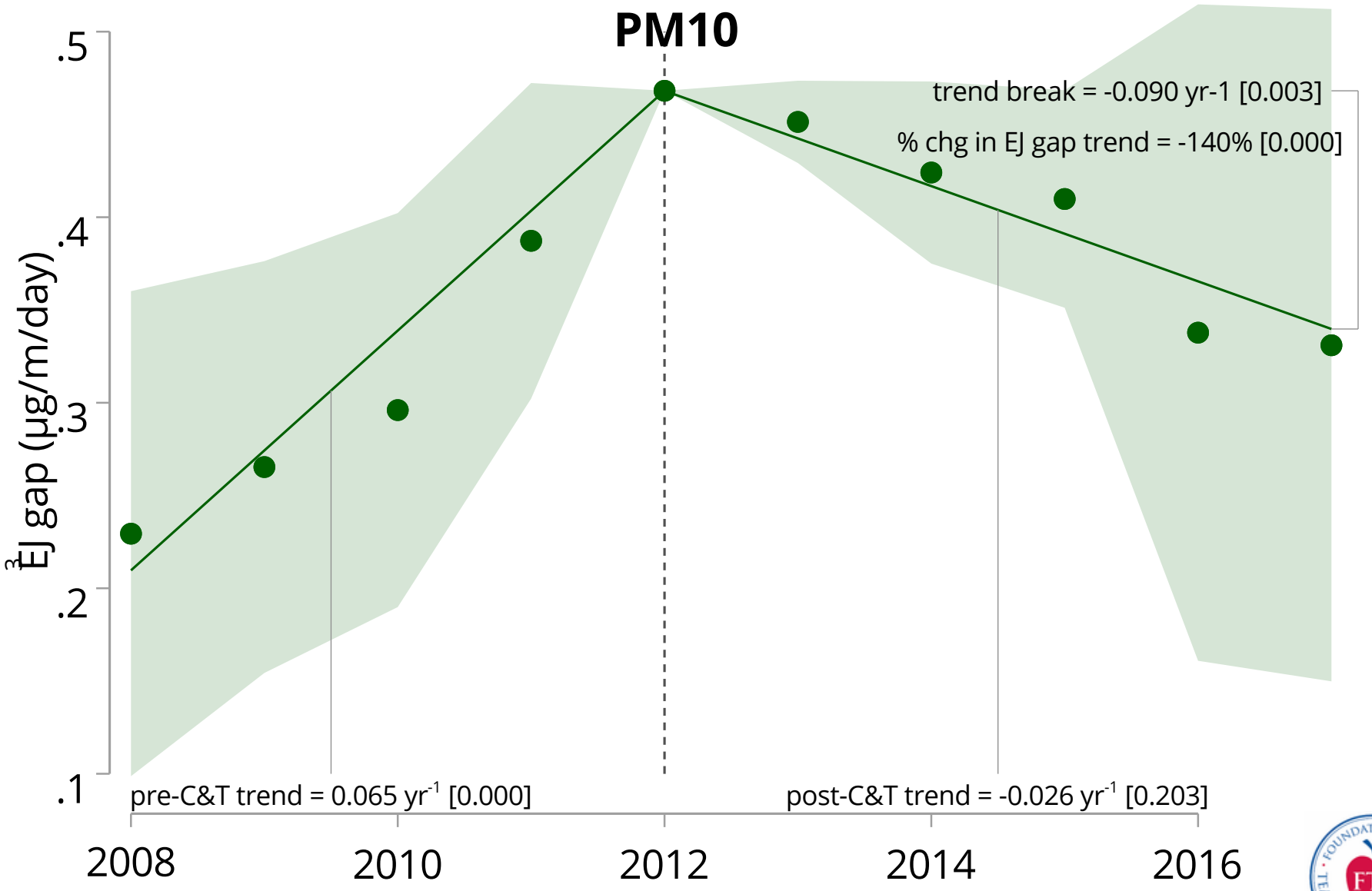

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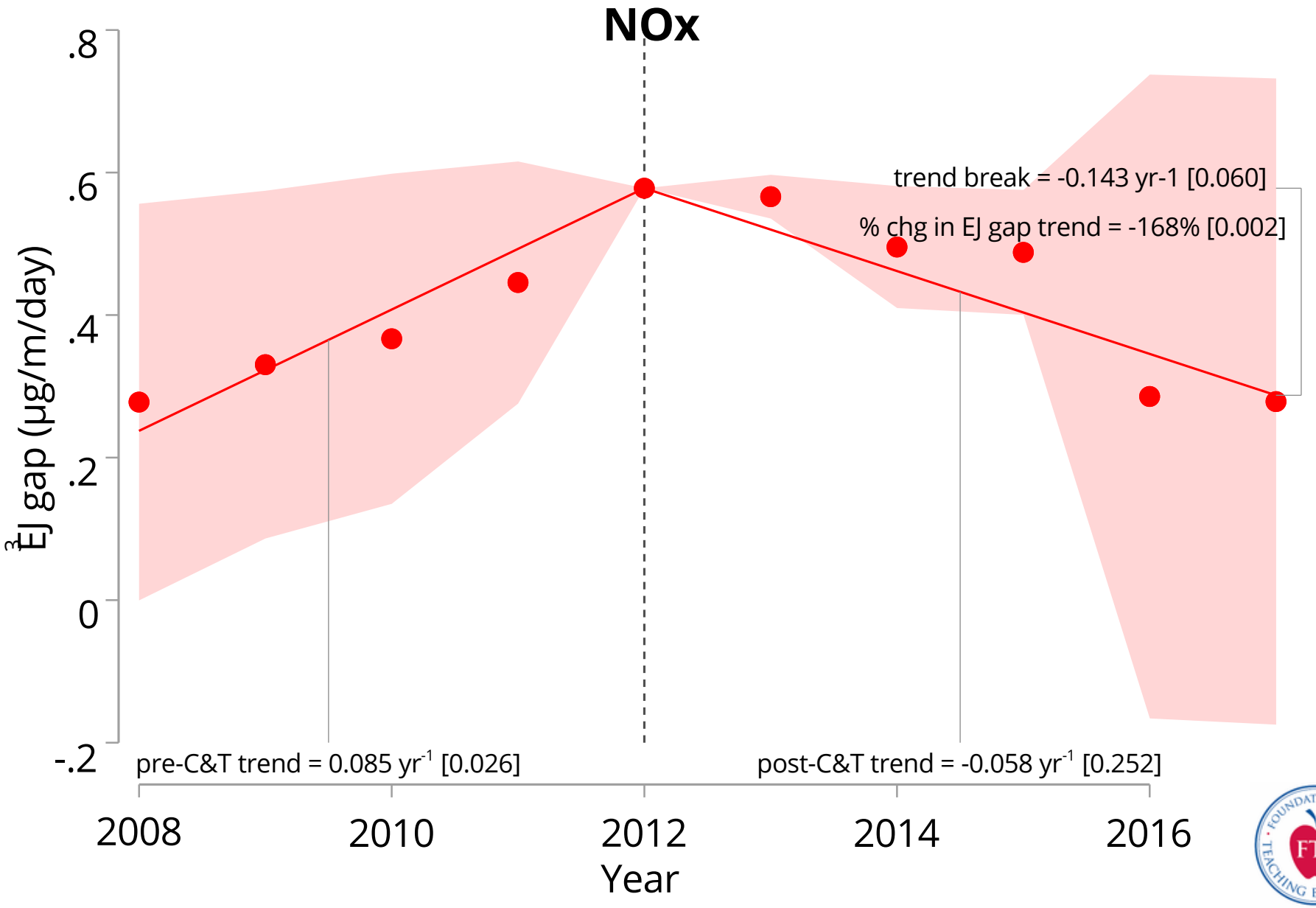

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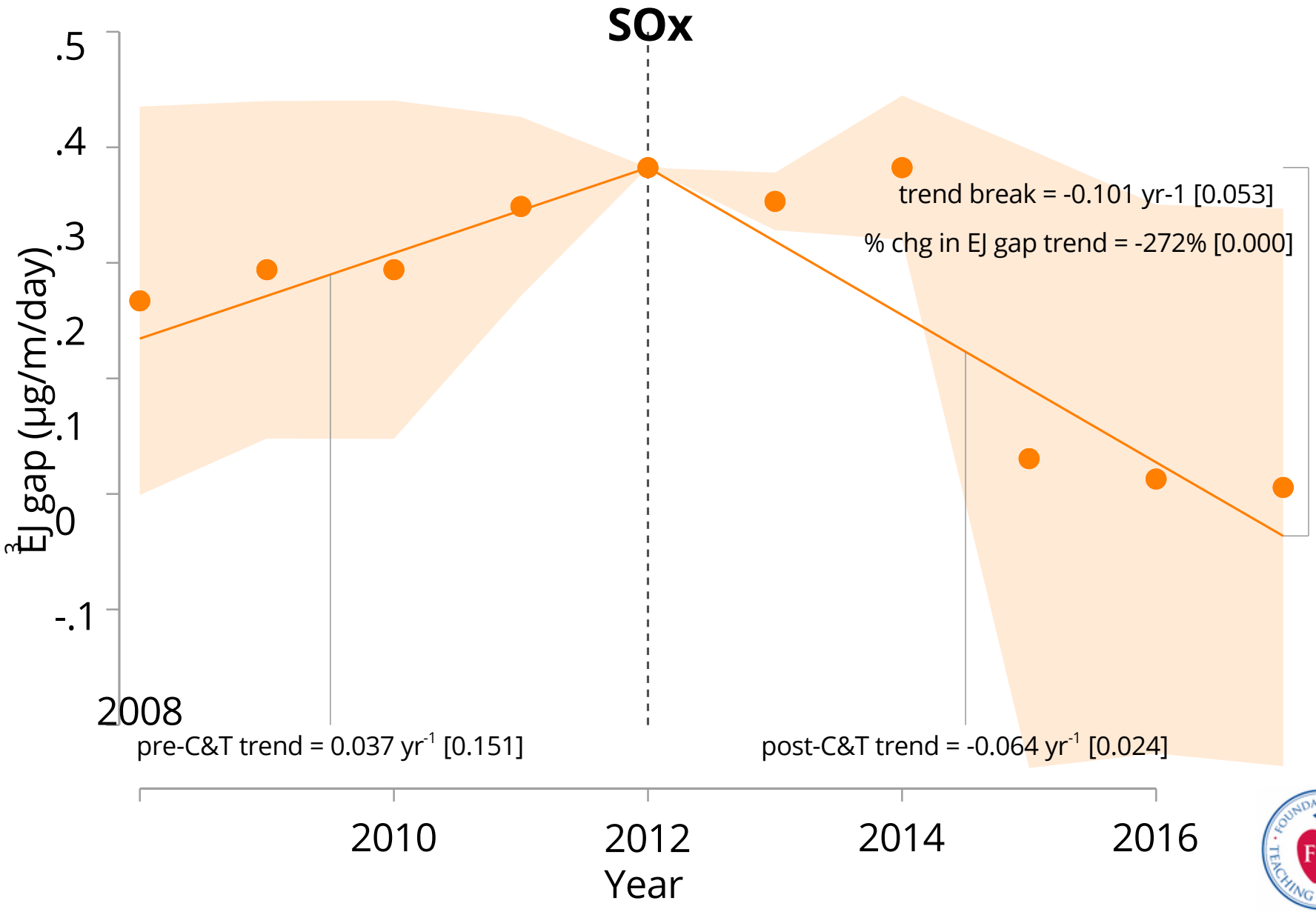
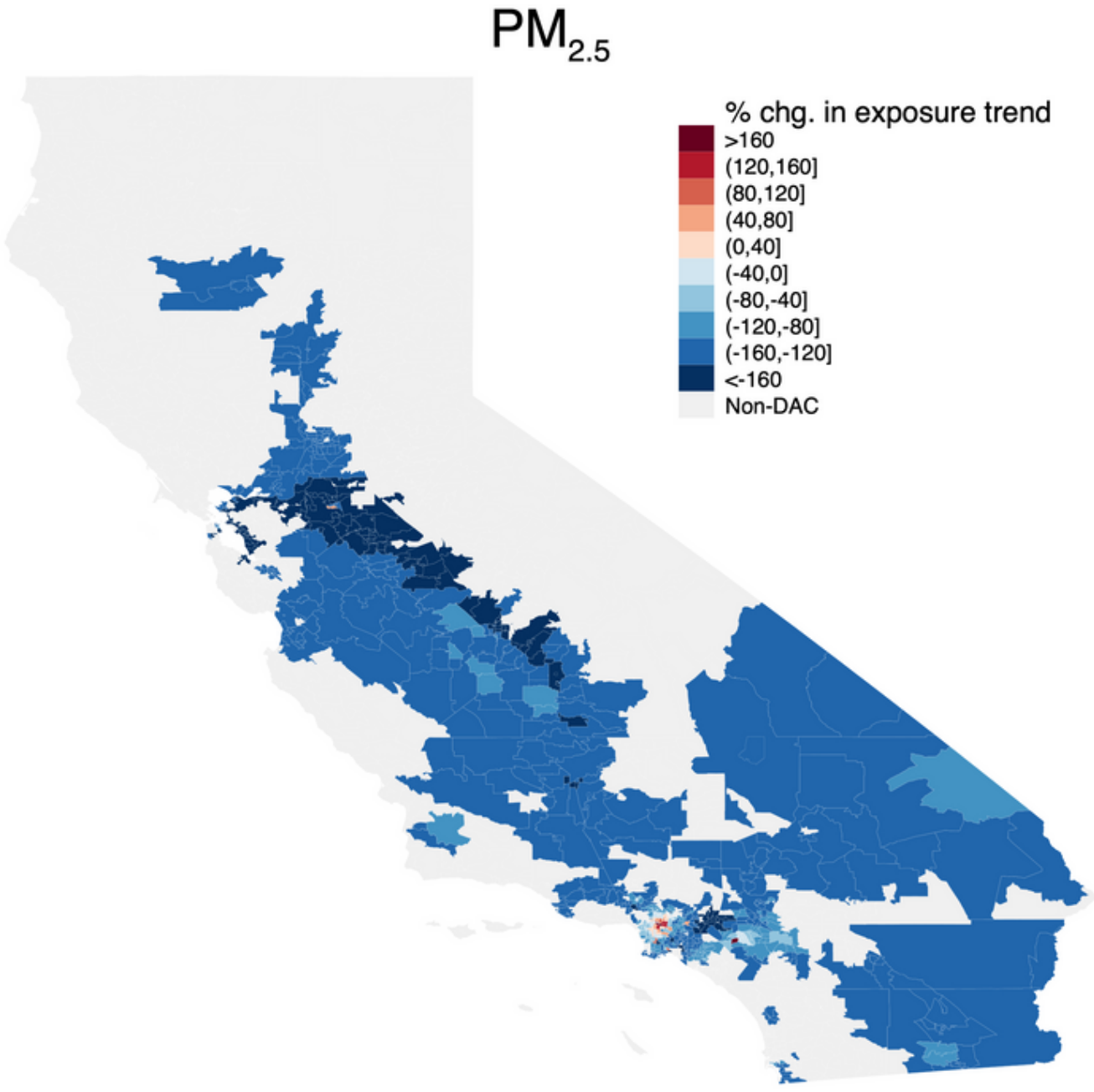
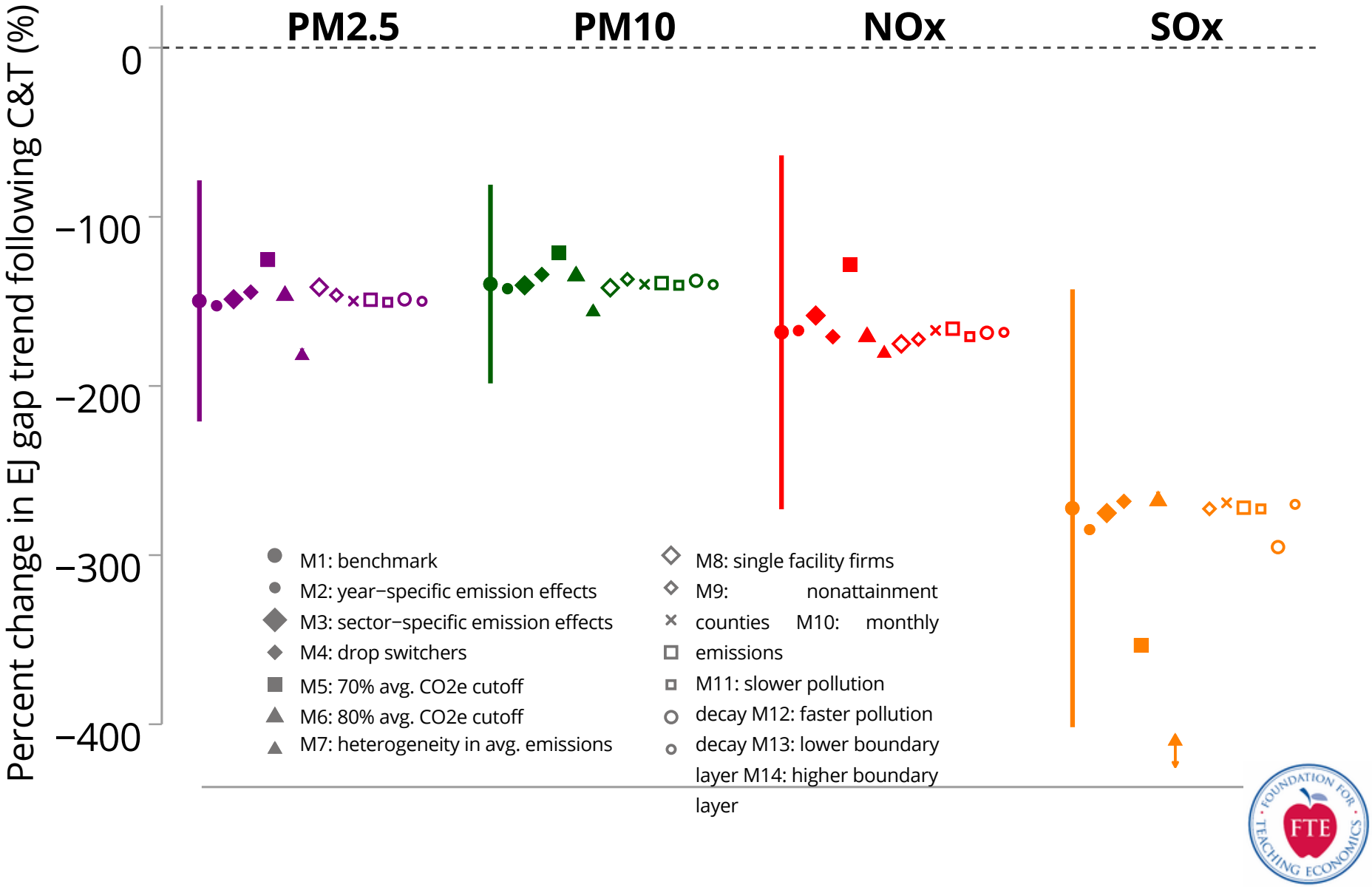


Spatial differences

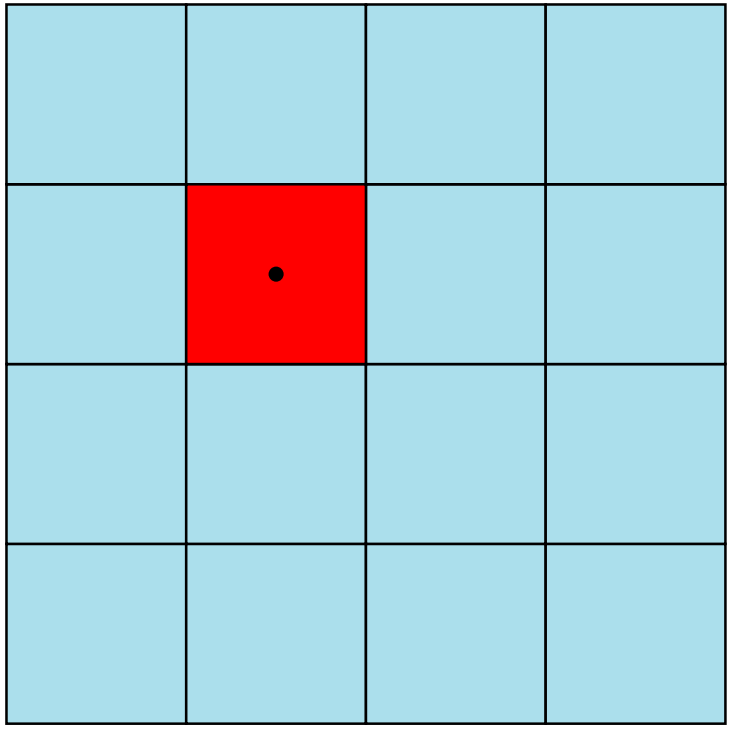


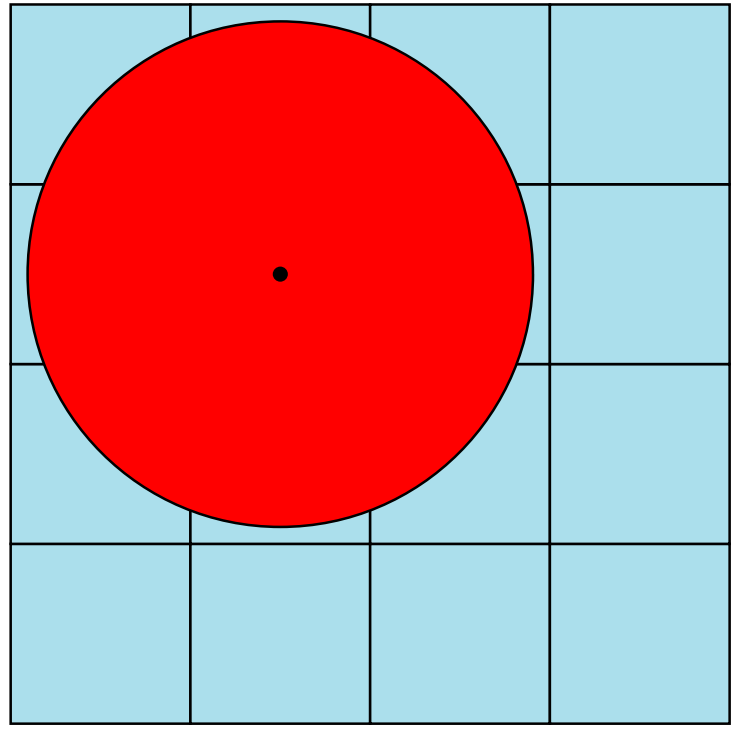
▸ Other pollutants

Step 3: Robustness checks across steps 1-3



Step 3: pollution modeling matters





Conclusion

California's GHG C&T program lowered GHG and criteria air pollution emissions

Between 2012-2017, C&T reduced emissions at 3-9%/yr across GHG and criteria air pollutants → 3.2 mil. tons of CO2e abated across sample facilities

Reversed previous widening EJ gap for PM2.5, PM10, NOx, and SOx

By 2017, EJ gaps returned to 2008 levels

Demonstrate importance of integrating pollution modeling with statistical techniques

Caveats

For California...

EJ gap effect compares pre- and post-2013, not against hypothetical alternative climate policies after 2013

EJ gap still there!

Full distributional analysis requires analyzing health outcomes and cost burden

More broadly...

Environmental markets may not always narrow the EJ gap

Need to generally understand when market-based policies (and other environmental policies) narrow or widen EJ gaps

EJ problems need EJ policies

Thank you

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