F. T. Dehos

Research question

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Econometrics II
4th Tutorial: Paper Discussion

Dobkin, C., Nicosia, N., Weinberg, M. (2014).
Are supply-side drug control efforts effective? Evaluating
OTC regulations targeting methamphetamine precursors.
Journal of Public Economics, 120, 48-61.

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Summer Semester 2019

Research question

Broadly formulated:

How effective are enforcorcment efforts in reducing illegal drug use in the U.S.?

More specifically:

Are laws regulating the sale of over-the-counter (OTC) cold medicines effective to reduce the production and consumption of methamphetamine?

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Background informationn

Background information on methamphetamine:

- *Definition:*
  methamphetamine is a central nervous system stimulant that induces a state of pleasure, high energy, and alertness that last up to 12 hours. (crystal meth $\rightarrow$ "Breaking Bad").

- *Production:*
  retail cold medicines can be used to produce methamphetamine since they contain pseudo-ephedrine or ephedrine, a key in put in methamphetamine production.

- *Negative side effects of methamphetamine consumption*
  addiction and adverse physical and psychological events including cardiovascular complications, premature mortality, mood disorders, cognitive impairment, risk-taking and aggressive behavior.

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Aim of the analyzed policy

- Reduction of illegal methamphetamine availability and consumption.

- Why? $\rightarrow$ High social and individual costs related to methamphetamine consumption.

- four restrictions on methamphetamine precursors (cold medicines)
    - sales restrictions (purchasing quotas, logbook, identification)
    - product placement (secure locations)

Contribution of the paper

- provide credible estimates of the impact of a smaller, but more typical enforcement effort than policies that have been previously investigated. $\rightarrow$ higher external validity.

- contribute further evidence to a literature that shows mixed results.

- provide an ex-post evaluation on the effectiveness of new drug control laws?

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Methodology

Difference-in-difference model where the treatment is at the state level, with controls for state and month/year fixed effects and state-specific time trends (linear and quadratic).

But not a typical Dif. and Dif. approach since the introduction of the laws is staggered.

Expand the Dif. and Dif. approach in terms of event-study design.

Identifying variation

Identifying variation:

- Geographic (federal states) and temporal variation (monthly) in the implementation of OTC regulations

- Between 2004 and 2006, 35 states enacted laws regulating the sale of over-the-counter (OTC) cold medicines that contain pseudoephedrine or ephedrine, a key input in methamphetamine production.

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DID assumptions I

Assumption (Stable Unit Treatment Value Assumption - SUTVA)

$$Y_t = DY_t^1 + (1 - D) Y_t^0 \tag{1}$$

One and only one **potential outcome** observed. No peer or GE effects.
$\Rightarrow$ violation of SUTVA...
... since production and consumption in a state potentially depend upon the regulatory status of neighboring states.
$\Rightarrow$ but authors address this issue.

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DID assumptions II

Assumption (Exogeneity - EXOG)

$$X^1 = X^0 = X, \ \forall x \in \chi. \tag{2}$$

Conditioning variables are independent of treatment.
$\Rightarrow$ introduction of the law could impact the control and monitoring behavior in a treated state (reporting bias).

What about other channels?

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DID assumptions III

Assumption (No Effect Prior to Treatment - NEPT)

$$\theta_0(x) = 0, \ \forall x \in \chi. \tag{3}$$

No **anticipation** effects from being treated.
$\Rightarrow$ Early retailer compliance.
$\Rightarrow$ but authors address this issue.

What about other channels?

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DID assumptions IV

Assumption (Common Trend - CT)

$$\mathbb{E}\left[Y_1^0|X=x, D=1\right] - \mathbb{E}\left[Y_0^0|X=x, D=1\right]$$
$$= \mathbb{E}\left[Y_1^0|X=x, D=0\right] - \mathbb{E}\left[Y_0^0|X=x, D=0\right] \qquad (4)$$
$$= \mathbb{E}\left[Y_1^0|X=x\right] - \mathbb{E}\left[Y_0^0|X=x\right], \forall x \in \chi.$$

Control group reflects **counterfactual trend** of treatment group in absence of treatment.

$\Rightarrow$ common trend assumption can just be tested for the time prior to the introduction of the law.

$\Rightarrow$ authors provide suggestive evidence that common trend is likely to hold.

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DID assumptions V

Assumption (Common Support - CS)

$$\Pr\left[T \cdot D = 1 | X = x, (T, D) \in \{(t, d), (1, 1)\}\right] < 1 \\ \forall (t, d) \in (0, 1), (0, 0), (1, 0); \quad \forall x \in \chi. \tag{5}$$

There must exist an **overlap** between all four group/time subsamples
for all values of X.
$\Rightarrow$ potentially violated since all states will be treated at one point

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Data

Data on three dimensions:

- Production:
  data on the number of methamphetamine labs (The number of labs discovered each month is an unknown fraction of the total number of labs in operation that month.) Other measures related to production are the price and purity of methamphetamine.

- Consumption:
  positive drug tests for amphetamine among workers and hospital inpatients

- Arrests:
  drug-related arrests for the possession and sale of illegal drugs

$\rightarrow$ data steems from various sources.

$\rightarrow$ rates for each state on a monthly are calculated.

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Results / findings

- 36% reduction in the number of methamphetamine laboratories.

- Decline in overall domestic production of methamphetamine of about 25%.

- However, no evidence of a change in the quality-adjusted price, consumption, or drug related arrests.

- spillovers:
    - meth. producers in border counties responded to the OTC laws by purchasing precursors in neighboring states.
    - but little evidence that producers relocate production.

$\rightarrow$ several robustness checks stress the validity

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Limitations of the paper

- External validity?
- Exogeneity - assumption violated?
  $\rightarrow$ introduction of the law changes the types of the labs. Hide themselves better. (over- / underestimation?)
  $\rightarrow$ increased investigation efforts with intro. of law.
- data issues: discovered labs (measurement error).
- GE-effects: producers substitute their production to other drugs or using other precursors.
- Do drug test reveal information on the consumed quantity?
  $\rightarrow$ perhaps there is just an impact on the intensive but not the extensive margin.
- Mobility of consumers?

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Interpretation of the results / implications / policy relevance

- The results indicate that the laws reduced the number of domestic methamphetamine laboratories but left consumption unchanged. This suggests that people were able to obtain methamphetamine produced outside of their state of residence.

- Introduction of a law within a state impacts border states as well.

- Evaluation of the law important because it places a burden on legitimate consumers of cold medicines and retailers (pharmacies). $\rightarrow$ Does the end justify the means?
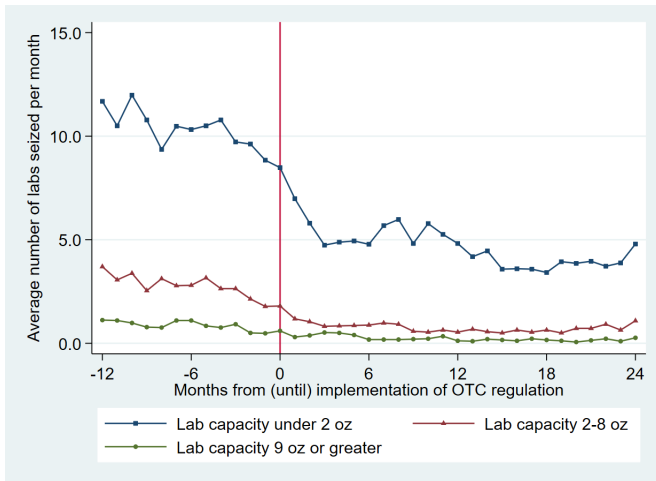
Exercise 2: DiD practical implementation

Exercise 2.a

Methamphetamine labs discovered and proportion of population covered by laws
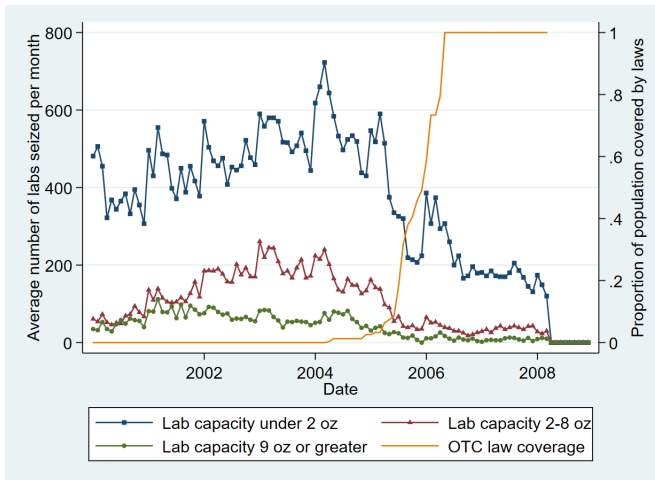
Exercise 2: DiD practical implementation

Exercise 2.b

Average number of labs discovered in event time by lab size

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Exercise 2: DiD practical implementation

Exercise 2.c

Impact of OTC regulations on methamphetamine labs by seize

	under 2 oz	2-8 oz	above 9 oz	all labs
OTC	-4.2505***	-2.2239***	-0.3038	-6.7783***
	(1.1741)	(0.5149)	(0.3240)	(1.8131)
Constant	9.7007***	1.2096**	0.6994***	11.6096***
	(1.8686)	(0.4653)	(0.1181)	(2.0356)
Adjusted R^2	0.125	0.179	0.056	0.170

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Exercise 2: DiD practical implementation

Exercise 2.d
allready discussed in previous slides

Exercise 2.e
allready discussed in previous slides

- treatment effect is homogenous across states.

- treatment effect is constant over time, i.e. cannot evolve.

- Event-study
    - more flexible and insightfull.
    - common pre-trend can be directly checked.
    - treatment effect can evolve over time.
    - but treatment effect still constant across states.

Exercise 2: DiD practical implementation

Exercise 2.f

Estimates of event time dummies for small labs