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Revisiting the Effect of Food Aid on Conflict: A Methodological Caution

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Spurious Interaction IVs

Sometimes a seemingly-perfect instrument doesn't vary much.

We therefore try to buy more variation by exploiting an intensive margin of exposure to the exogenous variation. Such 'Bartik' (or 'shift share') instruments are an increasingly common method.

But does it work if the exposure margin is endogenous?

What threat do common spurious trends pose to identification?

Background

American Economic Review 2014, 104(6): 1630–1666
http://dx.doi.org/10.1257/aer.104.6.1630

US Food Aid and Civil Conflict†

By NATHAN NUNN AND NANCY QIAN*

A novel IV strategy to identify what they claim is a causal effect of US food aid deliveries on conflict in recipient countries.

Substantive contribution: "a 1,000 MT increase in US wheat aid increases the incidence of conflict by .3 percentage points." (~+4% avg conflict incidence at sample means). Very serious.

Methodological contribution: Uses a (continuous) DID-like strategy to generate 1st stage plausibly exogenous variation in the variable of interest (food aid shipments).

Policy Motivation

The US is by far the largest global provider of food aid.

If US food aid causes conflict, further reduction of an already-controversial and diminished program might be warranted.

Sample coverage of N&Q results:

- "Cash for conflicts: New research suggests that development projects and food aid have fueled civil conflicts" *(The Economist)*
- "Please, Don't Send Food" (*Foreign Policy*)
- "Why Food Aid Fuels International Conflict" (*Huffington Post*)

Meanwhile, UN warns that cuts to food aid are "threatening to worsen already unacceptable levels of acute malnutrition, stunting and anemia, particularly in children."

Methodological Motivation

The IV strategy N&Q use increasingly used in empirical papers. Some prominent examples:

- Labor economics: Bartik (1991) interacts local industry shares (exposure) with national industry growth/wage shocks.

- Immigration: Peri (2012 *REStat*) interact distance to Mexican border with national immigration flows to identify employment and TFP effects.

- Growth and finance: Rajan & Zingales (1998 *AER*) interact financial development indicator with dependence on external financing.

- Environment: Hanna & Oliva (2015 *JPubEcon)* interact distance from factory with plant closures to look at effect of pollution on labor supply.

- Development: Dubé & Vargas (2013 *REStud)* interact global commodity prices with local commodity output shares to test whether price shocks induce civil conflict.

Methodological Motivation

But N&Q plausibly exogenous variation comes from just n=36 time series observations… maybe just spurious correlation?

Might L-R time series trends dominate S-R exogenous variation and violate (non-linear) parallel trends assumption?

N&Q use (potentially endogenous) cross-sectional heterogeneity in response to exogenous inter-annual variation to identify causal effects … a diff-in-diff approach.

Is interaction term exogenous conditional on controls?

Talk Outline

Outline for rest of talk:

1. N&Q estimation strategy
2. Intuition of potential problems with strategy
3. US policy changes: placebo test #1
4. Randomize variable of interest: placebo test #2
5. Use a clearly spurious IV: placebo test #3
6. Monte Carlo evidence

N&Q Strategy

$$C_{irt} = \beta F_{irt} + \mathbf{X}_{irt}\Gamma + \varphi_{rt} + \psi_{ir} + \nu_{irt}, \quad (3)$$

$$F_{irt} = \alpha(P_{t-1} \times \overline{D}_{ir}) + \mathbf{X}_{irt}\Gamma + \varphi_{rt} + \psi_{ir} + \varepsilon_{irt} \quad (4)$$

Estimate conflict as function of (endogenous) food aid receipts, given controls, incl. region-year and country fixed effects.

Policy generates random variation: "*USDA accumulates wheat in high production years as part of its price stabilization policies. The accumulated wheat is stored and then shipped as food aid to poor countries.*" Exogenous shocks to wheat production change food aid at margin, primarily among regular food aid recipients.

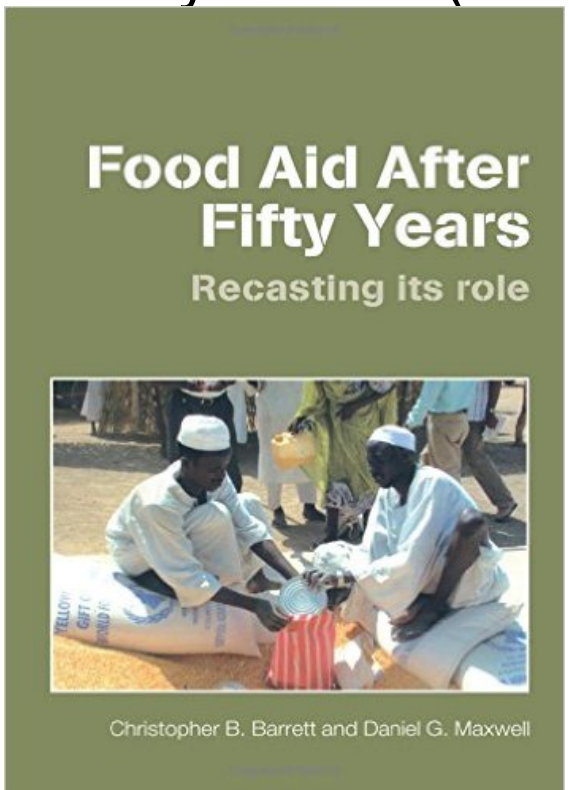
Identification:
"*US wheat production is associated with more conflict among regular US food aid recipients but not among irregular recipients.*"

N&Q Strategy

OLS results: negative, insignificant relationship b/n food aid flows and conflict. But potentially endogenous if food aid flows targeted partly on basis of conflict status (per policy).

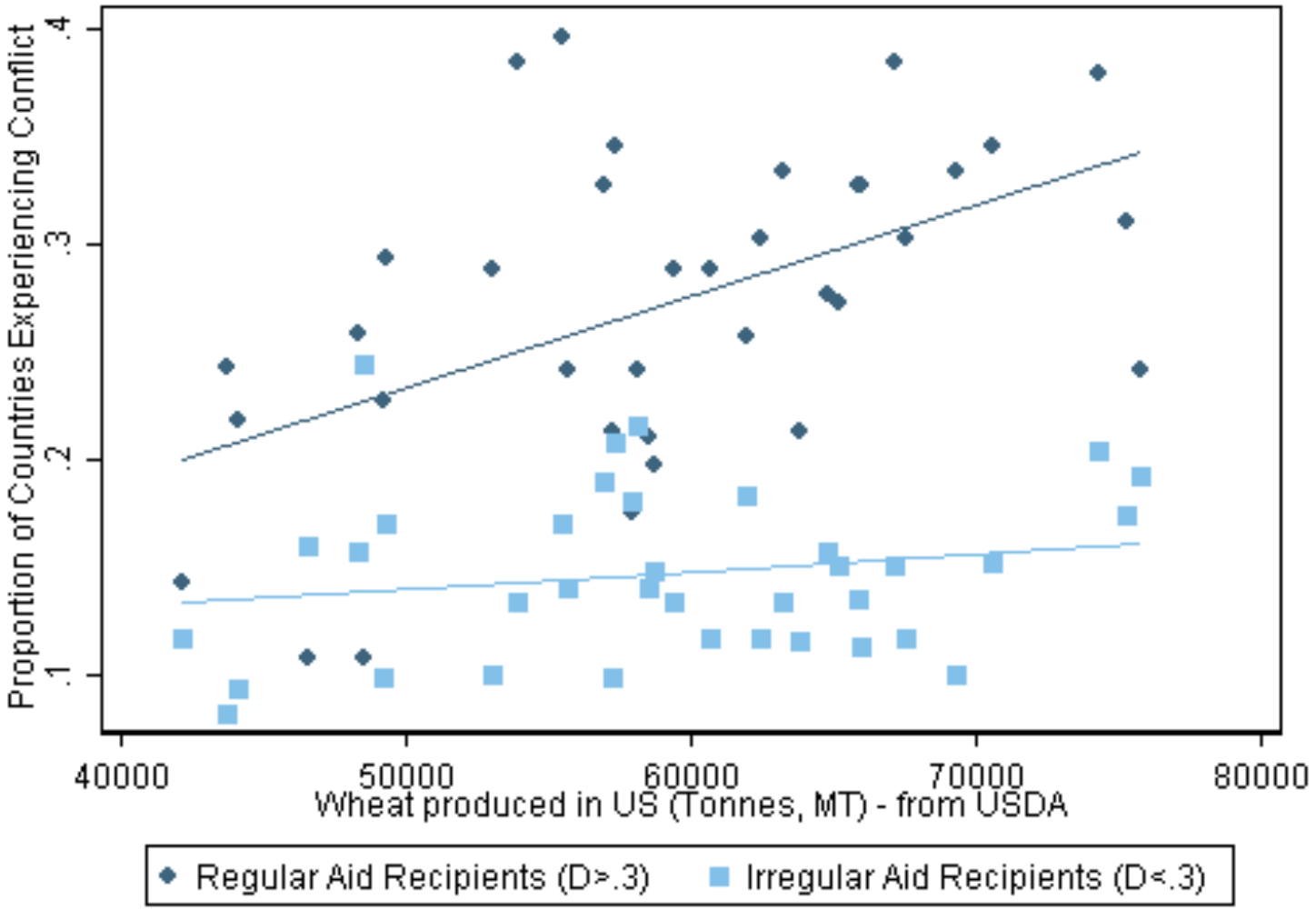
N&Q argue that OLS estimates *downwardly* biased because food aid targeted to countries less affected by conflict (where it is least likely to cause harm).

Really? US expressly targets emergency food aid toward conflict-affected states …



N&Q Strategy

A visual representation of N&Q's results:



Potential problems

1. N&Q mechanism (USG wheat purchases based on price support policy) only existed for part of the period they study.

2. Food aid is targeted to (not away from) conflict-affected countries per USAID policy.

3. Effectively leveraging n=36 inter-annual observations of wheat production fluctuations … longer-run trends may dominate year-on-year change from mechanism N&Q posit, esp. with just linear time trend controls.

Evolution of Food Aid 1971-2006

1970s-early 1980s: Policy more or less as described by NQ

- Wheat farmers supplied with non-recourse loans backed by their wheat production as collateral. Serve as de facto price floor. Rarely binding.
- Food aid disposes of occasional gov't-held surpluses.

1985-1996: Prices near loan rates, gov't builds stocks, raising costs and prompting major policy changes

- Sever the link between prices and CCC purchases
- Farm bills first change prices for NR loans
- 1996 farm bill formally severs the link

1996-2006: No direct link between production and food aid purchases

- Food aid now open market procurement, not surplus disposal

Placebo test #1

N&Q estimates should be a sample-weighted mixture of a strong pre-1985 effect (when mechanism was in place) and no effect post-1996 (when mechanism discontinued).

So split sample by periods and test for differences.

Placebo test #1

TABLE A1: INSTRUMENT AND FOOD AID SHIPMENTS BY FARM BILL ERA

VARIABLES	US wheat aid (1,000 MT)
Panel A: Pre-1985 (n=1,460)	0.00256
Baseline interaction instrument	(0.00175)
Panel B: 1985-1996 (n=1,245)	-0.00218
Baseline interaction instrument	(0.00246)
Panel C: Post-1996 (n=1,245)	0.00181
Baseline interaction instrument	(0.00114)

TABLE A2: 2SLS ESTIMATES OF FOOD AID ON CONFLICT BY FARM BILL ERA

VARIABLES	Any Conflict
Panel A: Pre-1985	0.00357
U.S. wheat aid (MT)	(0.00286)
Panel B: 1985-1996	-0.00386
U.S. wheat aid (MT)	(0.00408)
Panel C: Post-1996	0.00281
U.S. wheat aid (MT)	(0.00258)

1st stage instrument becomes insignificant in relevant (pre-1985) period; 2SLS estimate unchanged (but insig).

But placebo test period (post-1996) not stat sig different from relevant (pre-1985) period.

First hint that something else at play: aid procurement policy does *not* drive NQ results as hypothesized.

Potential problem 2

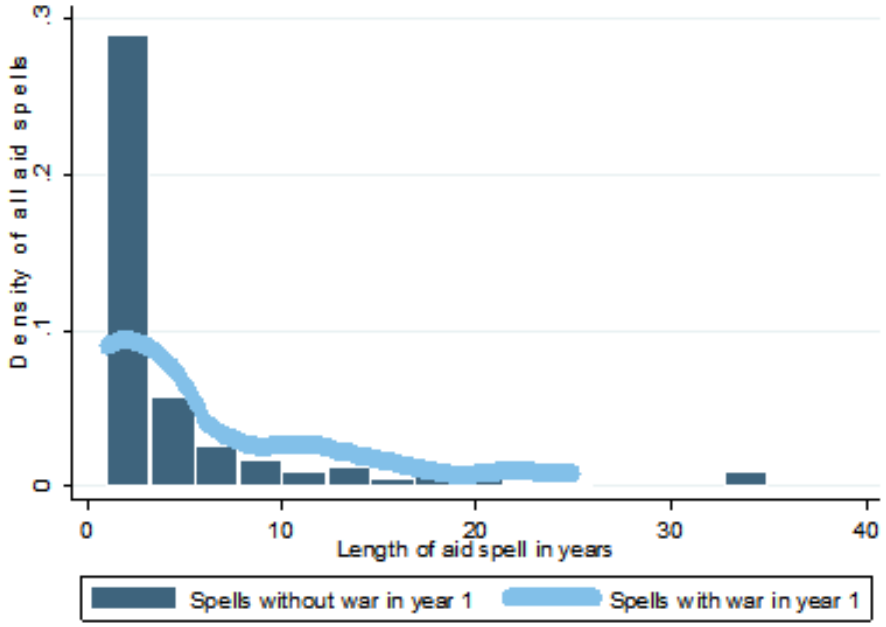
US Food for Peace policy expressly counters N&Q explanation for difference between OLS & IV estimates:

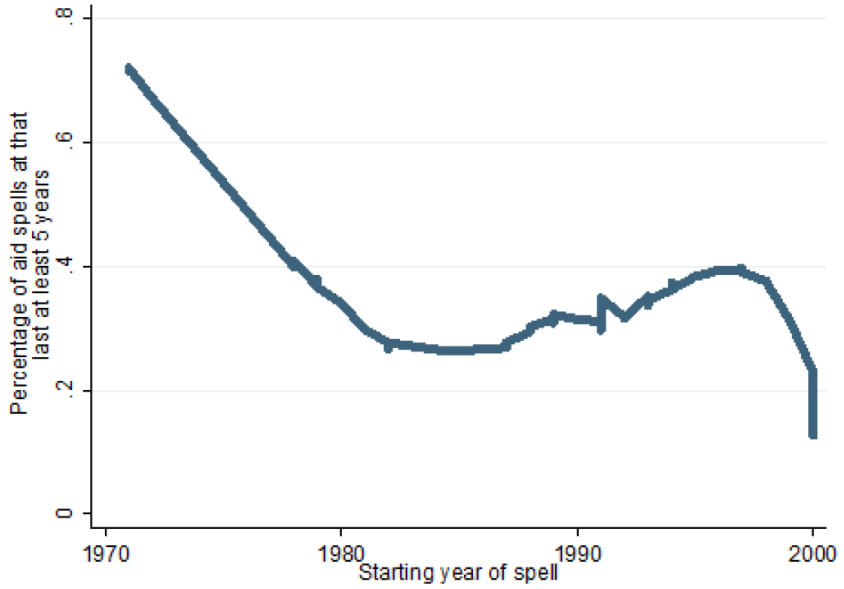
"[USAID Food for Peace] provides emergency food assistance to those affected by *conflict* and natural disasters and provides development food assistance to address the underlying causes of hunger." (2015, emphasis added)

Furthermore, food aid flows persist, esp. in places that may need emergency assistance. This makes exposure variable endogenous.

Potential problem 2

Food aid flows persist, esp. if a food aid spell begins in a year of conflict. Note that N&Q find no effect on conflict initiation, only on duration. Endogeneity if food aid is targeted to conflict-affected countries. Persistence falls over study period, so problem greatest in 1970s (the only period when diff exists b/n regular/irregular recipients).



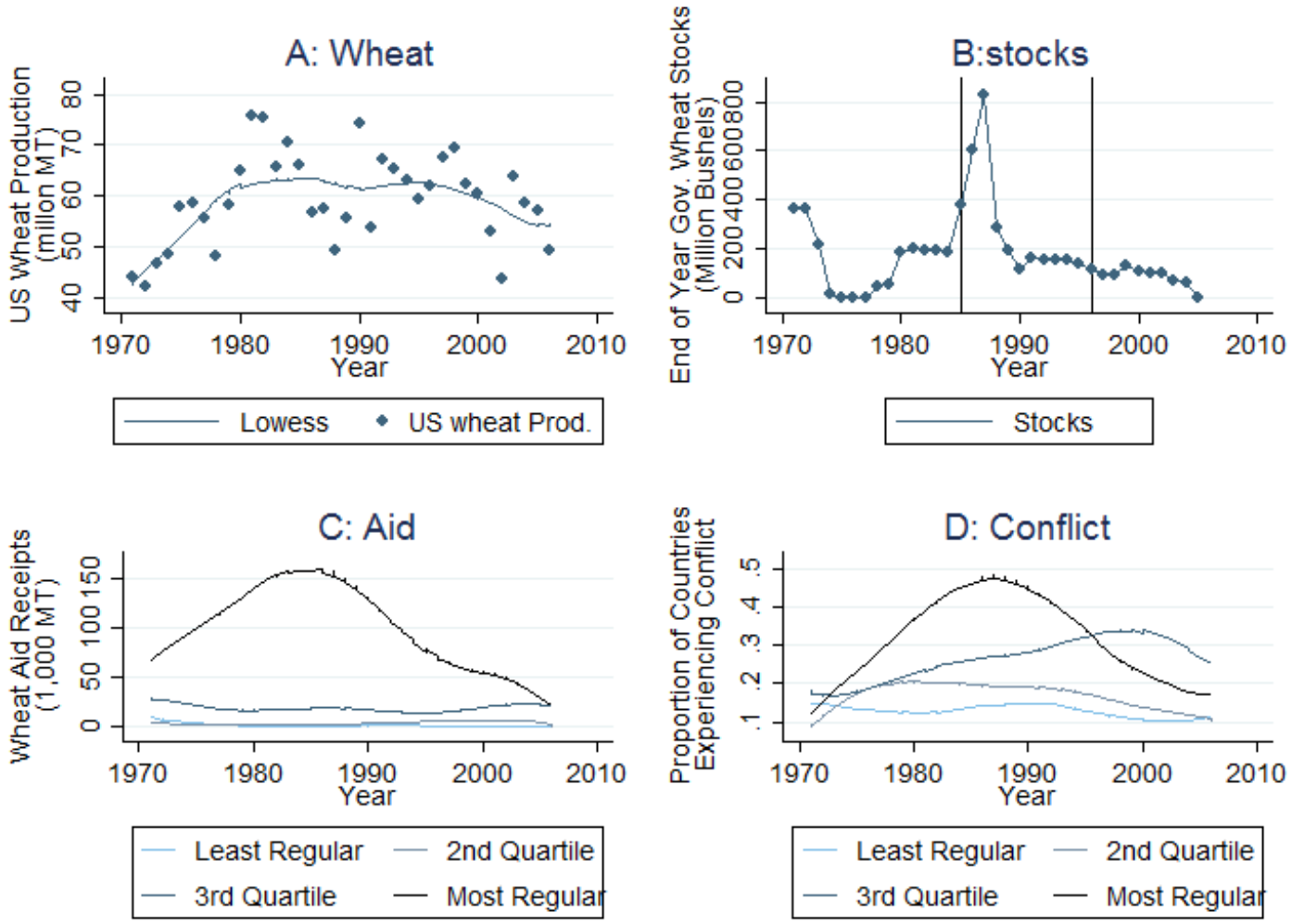


Potential problem 3

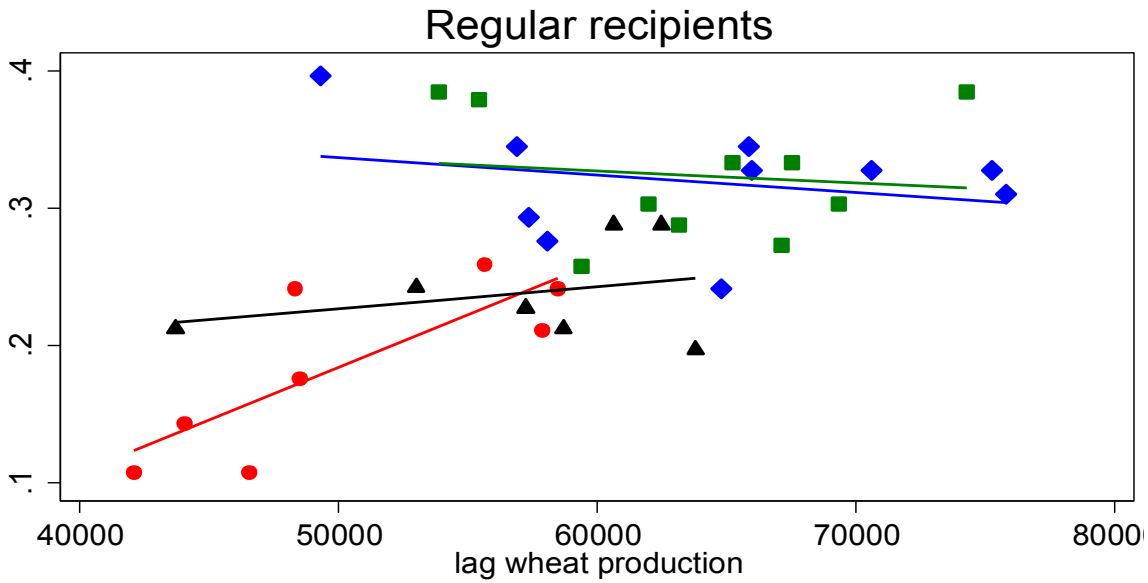
Longer-run, spurious trends may dominate the year-on-year change from the causal mechanism N&Q posit, esp. with just linear time trend controls.

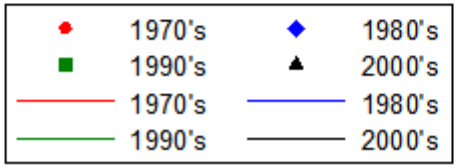
Potential problem 3

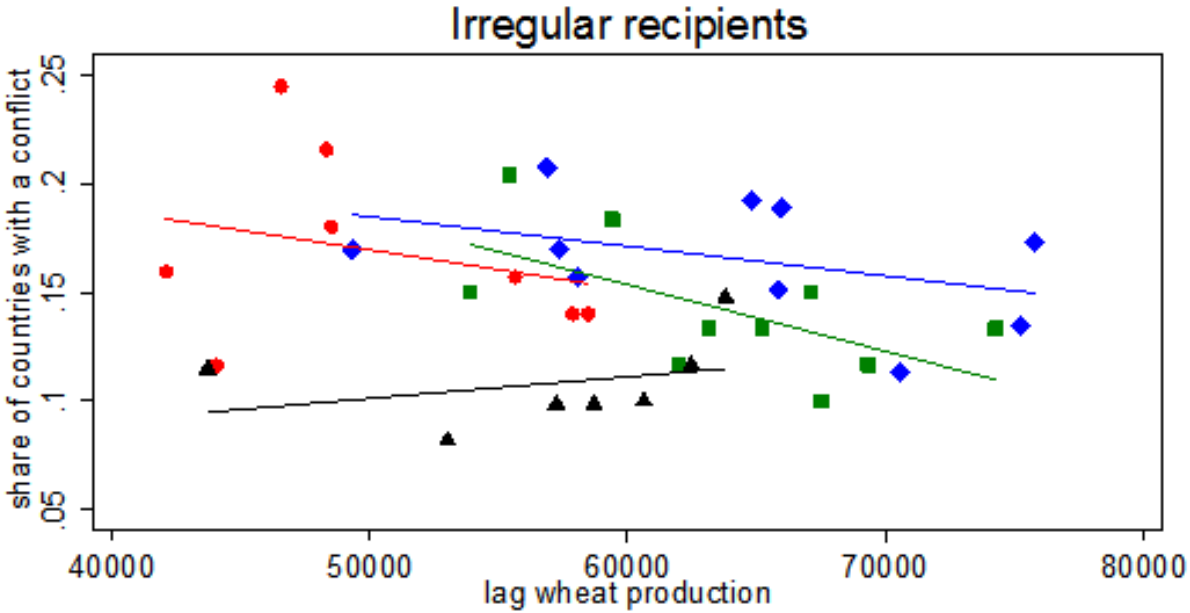
Core problem: non-parallel, nonlinear trends



Potential problem 3

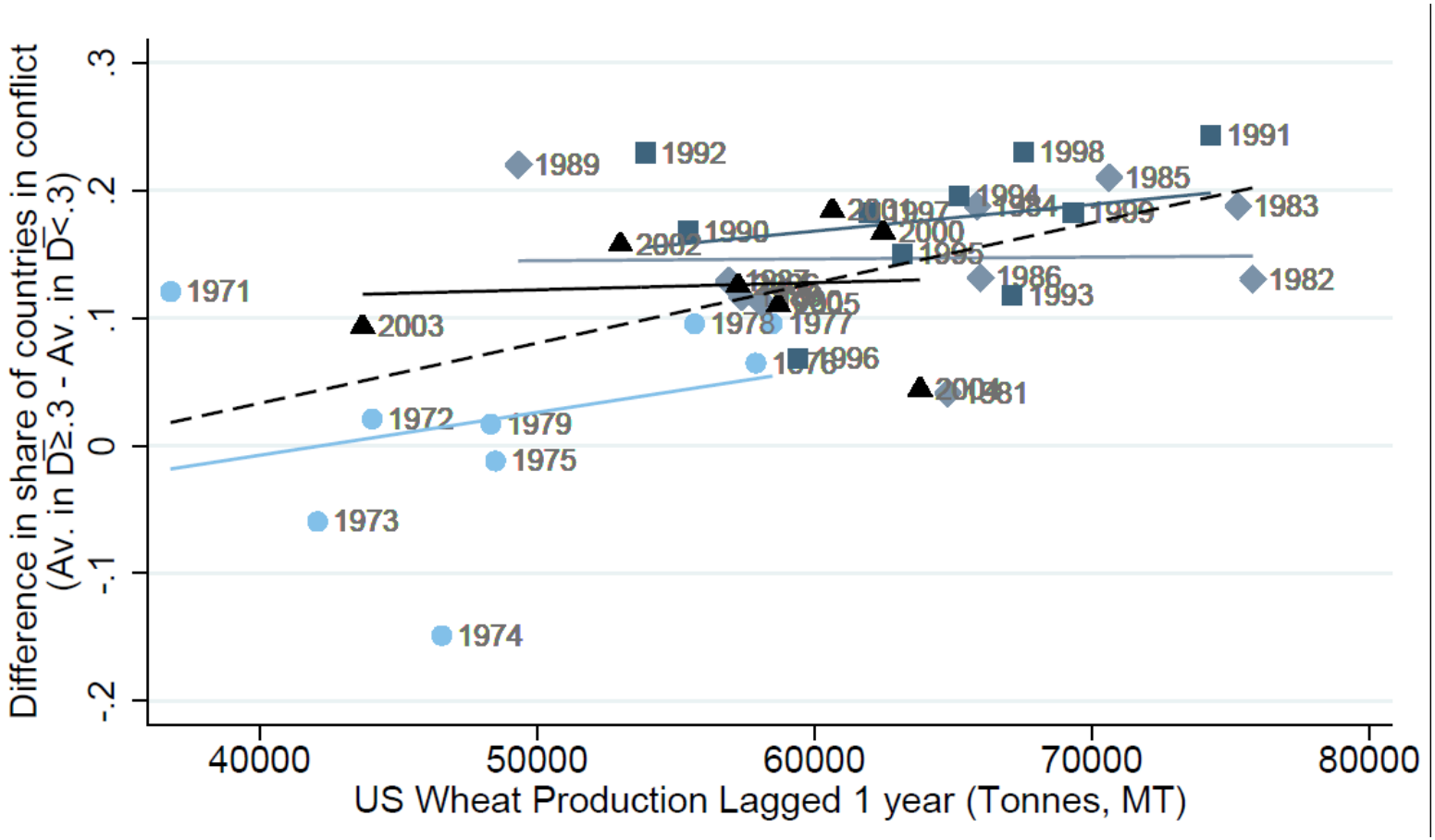




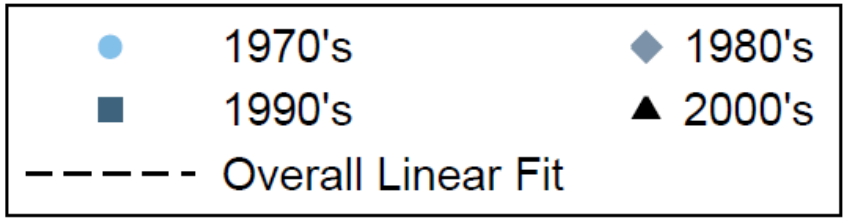


The difference between regular and irregular recipients occurs solely in 1970s, during transition to period of high US wheat output and conflict.

Potential problem 3



Most easily seen by looking at the differences between regular and irregular recipients by decade.



Placebo test #2

Longer-run (nonlinear) trends in time series dominate inter-annual exog variation that drives identification. Endog. group selection plus trends could fully explain N&Q results.

Year-region/country fixed effects not adequate controls.

Placebo test: randomizing food aid flows among recipients should break link unless background trends drive correlation.

Implication:
If coefficient estimate on randomized food aid still positive and statistically significant, it's picking up something else, (i) endog. identity of regular aid recipients and (ii) spurious background trends in conflict and wheat production.

Placebo test #2

Placebo Test Method:

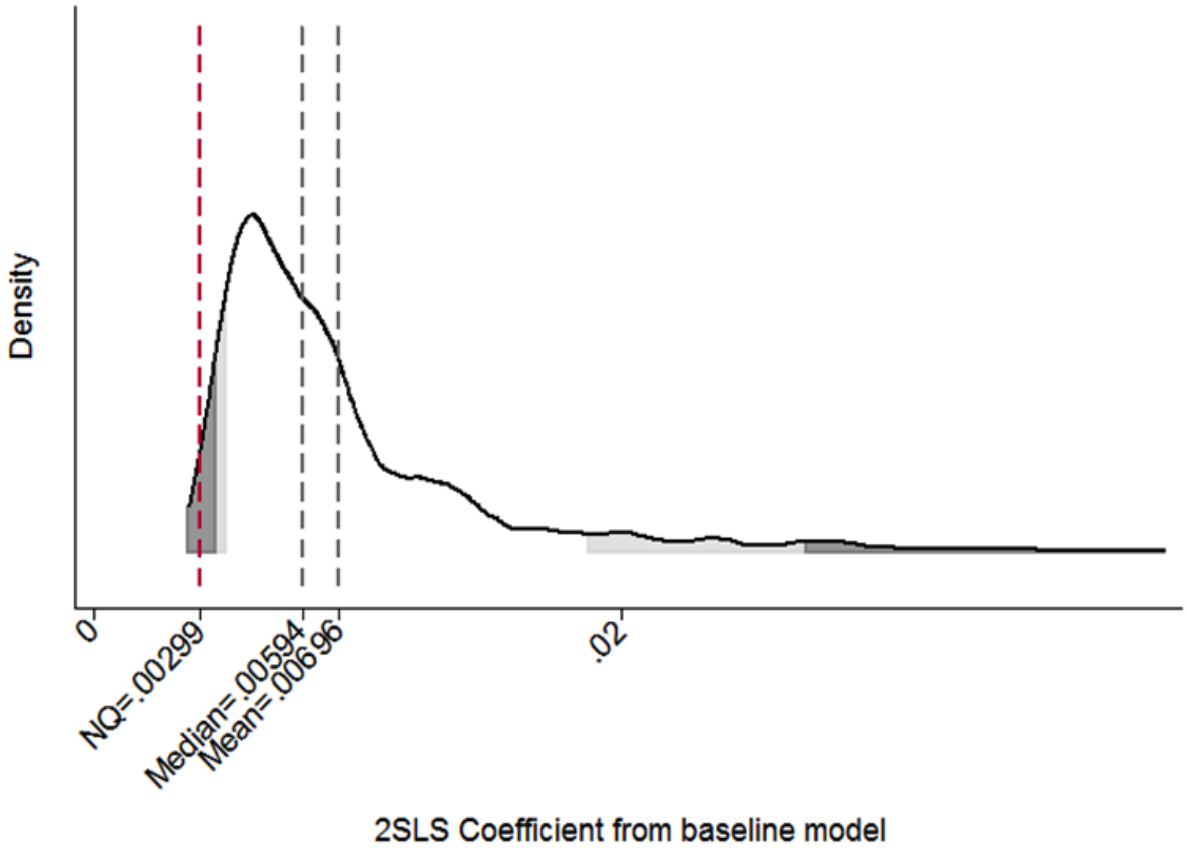
- Hold constant identity of aid recipients, timing and total availability of food aid, wheat production, etc.
- Randomize which country receives food aid flow each year.
- This preserves the endogenous macro time trends and the potential spurious correlation of wheat production and conflict.
- Also retains potential ORV and selection bias problems.

Implication:

If N&Q's hypothesized mechanism is true, this randomization should break correlation between food aid flows and conflict.

Placebo test #2

Dist'n of coefficient estimates from 1,000 randomizations does *not* center around 0. Instead, it moves rightward with no support around 0!



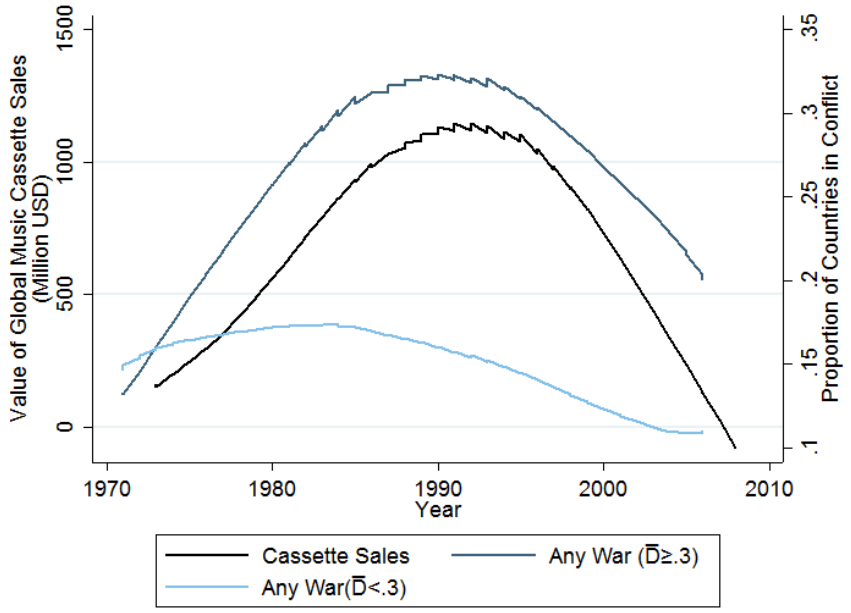
Implication:

(Endog.) identity of FA recipients and (nonlinear, non-parallel) background trends drive N&Q result, not the policy mechanism they posit. Indeed, randomized estimates higher, consistent w/neg OLS.

Placebo test #3

Given those results, try replicating N&Q with a clearly spurious IV with the same trend that can't possibly cause food aid flows.

We use global music cassette sales as spurious IV. Even when control for N&Q's instrument, this spurious IV generates very similar estimates (0.3%) to (not stat sig different from) N&Q's.



Take-away: Any time series variable with a spuriously similar trend yields biased IV estimates, even with lots of controls.

Monte Carlo tests

We construct 2 models where food aid has ***no*** positive effect on conflict: (i) uncorrelated, and (ii) food aid reduces conflict.

If we preserve the background trends, and L-R variation > S-R variation in exogenous component of IV, do we estimate the same negative OLS but positive IV relationship?

In such a model, does N&Q's estimation strategy accurately reflect the true DGP?

Take-away:
Using, N&Q's strategy, we consistently replicate their findings of negative OLS estimates and positive 2SLS estimates when there is no true positive, causal effect of food aid on conflict. Even do so when food aid truly, causally **reduces** conflict.

Monte Carlo tests

In the simplest model 1:

Wheat production and risk of conflict both follow independent but parallel quadratic trends. Conflict heterogeneously affect countries.

$Wheat\text{-}_{it} = f(t) + z_t$ with $\sigma_f >> \sigma_z$, $f(t) = g(t) = t-(1/36)*t^2$ where t=1… 36

$$Conflict_{it} = \begin{cases} 0 \text{ if } a_i * y_t < \theta \\ 1 \text{ if } a_i * y_t \geq \theta \end{cases}$$

where $a_i \in [0,1]$, $y_t = g(t) + u_t$, $\sigma_g >> \sigma_u$

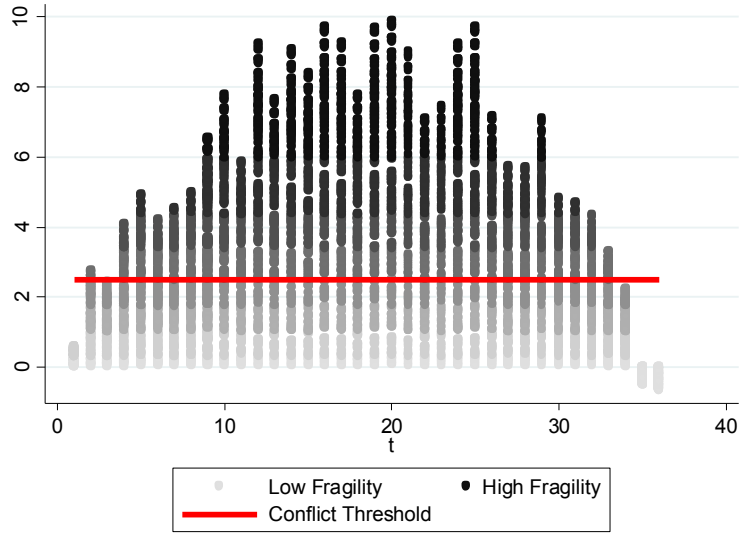
$Aid_{it} = Max(0, Conflict_{it} * \mu_{it})$ and μ_{it} , u_t , z_t ~iid N(0,1)

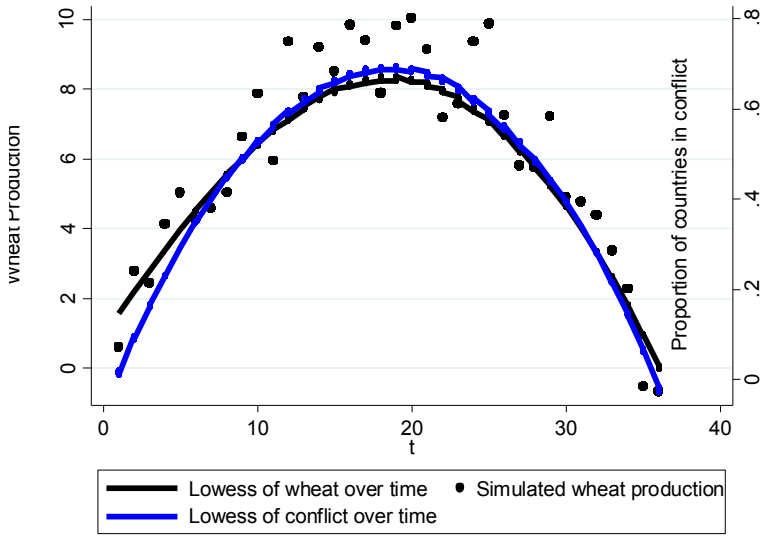
By construction:

- wheat production (the exogenous instrument) and conflict (the dependent variable) are random and correlated only through common nonlinear trend. *Conflict is not caused by food aid*.
- conflict is random but certain countries are always high risk.
- interannual variation around trends less than trend variation.
- food aid only sent to (some) countries suffering conflict.

Monte Carlo tests

When we generate 100 random samples of 126 countries and 36 years, we get the following key variables:



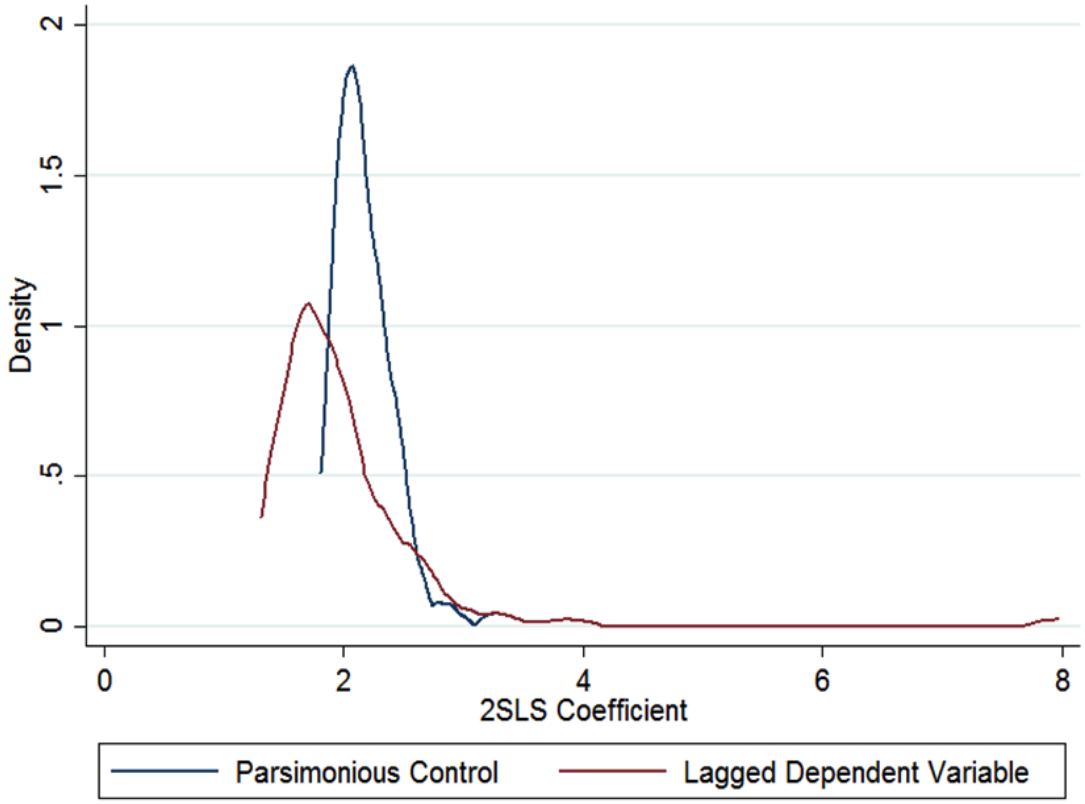


Conflict is random but certain countries are always high risk risk is high in middle period

Wheat yield also follows an inverse-U shape with little variation around the trend

Monte Carlo tests

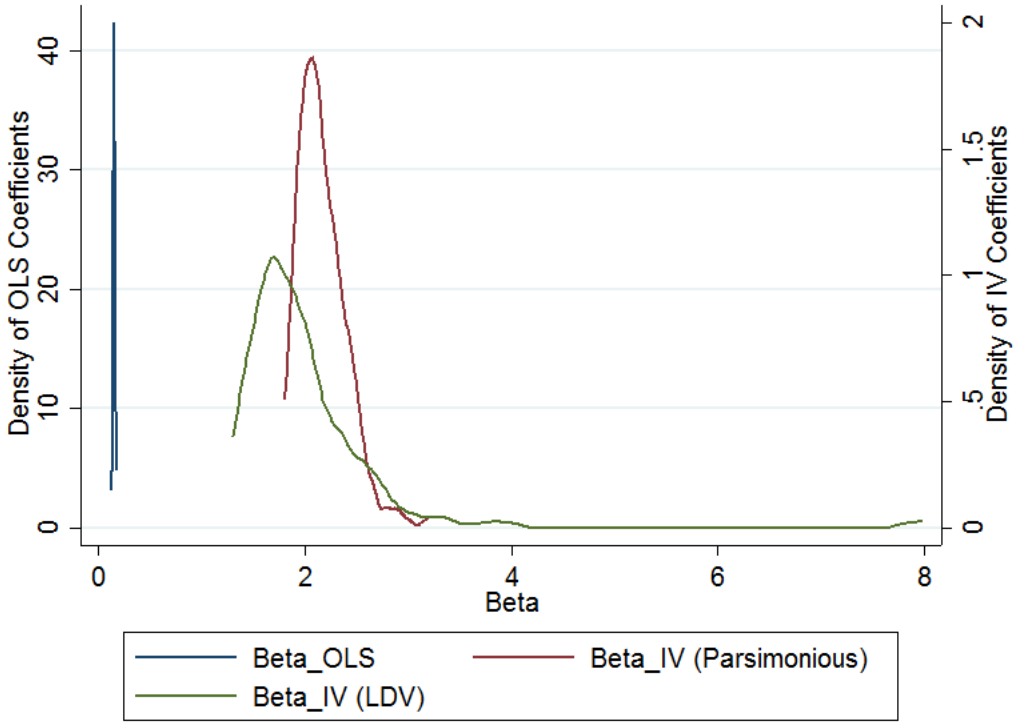
Despite true β=0, N&Q's 2SLS estimation strategy generates biased sampling dist'n of the parameter estimates of interest:



Main robustness check (including lagged conflict status) actually makes the bias worse.

Monte Carlo tests

Model 2: allow food aid to be driven partly by reasons other than conflict. Also let food aid *prevent* conflict in the true DGP.



Resulting parameter estimates for OLS and 2SLS qualitatively Identical to N&Q's *even though true β<0*!

Two core problems: (i) countries that experience the most conflict are most likely to get aid and (ii) conflict and wheat production are spuriously related over time.

Conclusions

Food aid: N&Q's findings not causal. Indeed, fully consistent w/ a model in which food aid *prevents* rather than causes conflict.

Methodological: Other papers use similar IV strategy: interact a plausibly exogenous time series variable with limited variation with a potentially endogenous cross-sectional variable with greater N to create continuous quasi-DID IV estimator. Be wary!

If the time-varying component of the IV has spurious correlation with the time trend in the outcome variable, and the strength of the time trend is correlated with the endogenous cross-sectional component of the IV, then the interacted instrument strategy will fail to identify causal impact. Time and group FE will not fix this. Pay attention to trends, esp. nonlinear ones.

Recommendations

- Know true data generating process (e.g., policy) and any changes during the period
- If diff-in-diff 'treatment' is endogenous look for differences in underlying trending variables. Plot data and inspect visually for non-parallel trends.
    - Year fixed effects only remove trends that are common to both "treated" and "untreated" groups. Country fixed effects only remove differences across countries that are constant over time.
    - Major violations of assumptions are often easy to spot visually
- Include flexible trend controls in weak instrument tests
- Try placebo tests to validate exclusionary restriction
    - Focus on the source of identifying variation
    - Randomizing assignment of treatment is likely to have strong predictions that can be tested

Thank you for your interest and comments!

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