Rural-Urban Water Sale and Urban Growth

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Background

Exhaustion of water resources due to substantial growth in Western U.S.

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Unmet water demand during early 1900s

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Long distance importation from Owens Valley

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Two options for LA County Water Board: purchase water rights or agricultural lands

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Chose to acquire agricultural land

What is the impact of Owens Valley Water Transfer on economic growth and urban sprawl of Los Angeles?

- High degree of secrecy surrounding the transactions to depress the transactions' cost to the city was perceived as "theft" and came to be known as *Owens Valley Syndrome.* A disproportionate share of surplus accrued to LA county.
- The growth was further inflated since imported water was 4-5 times higher than the demand and LA supplied water to neighboring areas on a condition that these areas would be annexed by the city.

Data

- Decennial Data for all counties in California : NHGIS IPUMS, University of Minnesota
- Dependent variables: Urban sprawl, GDP per capita, manufacturing product per capita, and agricultural product per capita

Research Design

Use synthetic control, difference-in-differences, and events studies for our causal inference.

- Intuition: Construct a synthetic control unit using a convex combination of control units to observe the trajectory with no intervention
- Two sets of weights (pre-intervention period):
  1. Co-variate weights: depends on predictive power of outcome
  2. County weights: Assigned to unexposed units
- Optimal W given by: $0=\sqrt{(X_1 - X_0W)'V(X_1 - X_0W)}$
  where, X_1: LA Characteristics, X_0: Control County Characteristics, V: Characteristic Weights
- Synthetic Control Units: $\widehat{Y_{1t}^{NI}} = w_2^* Y_{2t}^{NI} + w_3^* Y_{3t}^{NI}$ for t > 3
- Treatment Effect Estimator: $\widehat{\alpha}_{1t} = Y_{1t}^{I} - \sum_{i=2}^{3} w_i^* Y_{it}^{NI}$ for t > 3

Difference-in-differences specification:

$Y_{it} = \alpha \times (1[\text{LA County}]_i \times 1[\text{Post-OVWT}]_t) + Z_{it}\beta + \mu_i + \lambda_t + \epsilon_{it};$

where Y_{it}: Outcome Variable; $1[\text{LA County}]_i$: Dummy for LA; $1[\text{Post-OVWT}]_t$: Dummy for post-treatment; Z_{it}: Vector of explanatory variables; μ_i: County Fixed Effects; λ_t: Year fixed effects ; ϵ_{it}: Error Component

Results

Figure 1: Synthetic control results for GDP per capita.

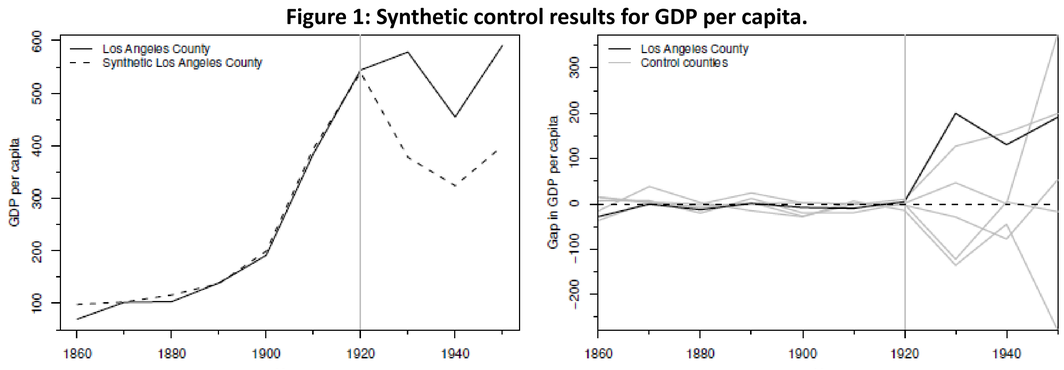


Figure 2: Synthetic control results for manufacturing product per capita.

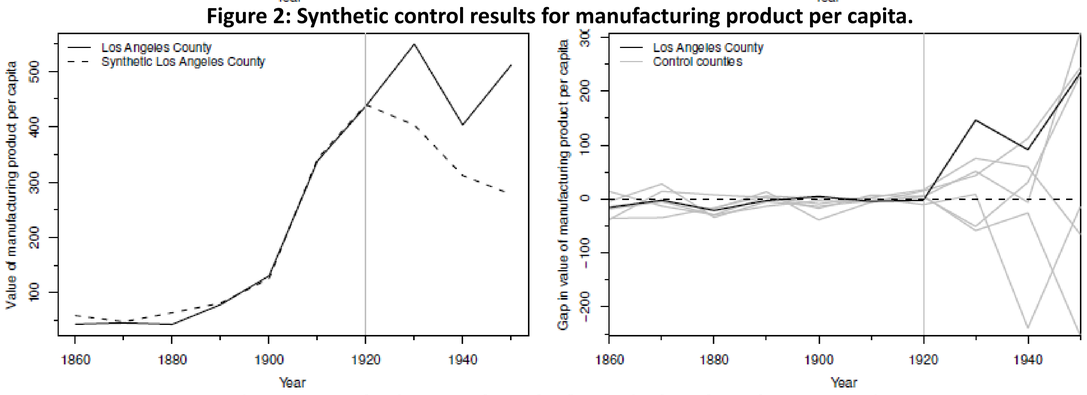


Figure 3: Synthetic control results for agricultural product per capita.

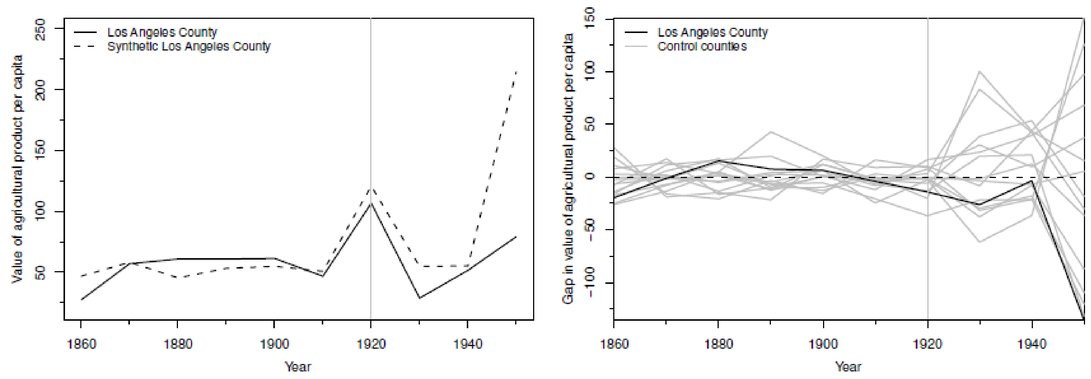
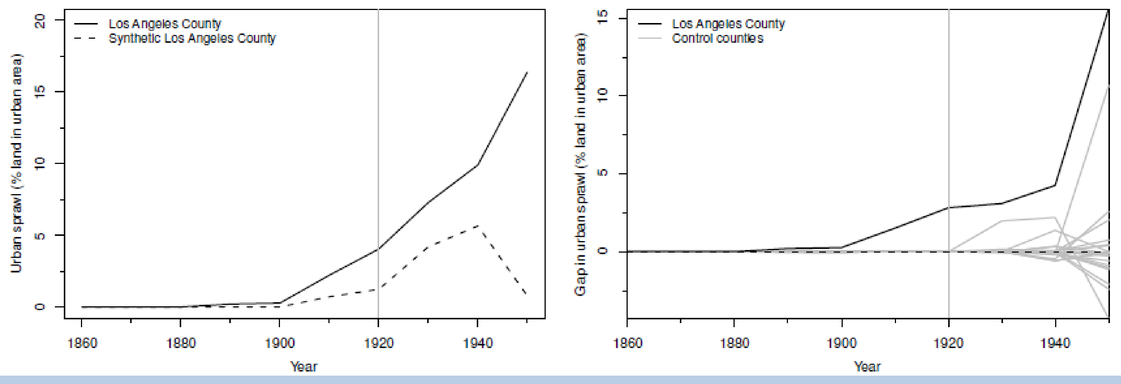


Figure 4: Synthetic control results for urban sprawl.



Robustness Checks

Figure 4: SDID analysis of economic growth and urban sprawl.

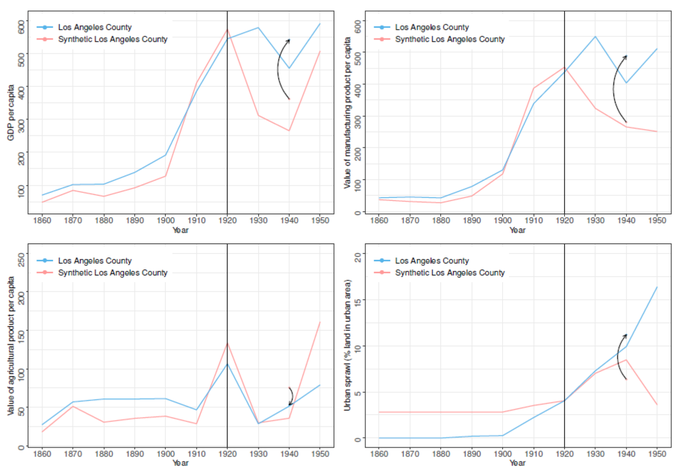
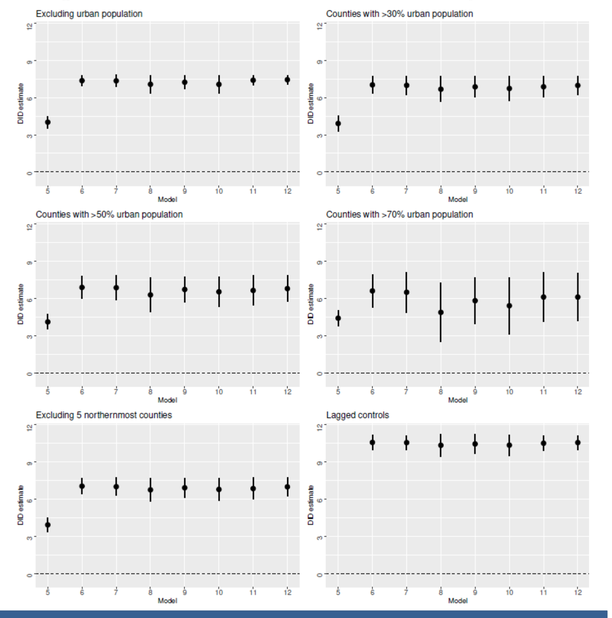


Figure 5: DID robustness checks for urban sprawl.



Discussion

- Strong evidence of **a positive and significant** treatment effect on LA County's GDP per capita and its value of manufacturing product per capita.
- Average effect: +$157 in manufacturing product per capita
  - 55$ in agricultural product per capita
  7.65% increase in urban sprawl
- Weak evidence for a negative and significant effect on agricultural product per capita: rezoning of planned agricultural land to urban area, given the property owners' interest.
- Urban Sprawl: Increase seems to have started before treatment period. Reasons?
  - Acquisition of agricultural lands started from 1905.
  - Completion of aqueduct in 1913.
- **Robustness Checks**
  - Synthetic Difference-in-Differences
  - Event Study: Parallel Trend Assumption
- Sensitivity analysis for Urban Sprawl.

Conclusions

- Literature has shown the impact of water transfers on the economy and the environment of importing region: *We analyze the opposite relationship. We show the impact of procuring resources on the economic growth and urban sprawl.*
- Under the current climate induced water scarcity scenario; further research indispensable to inform efficient water transfers and must include environmental stressors.

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