The Buck Stops Where? Federalism and Investment in Public Utilities: Evidence from the Brazilian Water and Sanitation Sector

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Motivation

<table>
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<th>Electricity</th>
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**Figure:** Government Public Goods Provider by Country
Motivation and Question

• Government provision of public goods is a first-order concern for economic and general well-being

• Multiple levels of government commonly share responsibility for provision of these goods

• This paper considers what types of inefficiencies overlapping responsibilities for government service provision may introduce
Identification

- Look at the Brazilian water and sanitation (WS) sector:
  - Overlapping legal and organizational structure
    - Self-run vs state-run WS service in municipalities
    - Congressional reform in 2005 to clarify government’s role in the sector

- Can estimate effect of legal reform on investment decisions by WS companies
Preview of Results

- Post-legislation, self-run municipal WS companies:
  - Almost doubled total investment from pre-reform levels
  - Increased investment funded by Loans and Debt and Self Financing
  - Increased investment in all aspects of network

- 2 years later, significant increase in water and sewer access
  - Increased number of connections & network length

- Associated with access, significant decrease in child mortality
  - ≈24% decrease in annual deaths from pre-reform levels
Institutional Context

• 1960’s: Municipal provision of WS services

• 1971: National Sanitation Plan (PLANASA)
  ▶ Created 25 state-wide companies (CESBs)
  ▶ Approximately 70% of municipalities contracted with CESBs
    ▶ Self-run municipalities were (on average) richer, more developed, & more politically autonomous (Rezende; 2005), (Castro & Heller; 2004)
Municipality by WS Provider Type

WS Service Provider Type
- Municipality Company
- State Company
- No Observations
Institutional Context

- Unclear legal arrangement between states and municipalities
  - 1988 Brazilian Constitution, Article 30: municipality as the holder of operational authority over all public services “of the local interest”
  - National Association of Municipal Sanitation (ASSEMAE)
    - Lobby group for ≈2000 municipality-run WS companies
  - 1990s: Attempted state takeover by Bahia & Rio de Janeiro
Institutional Context

- Congressional bill in 2005 to reform WS sector:
  - Control to municipalities → “residual rights of control”
  - Eliminated takeover threat by state WS companies
  - Passed Congress in January 2007 at National Water Law 11.447
Intuition

- How does legal reform affect public utilities’ investment?

  - Observations:
    - More well-off municipalities created self-run companies
    - Attractive for state-run company takeover
    - If taken over, resources could be expropriated to other municipalities

- **Main result**: Reform that reduces takeover risk should increase investment in public utilities
Empirical Strategy

- Proposal and the subsequent passage of 2005 Bill:
  - Clarified roles of different levels of gov’t in the WS sector
  - Eliminated takeover threat by state-run companies

- Use in Diff-in-Diff framework:
  - Compare investment levels across municipalities:
    - Self-run (treatment) vs state-run (control)
  - Investment level before and after legal reform
Data

- Main data source: Ministry of cities

- Annual panel dataset of Brazilian WS sector
  - Data disaggregated at the municipality level
  - Period of study: 2001-2012
  - Seven types of network investment categories
    - 1 total, 3 sources, 3 destinations
Estimating Equation

\[ y_{mt} = \alpha + \gamma_m + \lambda_t + \delta \text{Reform}_{mt} + \beta \mathbf{X}_{mt} + \theta \text{InitialInvest}_m \times \text{timetrend} + \varepsilon_{mt} \]

- For municipality \( m \) in year \( t \), where:
  - \( y_{mt} \) are the 7 investment categories
  - \( \text{Reform}_{mt} = 1 \) after 2005 for municipality \( m \) with self-run company
  - \( \gamma_m \) and \( \lambda_t \) are municipality and year fixed effects
  - \( \mathbf{X}_{mt} \) is a vector of control variables (population, public finances, etc.)
  - \( \varepsilon_{mt} \) are robust SEs clustered at the WS company level
Results - Total Investment

![Graph showing total investment over years for Municipal-Run Company and State-Run Company. The graph indicates a steady increase in investment for both companies, with Municipal-Run Company showing a more significant growth rate compared to State-Run Company.]
Results - Investment by Source

Panel A: Investment from Self-Financing

Panel B: Investment from Loans and Debt

Panel C: Investment from Government Grants

- Municipal-Run Company
- State-Run Company
Results - Investment by Destination

Panel A: Investment in Water Network

Panel B: Investment in Sewer Network

Panel C: Other Network Investments

Investment (in 0,000 Reals)

Year

Investment (in 0,000 Reals)

2001 2003 2005 2007 2009 2011

2001 2003 2005 2007 2009 2011

2001 2003 2005 2007 2009 2011

Municipal-Run Company
State-Run Company
## Table: WS Investment

<table>
<thead>
<tr>
<th>Source of Investments</th>
<th>Total Investment</th>
<th>Source of Investments</th>
<th>Destination of Investments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Self-run company, Post-reform</td>
<td>2,856** (1,319)</td>
<td>1,768*** (489.5)</td>
</tr>
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<td>Observations</td>
<td>14,460</td>
<td>14,460</td>
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<td></td>
<td>R-squared</td>
<td>0.817</td>
<td>0.618</td>
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<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td></td>
<td>Municipality FE</td>
<td>Yes</td>
<td>Yes</td>
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<td></td>
<td>Controls</td>
<td>Yes</td>
<td>Yes</td>
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</table>
• Did increased investment lead to better service/access?

• Look at access to system 2 years after reform:
  ▶ Number of system connections
  ▶ Length of system network pipes
### Results

#### Table: WS System Access

<table>
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<tr>
<th></th>
<th>Number of Water Connections - Total</th>
<th>Number of Water Connections - Active</th>
<th>Number of Water Connections - Metered</th>
<th>Number of Households with Water Connection</th>
<th>Water Network Length</th>
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<tbody>
<tr>
<td>Self-run company, 2 years post-reform</td>
<td>2,854** (1,176)</td>
<td>2,243** (1,092)</td>
<td>2,770*** (910.1)</td>
<td>3,114** (1,477)</td>
<td>34.30*** (10.50)</td>
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<td>15,256</td>
<td>15,262</td>
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<td>R-squared</td>
<td>0.986</td>
<td>0.987</td>
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<table>
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<th>Number of Sewer Connections - Total</th>
<th>Number of Sewer Connections - Active</th>
<th>Number of Sewer Connections - Metered</th>
<th>Number of Households with Sewer Connection</th>
<th>Sewer Network Length</th>
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<tr>
<td>Self-run company, 2 years post-reform</td>
<td>4,191*** (1,132)</td>
<td>3,748*** (1,064)</td>
<td>5,206*** (1,527)</td>
<td>4,552*** (1,413)</td>
<td>60.08*** (19.90)</td>
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<td>Observations</td>
<td>15,169</td>
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<td>15,262</td>
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<td>0.990</td>
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Second Stage - Health Outcomes

- Did increased investment (and access) lead to improved welfare?

- Look at mortality across age cohorts
  - Children (< 5 years) likely more affected by access to improved WS
    - Less developed immune systems
    - Less knowledge of avoidance behaviors
  - Older age cohorts should be less affected
### Table: Mortality by Age Cohort

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<th>Less Than 5 Years</th>
<th>5 - 9 Years</th>
<th>10 - 19 Years</th>
<th>20 - 29 Years</th>
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<tr>
<td>Self-run company,</td>
<td>-4.196***</td>
<td>-0.189</td>
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<td>2 years post-reform</td>
<td>(1.615)</td>
<td>(0.142)</td>
<td>(1.124)</td>
<td>(2.182)</td>
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<td>R-squared</td>
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Summary

- Post-legislation, self-run municipal WS companies:
  - Almost doubled total investment from pre-reform levels
  - Increased investment funded by debt and self-financing
  - Significant increases in investment in all aspects of network

- 2 years later, significant increase in water and sewer access
  - Increased number of connections & network length

- Associated with access, significant decrease in child mortality
  - $\approx 24\%$ decrease in annual deaths from pre-reform levels
Policy Implications

- Document new way in which weak institutional environment undermines provision of public services

- Stress the importance of strong legal framework in government provision
  - Alternative method for achieving increases in public investment: strengthening property rights
  - Strong institutional framework could maintain investments from conventional outside sources
Questions & Comments