The Effects of Class Size on Quality of Education in Colombia

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Olga Lucía Bríñez
The Colombian government seek to increase enrollment in public schools by promoting the increase in class sizes of public schools:

What is the effect of the observed increases in public school class sizes on education quality?
Contents

• The Education System in Colombia
• Empirical Strategy
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The Education System in Colombia

- Decentralization: Resources transferred from the national to local levels for them to implement policy mandated by national government

- FECODE: public teacher’s union, very powerful
  - Teachers used to have inertial (rather than merit based) promotions
  - Protest for proposal seeking merit-based promotions

- Scarce resources

- Public and private schools with large variation in quality, on average private schools leading
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The Education System in Colombia: Recent Interventions

• Scarcity of resources + need to increase coverage → Increase coverage by reallocating teachers among schools (Art. 37, law 715/2001): from regions with high density of teachers (small class sizes) to others with low density of teachers (large class sizes)

The Education System in Colombia: Recent Interventions

- Requirement to for a public school to offer all preschool, primary and secondary levels of education (Art. 9, law 715/2001): if they do not, they must merge!

- Criteria to relocate teachers are priority over other (quality enhancing) policies, until the locality attains 32 and 22 students per teacher in urban and rural areas respectively (Art. 11, Decree 3020/2002)
The Education System in Colombia: Effect of “Merging” Policy on Class Size

Schools Distribution by Class Size and Year:

Not Merged Schools
The Education System in Colombia: Effect of “Merging” Policy on Class Size

Schools Distribution by Class Size and Year:

Merged Schools
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Secondary Schools Distribution by Class Size and Year:

Not Merged Schools
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Secondary Schools Distribution by Class Size and Year:

Merged Schools

Class Size 2002

Class Size 2005
• Slight increase in coverage (5%): larger in public than private

• Households survey underestimates coverage
Evolution of Enrollment Rates in Colombia

Primary Education

- Stable enrollment (slight increase: 1%)
- Higher Increase in public, moderate in private
Evolution of Enrollment Rates in Colombia

Secondary Education (1-4)

Enrollment Rate


Gross

Net
Evolution of Enrollment Rates in Colombia

Secondary:

- Important increase in enrollment (13%)
- Increase in public (25%), fall in private (10%)
- Increase in enrollment (15%)
- Increase in public (60%), stable in private

Evolution of Enrollment Rates in Colombia

Higher Education

Gross
Net

Enrollment Rate

0.3
0.2
0.1

Policies seem to have increased public enrollment (mostly secondary and higher education!), as private enrollment stayed steady!

Who are the most likely new beneficiaries of public education?
Maintaining current enrollment rates is costly!

Public Expenditure in Primary and Secondary Education, 2001

<table>
<thead>
<tr>
<th>Country</th>
<th>% of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>3.6</td>
</tr>
<tr>
<td>Brazil</td>
<td>3.0</td>
</tr>
<tr>
<td>Chile</td>
<td>3.4</td>
</tr>
<tr>
<td>Colombia (2001)</td>
<td>4.3</td>
</tr>
<tr>
<td>Colombia (2006)</td>
<td>5.1</td>
</tr>
<tr>
<td>India (2001)</td>
<td>3.1</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1.0</td>
</tr>
<tr>
<td>Israel</td>
<td>4.7</td>
</tr>
<tr>
<td>Jamaica</td>
<td>4.8</td>
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<tr>
<td>Jordan</td>
<td>4.3</td>
</tr>
<tr>
<td>Malaysia</td>
<td>4.9</td>
</tr>
<tr>
<td>Paraguay</td>
<td>3.7</td>
</tr>
<tr>
<td>Peru</td>
<td>2.0</td>
</tr>
<tr>
<td>Philippines</td>
<td>2.7</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>1.8</td>
</tr>
<tr>
<td>Thailand</td>
<td>2.7</td>
</tr>
<tr>
<td>Tunisia</td>
<td>5.3</td>
</tr>
<tr>
<td>Uruguay</td>
<td>2.2</td>
</tr>
<tr>
<td>Zimbabwe (2001)</td>
<td>2.5</td>
</tr>
<tr>
<td>Zimbabwe (2006)</td>
<td>5.6</td>
</tr>
</tbody>
</table>
Distribution of ICFES Scores

The graph shows the distribution of ICFES scores for different years and types of schools. The x-axis represents the score range from 0 to 100, while the y-axis represents the density of scores. The lines indicate the distribution for Pub 2001, Pub 2004, Priv 2001, and Priv 2004.
⇒ Math scores: public education worsened relative to private between 2001 and 2005, but more between 2001 and 2004!
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Empirical Strategy

We specify a standard education production function:

\[ ICFES_{jt} = X_{jt} \beta + \theta \cdot CS_{jt} + \sum \alpha_j D_j + e_{jt} \] (1)

*ICFES* _jt_: Mean (medians) total (math) score of individuals of school _j_ at _t_ (2002, 2005)

*X*_ _jt_: Mean (medians) characteristics of individuals and school variables of school _j_ at _t_

*CS* _jt_: Class Size of school _j_ at _t_

*D*_ _j_: School fixed effects
Empirical Strategy

An estimate the differenced equation:

$$\Delta ICFES_j = \Delta X_j \beta + \theta \cdot \Delta CS_j + \Delta e_j$$

(2)

$\Delta ICFES_{jt}$: change in Mean (medians) total (math) score of individuals of school $j$ between 2002 and 2005

$\Delta X_{jt}$: change in mean (medians) characteristics of individuals and school variables of school $j$ between 2002 and 2005

$\Delta CS_{jt}$: change in Class Size of school $j$ between 2002 and 2005
Empirical Strategy

$\Delta CS$ id endogenous:

$\Rightarrow$ Change in $CS$ is exogenous at the moment of implementing the policy, $\Delta CS$ already includes information of 2005, and people (teachers/students) might have endogenously responded to the policy (for example, by changing schools, etc.)
Empirical Strategy

⇒ Since $\Delta CS$ is exogenous at the moment of implementing the policy, we exploit the fact that once schools (say two schools) are merged in 2002, the merged school with the lower mean (median) class size, will very likely end up increasing it in the very short run, as the merged institution will very likely optimize under equity criteria. That is, we consider it would be (politically and ethically) very difficult to keep important class size differences within a merged school.
Empirical Strategy

Since $\Delta CS$ is exogenous at the moment of implementing the policy, we construct the following variables:

$\text{Increment}_{02} = 1$ if $CS_{02}$ after merged $> CS_{02}$ before merged

$= 0$ otherwise

$\Delta CS_{02} = (CS \text{ right after merged} - CS \text{ right before merged})$

if $CS_{02}$ after merged $> CS_{02}$ before merged

$= 0$ otherwise

And use each of them as instrument in:

$$\Delta CS_j = \Delta X_j \beta + \gamma \cdot IV_{j02} + u_j$$

(3)

$IV_{j02}$: Instrumental variable
Empirical Strategy

- We cannot (in general) estimate (3) with the whole sample, as merged schools are not randomly selected (although for secondary schools their CS were very similar).

- We can estimate (3) for the sample of merged schools. Implicit assumptions:
  - Variation in class size can have a significant effect in the period of time analyzed (2-3 years).
  - Changes in class size would affect similarly the merged schools with the smaller CS and the one with the larger CS (if changes would affect more the one with the larger CS, then we would very likely OVERestimate the effect of CS on education quality, as its increase would bring a cost to the former smaller than the benefit the later receives with a similar decrease).
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Data

• ICFES scores: Total, Math

• Schools information: amount paid for tuition (discrete), education levels available in school (preschool, primary, secondary, higher), share of teacher with higher education, share of teacher with postgraduate education

⇒ 1375 school out of nearly 3000 with secondary education in 2002 and 2005

• Students information: mean (median) age, gender, ethnicity
Data

Schools Distribution by Class Size and Year:

Merged and Not Merged
Data

Secondary Schools Distribution by Class Size and Year:
Merged and Not Merged
Secondary Schools Distribution by Class Size and Year:

Merged and Not Merged
Data

Schools Distribution by Class Size 2002
Merged and Not Merged: Total vs. Secondary

- Not Merged
- Sec. Not Merged
- Merged
- Sec. Merged
Data

Schools Distribution by Class Size 2005
Merged and Not Merged: Total vs. Secondary

Relative Frequency

Class Size

Not Merged
Sec. Not Merged
Merged
Sec. Merged
Distribution of Merged Schools by Class Size in 2002
Relative to the Merged School

Class Size in 2002

Relative Frequency

- Smaller CS in 2002
- Larger CS in 2002
Data

Distribution of Merged Schools by Class Size in 2002
Relative to the Merged School

- Smaller CS in 2002
- Larger CS in 2002
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## Results

<table>
<thead>
<tr>
<th></th>
<th>ΔCS₀₂</th>
<th>ΔCS₀₂ Secondary</th>
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<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Math</td>
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<tr>
<td></td>
<td>Median</td>
<td>Mean</td>
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<tr>
<td>CS</td>
<td>-0.00011</td>
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<td>CS1</td>
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<td>CS2</td>
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<tr>
<td>ΔCS₀₂</td>
<td>0.325</td>
<td>0.11</td>
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</tbody>
</table>
Results
Avoiding Measurement Error

⇒ ΔCS secondary instrumented with Increment$_{02}$ of all levels and ΔCS$_{02}$ of all levels (not just secondary)
## Results

### Avoiding Measurement Error

<table>
<thead>
<tr>
<th></th>
<th>$\Delta CS_{02}$ Secondary (CS&lt;100)</th>
<th>$\Delta CS_{02}$ Secondary (CS&lt;200)</th>
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<tr>
<td></td>
<td>Total</td>
<td>Math</td>
</tr>
<tr>
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<td>-0.00011</td>
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<tr>
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<td>-1.34</td>
<td>-1.48</td>
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<tr>
<td>CS1</td>
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<td>0.39</td>
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<td>Increment$_{02}$</td>
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<td>CS2</td>
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<tr>
<td>$\Delta CS_{02}$</td>
<td>3.504</td>
<td>4.45</td>
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</tbody>
</table>
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Conclusiones

• We analyze the effect of increases in class size in Colombia promoted by exogenous policies.

• Although the increase in class size, due to the intervention was expected to affect negatively the quality of education (given the evidence of deterioration of public scores relative to private scores), we did not find robust evidence in favor to this hypothesis.
Gracias!!