Peer Effects in Middle School Students’ Test Scores
with Accounting for Individual Heterogeneity

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Keywords: Test scores, peer effect, unobserved individual heterogeneity

Abstract
We estimate economically significant peer effects in test scores:

- In 8th graders in a typical county school district in U.S. state of Georgia
- Utilize variation in test scores across different subjects within the individual student to account for individual unobserved heterogeneity

Research Question & Context

- **Peer effect (or endogenous social effect) in early education can play crucial role in tracking, education finance issues such as school vouchers, busing and desegregation policies**
- **Peer effects in test scores** can be crucial in policy formulation: Suppose a policy is aimed at improving the test scores of underperforming students within a group. If the scores of these students improve, they raise the average test score of the group and thereby exerts a positive effect on everyone’s test scores in the group, and so on… (multiplier).
- **Peer effects difficult to identify and quantify. Existing approaches are Controlled experiments (expensive) Valid instruments (difficult to find)**
- **Our approach is intuitive and easy to implement**
  - Only requires test score in multiple subjects
  - No prohibitive technical skills required

Social Effects
Why students in a group may behave similarly?

- Students may act similarly because they are influenced by their peers’ behaviors (peer effects with possible social multipliers)
- Students may attain similar outcomes because they are influenced by their peers’ characteristics (exogenous or contextual effects)
- Students in a group may exhibit similar outcomes because they all share the same characteristics (correlated effects)

Obstacles in Identification of Peer Effects
Regression individual test scores on group average test scores and find a positive significant coefficient: not necessarily peer effect

- Correlation between students’ outcomes may arise from self-selection into groups and common unobserved shocks
- Reflection problem (Manski 1993): Simultaneity between individual & peer outcomes may prevent separating some contextual effects – e.g., the influence of peers’ unobserved characteristics – from the peer effect

Data
A typical county school district in the U.S. state of Georgia

There are 4 middle schools in the district

Test scores are available for each school for each of the 4 years: 2006-2009

Group = 8th graders in a certain school in a certain year

16 distinct groups

Strength of data set: test score available for 98.6 percent of the students

Comparing with Existing Literature

- Identification in this model achieved when:
  - Individual is excluded from the peer average
  - There are sufficient number of groups of different sizes
  - The average group size is small relative to number of groups in sample

- Our sample has large group sizes:
  - Excluding the individual from the peer group creates little distinction between the individual’s peer average and the overall group average

- In this kind of a sample:
  - Peer effect of the outcome may not be identified in the presence of average peer characteristics or group fixed effects

Specification

\[ y_{it} = \theta_i + \eta_t + \gamma_{ri} + \beta \sum_{k \in r} + \epsilon_{it} \]

- \( y_{it} \) = score on test \( k \) obtained by student \( i \) of group \( r \)
- \( k \) = math, reading, science, social studies
- \( r \) = \{math, reading, science, social studies\}
- \( \epsilon_{it} \) = individual fixed effect (FE)
- \( \gamma_{ri} \) = group fixed effect
- \( \eta_t \) = other fixed effects (school FE, year FE, test subject FE)
- Individual FE encapsulates observed and unobserved time-invariant individual characteristics
  - Sources of observed and unobserved exogenous effects
  - (peer groups individual specific & invariant across four test scores)

Results

Estimation of Peer Effects

<table>
<thead>
<tr>
<th>Group average test score</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>10,928</td>
<td>10,928</td>
<td>10,928</td>
</tr>
<tr>
<td>Number of students</td>
<td>2732</td>
<td>2732</td>
<td>2732</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-579,785</td>
<td>-575,528</td>
<td>-567,756</td>
</tr>
<tr>
<td>Individual FE</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Group FE</td>
<td>no</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Subject FE</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>School FE</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Year FE</td>
<td>no</td>
<td>yes</td>
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Concluding Remark

Our approach can offer local officials and policy-makers a quick, inexpensive and easy-to-calculate tool to evaluate peer effects in local school districts.