The Effects of Public Prekindergarten for 3-Year-Olds on Early Elementary School Enrollment

Evidence from the DC Centralized Lottery

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The Effects of Public Prekindergarten for 3-year-olds on Early Elementary School Enrollment
Evidence from the DC Centralized Lottery

Breno Braga, Justin B. Doromal, Erica Greenberg, Tomás Monarrez, Leonardo Restrepo, & Rachel Lamb
Motivation

- Universal public Pre-K programs are becoming popular
  - 6 states & DC offer universal public Pre-K
    - Mostly focused on 4-year-olds
  - DC is the exception offering Pre-K for 3-year-olds (Pre-K3)
    - Serves about 69% of District 3-year-old population (NIEER, 2023)
  - Little is known about its effect of Pre-K3 on students
    - This project aims to fill this gap
Motivation

- Declines in K-12 public school enrollment exacerbated during the pandemic
  - More than 1.2 million students drop from public schools
- Enrollment losses are prominent in kindergarten (Goldstein and Parlapiano, 2021)
  - Increase in homeschooling explains part of the decline (Dee 2023)
  - Questions about the quality of these alternative learning environments and resulting financial and operational challenges for school districts
- Can universal public pre-K offer a solution?
Primary Research Questions

• Are school-based Pre-K3 students more likely to:
  • enroll in a public kindergarten program?
  • persist in the public school system?
  • be assigned special education status in kindergarten?
  • switch public schools?
  • be retained in a grade?
Secondary Research Questions

• Do students furthest from opportunity benefit the most from Pre-K3?
  
  • Residents of communities of color and lower-income communities

• Which program models are the most effective?
  
  • Dual language and Montessori
How do we answer these questions?

1. Leverage the DC centralized admissions lottery for public Pre-K3
   - Mimics an RCT for some students

2. Restrict sample to PK-3 applicants whose lottery draw determines a match
   - About 24% of all applicants

3. Compare later outcomes of students with the same probability of a match
DC Public Pre-K
DC Pre-K3

- Academic year schedule & 5 days a week & 6.5 hours per day
- Most programs offer before and after care
- Ongoing professional development and pay parity for teachers
- 14 authorized curricula aligned with DC’s comprehensive Early Learning Standards
- In 2021-22, DC spent $20,442 per child enrolled—the highest in the nation (NIEER, 2023)
DC Pre-K3

- Mixed-delivery system with 3 sectors

1. DCPS
   - Teachers require at least a BA
   - Max class size is 16
   - Undergoing curriculum reforms

2. Public Charter Schools
   - Operators choose their own program and standards

3. CBOs
   - Operators generally follow DCPS standards and use a variety of curricula

- Participate in the My School DC lottery; included in treatment group
- Do not participate in the My School DC lottery; included in control group
My School DC Lottery for Pre-K3

- All 3-year-old DC residents are eligible and about 75% apply (Greenberg, 2021)
  - Applicants rank up to 12 programs
  - Programs can give admission preferences based on several factors, including
    - In-boundary residence (DCPS)
    - Siblings
    - Transfers & children of staff
  - Fill slots using deferred acceptance algorithm
    - Lottery number break ties
  - From 2014-17, about 87% of applicants are matched to a program & 79% enroll
Data
My School DC Lottery data

- All 2014 to 2017 applications to DC public Pre-K3 Programs
  - Students’ unique student identifier and application id
  - Ranked choice, school priority and random lottery draw
  - Gender, Home address, and language of application (Spanish or English)
  - Whether student was matched to a program or waitlisted
DC Public School Enrollment data

- 2014 to 2019 students enrolled in DC public schools – before the pandemic
  - Students’ unique student identifier
  - Grade of enrollment and school
    - PK3 and later grades
  - Special education status
2010 U.S. Census data

- Census block characteristics
  - Median Income
    - Lower income neighborhoods
  - Racial and ethnic composition
    - Communities of color
      - More than 50% of residents are of color
Method
Deferred Acceptance Propensity Score

- Applicants with the same ranked list & priority status → same chance of a match
  - Depends solely on their lottery draw
- Abdulkadiroğlu et al. (Econometrica 2017): estimate the probability of each student obtaining a match ($P_{Score}$)
  - Based on all students' rankings and priority statuses
  - Applicants with the same ranked list & priority status → same chance $P_{Score}$
- Comparing students with the same $P_{Score}$ is as good as random assignment
Estimation Method

- Restrict sample to applicants whose lottery draw could determine a match
  
  \[ 0 < P\text{Score} < 1 \]

- Instrumental Variable to recover TOT
  
  - First Stage
    
    \[ Enroll_i = \alpha \text{Matched}_i + P\text{Score}_i + X_i + e_i \]
  
  - Second Stage
    
    \[ Y_i = \beta \text{Enrolled}_i + P\text{Score}_i + X_i + u_i \]
Comparing All Applicants with the Evaluation Sample

Evaluation sample includes treatment and control groups

<table>
<thead>
<tr>
<th>Applicant Characteristics</th>
<th>All Applicants</th>
<th>Evaluation Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td># Programs Ranked</td>
<td>5.53</td>
<td>6.14</td>
</tr>
<tr>
<td>Spanish Applications</td>
<td>4.5%</td>
<td>5.3%</td>
</tr>
<tr>
<td>Female</td>
<td>49.4%</td>
<td>48.8%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Census Block Average Characteristics</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Median HH Income ($)</td>
<td>81,152</td>
<td>106,938</td>
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<table>
<thead>
<tr>
<th>Education</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>HS or Less</td>
<td>35.5%</td>
<td>24.4%</td>
</tr>
<tr>
<td>Some College &amp; Bachelor</td>
<td>40.4%</td>
<td>40.8%</td>
</tr>
<tr>
<td>Graduate</td>
<td>24.1%</td>
<td>34.8%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race &amp; Ethnicity</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian</td>
<td>2.6%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Black</td>
<td>57.4%</td>
<td>37.1%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>11.0%</td>
<td>13.2%</td>
</tr>
<tr>
<td>Multiracial</td>
<td>3.8%</td>
<td>4.5%</td>
</tr>
<tr>
<td>White</td>
<td>24.4%</td>
<td>40.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PK3 Enrollment</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Public School</td>
<td>78.5%</td>
<td>63.1%</td>
</tr>
</tbody>
</table>

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td># Applicants</td>
<td>19,528</td>
<td>4,683</td>
</tr>
</tbody>
</table>
Primary Outcome Definitions

- **Kindergarten enrollment** in the DC Public system
  - Indicator for whether student is enrolled in kindergarten in a public school in DC

- **Persistence** in the DC Public system
  - Indicator for whether student was enrolled in a school-based PK4 previous year & enrolled in KG in the current year

Available for all Pre-K3 lottery applicants
Secondary Outcome Definitions

- Special Education
  - Indicator for special education status

- Moved to a new DC Public School
  - Indicator for whether student is at a new DC public school in KG in relation to their school previous year

- Retained in kindergarten
  - Indicator for whether KG student was enrolled in KG in a previous year (following OSSE)

Available for Pre-K3 lottery applicants who later enroll in KG in a public school in DC
Results
The Effects of Pre-K3 Enrollment on Kindergarten Outcomes
Pre-K3 increases KG Enrollment and Persistence in DC System

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Kindergarten enrollment in the DC Public system</th>
<th>Persistence in the DC Public system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrolled in a DC Public School PK3 Program</td>
<td>0.185</td>
<td>0.372</td>
</tr>
<tr>
<td></td>
<td>[0.069][***]</td>
<td>[0.068][***]</td>
</tr>
<tr>
<td>Year FE &amp; Covariates</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>DA formula P-score X Year Effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>4,683</td>
<td>4,683</td>
</tr>
<tr>
<td>Dep var mean</td>
<td>0.717</td>
<td>0.644</td>
</tr>
<tr>
<td>Kleibergen-Paap F-statistic</td>
<td>170.4</td>
<td>170.4</td>
</tr>
</tbody>
</table>
## Pre-K3 Decreases School Mobility & Increases KG Special Education

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Kindergarten Special Education</th>
<th>Moved to a New DC Public School</th>
<th>Retained in Grade</th>
<th>Ever Retained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrolled in a DC Public School PK3 Program</td>
<td>0.104 [0.059]*</td>
<td>-0.199 [0.087]**</td>
<td>-0.026 [0.021]</td>
<td>0.04 [0.047]</td>
</tr>
<tr>
<td>Year FE &amp; Covariates</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>DA formula P-score X Year Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Observations</td>
<td>3,360</td>
<td>3,360</td>
<td>3,360</td>
<td>3,360</td>
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<tr>
<td>Dep var mean</td>
<td>0.090</td>
<td>0.234</td>
<td>0.009</td>
<td>0.050</td>
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<tr>
<td>Kleibergen-Paap F-statistic</td>
<td>128.4</td>
<td>128.4</td>
<td>128.4</td>
<td>128.4</td>
</tr>
</tbody>
</table>
Which Groups Benefit the Most from Pre-K3?
Effect of Pre-K3 on Kindergarten Enrollment in the DC Public System
Effect of Pre-K3 on Persistence in the DC Public System

95% Confidence Interval

- All
- Communities of Color
- Communities with Lower Incomes
- Female
- Male
Effect of Pre-K3 on Kindergarten Special Education Status

95% Confidence Interval

- All
- Communities of Color
- Communities with Lower Incomes
- Female
- Male
Do Enrollment Effects Persist after Kindergarten?
Effect of Pre-K3 on Later Enrollment in a DC Public System

Kindergarten enrollment

1st Grade Enrollment

2nd Grade Enrollment

95% Confidence Interval
The Effect of Dual Language Pre-K3 on Kindergarten Outcomes
Pre-K3 Dual Language Enrollment increases Persistence in DC System

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Kindergarten enrollment in the DC Public system</th>
<th>Persistence in the DC Public system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrollment in DC Pre-K3 DLP Program</td>
<td>0.005 [0.049]</td>
<td>0.114 [0.051]**</td>
</tr>
<tr>
<td>Year FE &amp; Covariates</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>DA formula P-score X Year Effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>3,125</td>
<td>3,125</td>
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<tr>
<td>Dep var mean</td>
<td>0.752</td>
<td>0.686</td>
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<tr>
<td>Kleibergen-Paap F-statistic</td>
<td>329.3</td>
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### Pre-K3 Dual Language Enrollment Decreases School Mobility

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Kindergarten Special Education</th>
<th>Moved to a new DC Public School</th>
<th>Retained in grade</th>
<th>Ever retained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrollment in DC Pre-K3 DLP Program</td>
<td>-0.022</td>
<td>-0.251</td>
<td>-0.010</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>[0.032]</td>
<td>[0.043]**</td>
<td>[0.006]*</td>
<td>[0.020]</td>
</tr>
<tr>
<td>Year FE &amp; Covariates</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>DA formula P-score X Year Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>2,350</td>
<td>2,350</td>
<td>2,350</td>
<td>2,350</td>
</tr>
<tr>
<td>Dep var mean</td>
<td>0.085</td>
<td>0.236</td>
<td>0.006</td>
<td>0.042</td>
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<tr>
<td>Kleibergen-Paap F-statistic</td>
<td>391.6</td>
<td>391.6</td>
<td>391.6</td>
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</tr>
</tbody>
</table>
The Effect of Montessori Pre-K3 on Kindergarten Outcomes
No Effect of Pre-K3 Montessori on KG Enrollment & Persistence in DC System

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Kindergarten enrollment in the DC Public system</th>
<th>Persistence in the DC Public system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrollment in DC Pre-K3 Montessori Program</td>
<td>0.003 [0.049]</td>
<td>0.063 [0.050]</td>
</tr>
<tr>
<td>Year FE &amp; Covariates</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>DA formula P-score X Year Effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>2,236</td>
<td>2,236</td>
</tr>
<tr>
<td>Dep var mean</td>
<td>0.726</td>
<td>0.673</td>
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<tr>
<td>Kleibergen-Paap F-statistic</td>
<td>396.9</td>
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# No Effect of Pre-K3 Montessori on Other KG Outcomes

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Kindergarten Special Education</th>
<th>Moved to a new DC Public School</th>
<th>Retained in Grade</th>
<th>Ever Retained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrollment in DC Pre-K3 Montessori Program</td>
<td>0.035</td>
<td>-0.044</td>
<td>-0.006</td>
<td>0.036</td>
</tr>
<tr>
<td></td>
<td>[0.034]</td>
<td>[0.050]</td>
<td>[0.012]</td>
<td>[0.026]</td>
</tr>
<tr>
<td>Year FE &amp; Covariates</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>DA formula P-score X Year Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>1,624</td>
<td>1,624</td>
<td>1,624</td>
<td>1,624</td>
</tr>
<tr>
<td>Dep var mean</td>
<td>0.086</td>
<td>0.246</td>
<td>0.011</td>
<td>0.039</td>
</tr>
<tr>
<td>Kleibergen-Paap F-statistic</td>
<td>373.3</td>
<td>373.3</td>
<td>373.3</td>
<td>373.3</td>
</tr>
</tbody>
</table>
Conclusions
Conclusion

- Students enrolled in a DC public Pre-K3 are more likely to persist in the DC public system
  - The are also less likely to switch schools
- Evidence that persistence effects are stronger for students furthest from opportunity
  - Residents of communities with lower incomes and communities of color
- Dual language Pre-K3 students are more likely to persist in the system & stay in the same school
Are these findings positive, and for whom?

- School mobility increases the risk of poor achievement, behavior problems, and grade retention (Reynolds, Chen, and Herbers, 2009; Schwartz, Stiefel, and Cordes, 2017)

- Early educational stability facilitates secure attachment and the development of foundational academic and social skills (Sandstrom and Huerta, 2013)

- Questions about quality of alternative learning environments outside the public system
  - Homeschooling and private sector

- Financial health of families facing rising costs and school districts grappling with a decline in enrollment
Thank You!

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For more information, see our project homepage
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