Brianna Felegi
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Dear Selection Committee,

I am writing to apply for the opportunity to participate in the Review of Economics and Statistics Fellowship for NBER Summer Institute. I am an assistant professor in the Economics department at Virginia Tech and received my Ph.D. in May 2023 from the University of Notre Dame. I am an applied microeconomist who focuses on labor economics and the economics of education.

My current research agenda includes work both the extent to which policies intended to increase access to schooling alter education outcomes and whether local labor market conditions influence the likelihood to adopting anti-immigration policies. Specifically, as part of the first strand of my work, I examine the indirect effects of private school voucher programs by evaluating changes in school quality and the impacts of these policies on students already attending private schools (this work in progress is attached to this application). I also have work studying the impact of test-optional policies on the racial and socioeconomic diversity of enrolled students at adopting schools, as well as changes in financial aid outcomes. On the latter front, I have work examining how changes in the unemployment rate due to the Great Recession impact the likelihood of sheriff's departments signing agreements with Immigration and Customs Enforcement through 287(g) contracts.

I believe my experiences would align well with the goals of the Review of Economics and Statistics Fellowship as Virginia Tech is often unrepresented at the NBER Summer Institute across all subfields. Furthermore, the number of faculty at Virginia Tech focusing on applied microeconomics in quite limited, so the opportunity to attend the NBER Summer Institute will give me the chance to network and learn from scholars in my field in ways that are impossible at my home institution.

It would be an honor to participate in the Review of Economics and Statistics Fellowship for NBER Summer Institute and I would be grateful for the opportunity to attend either the Economics of Education or Labor Economics sessions. Thank you for your consideration.

Regards,
Brianna Felegi
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Academic Appointments

Virginia Polytechnic Institute and State University — Fall 2023 to Present
- Assistant Professor, Department of Economics
- Affiliate, Center for Future Workplaces and Practices
- Affiliate, Kellogg Center for Philosophy, Politics, and Economics

University of Notre Dame — Fall 2023 to Present
- Affiliate, Center for Research on Educational Opportunity

W.E. Upjohn Institute for Employment Research — Summer 2025
- Summer Economics Fellow

Education

Ph.D. Economics, University of Notre Dame — May 2023
- Dissertation Title – "Essays on the Economics of Education"
- Committee – Daniel Hungerman, Chloe Gibbs, Kasey Buckles, and William Evans

M.A. Economics, University of Notre Dame, — June 2019

B.A. Economics, University of Florida, — May 2018
- Minor - Actuarial Science
- Honors - Summa Cum Laude

Fields of Interest

Applied Microeconomics, Labor Economics, and Economics of Education

Publications

Barrera, Sergio, Brianna Felegi, and Sarina Heron. 2025. "Labor Market Shocks and Immigration Enforcement." *AEA Papers and Proceedings* 115:1-5

Felegi, Brianna. 2025. "Examining Key Impacts of the Test-Optional Movement for Early Adopters." *AEA Papers and Proceedings* 115:1-7

Working Papers (sorted alphabetically)

1. "Can Light-Touch Interventions in High School Impact Education Outcomes?"
2. "Supply-Side Responses in School Choice" with Chandon Adger (revise and resubmit at *American Economic Journal: Economic Policy*)
3. "The Impacts of Removing College Entrance Exams: Evidence from the Test-Optional Movement" (revise and resubmit at *Southern Economic Journal*)
4. "From the Ground Up: Labor Demand and Intergenerational Mobility in the US" with Paul Shaloka

Research in Progress (sorted alphabetically)

1. "Evaluating the Impact of Vouchers on Peer Interactions in Private Schools Using Mixed Methods" with Joseph Waddington
2. "The Free Tuition Laws and Their Impact on Educational Attainment in the 20th Century" with Christopher Monjares
3. "The Non-Labor Impacts of GED Receipt" with Antionette Strotter
4. "The War on Poverty and Higher Education Access: Educational Attainment and Intergenerational Effects of Upward Bound" with Chloe Gibbs and Esra Kose
5. "Understanding the Impacts of First Semester Math Placement on Post Secondary Outcomes" with Sergio Barrera and Susan Sajadi

Research Experience

Research Assistant, University of Notre Dame, Department of Economics
Chloe Gibbs, Fall 2021 through Summer 2022
Kasey Buckles, Spring 2020 through Summer 2021

Presentations

2025 Allied Social Science Association Annual Meeting, Association of Education Finance and Policy Annual Conference, Harvard Kennedy School (scheduled), Southern Economic Association Annual Meeting (scheduled)

2024 Association of Education Finance and Policy Annual Conference, 2024 Society of Government Economists Annual Conference, APPAM Fall Research Conference, Southern Economics Association Annual Meeting

2023 Texas Christian University, Xavier University, Bates College, Montana State University Applied Economics Summer Conference, APPAM Fall Research Conference (presenter x 2, discussant), Commonwealth Finance Workshop (discussant)

2022 Federal Reserve Bank of Chicago, Virginia Polytechnic Institute and State University, Southern Economics Association Annual Meeting, University of Wisconsin-Milwaukee

Trainings

2025 CeMENT Mentoring Workshop for Junior Faculty

2024 AEFP Early Career Mentoring Workshop, AEFP Writing for Federal Policy Impact Workshop, Mentorship Program to Support NSF Grant Proposal Development for MSI Faculty Workshop

2023 APPAM Networking and Mentoring in Economics and Policy

2020 Successfully Navigating Your PhD: A Mentoring Workshop for Third- and Fourth-Year Women and Non-Binary PhD Students

Teaching Experience

Instructor, Virginia Polytechnic Institute and State University, Department of Economics
Labor Economics, Fall 2024
Analysis of Economic Data, Fall 2023

Instructor, University of Notre Dame, Department of Economics
Statistics for Economics Tutorial, Fall 2022
Principles of Microeconomics, Summer 2022

Teaching Assistant, University of Notre Dame, Department of Economics
Graduate Microtheory I, Michèle Müller-Itten, Fall 2019
Principles of Microeconomics, Daniel Hungerman, Spring 2019
Principles of Microeconomics, Ethan Lieber, Fall 2018

Academic Student Services, University of Notre Dame, Tutor
Principles of Microeconomics, Fall 2018 through Fall 2021

Advising (* denotes student outside of current affiliation)

Amaryllis Adey*, Committee Member (2025)
Initial Placement: Postdoctoral Researcher, Department of Etymology, Virginia Tech
Jonathan Gendron, Committee Member (expected completion 2026)
Reza Tavakoli Jaghargh, Co-Adviser (expected completion 2027)
Faezah Najafi, Committee Member (expected completion 2027)
Yuecheng Gong, Committee Member (expected completion 2027)

Awards and Fellowships

Outstanding Faculty in Undergraduate Courses, Virginia Tech, Spring 2024
New Faculty Mentoring Grant, Virginia Tech, Spring 2024

Burns Fellow, Program for Interdisciplinary Educational Research, Spring 2020 to Spring 2023
Dean's Fellow, University of Notre Dame, Fall 2018 to Spring 2023

Service

Referee: *Journal of Human Capital, Research in Higher Education, China Economic Review*

Professional Memberships:

- American Economic Association
- Association for Education Finance and Policy
- Association for Public Policy Analysis and Management
- Southern Economic Association

Service Committees, Virginia Polytechnic Institute and State University, Department of Economics

- Diversity Committee, Fall 2024
- Seminar Coordinator, Fall 2024
- Visibility Committee, Fall 2024, Fall 2023
- Enrollment Committee, Fall 2023

Faculty Advisor, Virginia Polytechnic Institute and State University

- Women in Economics Club, Spring 2024 to Present
- Econ Games Team, Spring 2025 to Present

Graduate Student Committee, University of Notre Dame

- Co-Chair, Fall 2021 to Spring 2022

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Evaluating the Impact of Voucher Programs on Students in Participating Private Schools: A Mixed Methodology Approach

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May 1, 2025

Abstract

Indiana Choice Scholarship Program (ICSP) is one of the largest voucher programs in the United States, yet most of the research evaluating this policy has focused on its impact on either participating students' outcomes or on students remaining in the public school system. This study seeks to evaluate ICSP's impact on students attending voucher-participating private schools using a mixed methodology approach. Using student-level data, this study will evaluate whether the presence of voucher students is associated with changes in test scores and attendance for non-voucher students. This analysis will allow us to understand any potential spillover effects of ICSP on the broader student body within these private schools. Second,

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I Introduction

Private school voucher programs are becoming an increasingly popular policy to increase access to schooling options in the United States. Since their inception in 1991, there has been a large increase in the number of state funded programs and a growth in the share of students eligible to participate. As a result, a large literature examines the impacts of these programs on students using vouchers (Rouse, 1998; Mayer et al., 2002; Howell et al., 2002; Witte et al., 2014; Wolf et al., 2010; Chingos and Peterson, 2015; Abdulkadiroğlu et al., 2018; Waddington and Berends, 2018) and the competitive effects on students remaining in the public school system (Hoxby, 2003; Figlio and Rouse, 2006; Chakrabarti, 2008, 2013; Rouse et al., 2013; Chiang, 2009; Greene and Marsh, 2009; Figlio and Hart, 2014). However, much less attention has been focused on how voucher programs impact private schools and their existing students.[1] It is impossible to assess the total impact of these programs if researchers and policymakers do not consider the effects on this group of students.

In this paper, we evaluate the effect of voucher programs on existing private school students using a mixed methodology approach. Our context centers around the Indiana Choice Scholarship Program (ICSP), which was initially adopted in 2011 and expanded in 2013. The literature on peer effects in education is extensive and has long been theorized in the context of voucher programs (Epple and Romano, 1998). However, this phenomenon has been challenging to study in an applied context both because of the lack of extensive data on incumbent private school students and the joint problems of reflection (Manski, 1993) and selection (Hoxby, 2000). Our study seeks to overcome these issues by leveraging a rich set of student-level longitudinal data in Indiana, which includes the demographic, achievement, and attendance information for voucher and non-voucher students in voucher-participating private schools. To estimate the effects of voucher students on their peers, we use a fixed effects model that relies on plausibly exogenous variation in the proportion of students participating in the ICSP in a school by grade cohort.

We complement the quantitative analysis by incorporating findings from two waves of interviews with principals, teachers, and students in eight voucher-participating private schools across the state. These interviews were initially conducted during the second year of the voucher program in the 2012-13 school year along with a follow up in the same schools during the 2017-18 and 2018-19 school years. The interviews provide important contextual information about changes in private schools after the initial implementation and maturation of the voucher program and help to contextualize some of the findings from the quantitative analysis.

Between the quantitative and qualitative inquiries, this paper addresses the following questions:

[1] Notable exceptions include studies that examine the effects of these policies on private school enrollment, finances, school inputs, and quality (Hungerman and Rinz, 2016; Hungerman et al., 2019; Rinz, 2015; Adger and Felegi, 2023).

- How does the composition of private school classrooms change in terms of race/ethnicity, socioeconomic background, and achievement after new voucher students enter?
- How does the achievement and attendance of existing private school students change after new voucher students enter?
- To what extent are these findings supported by (or different from) the insights of private school teachers and non-voucher students into the classroom dynamics after new voucher students enter?

Taken together, this mixed methods paper has the opportunity to provide rich insight into private school classrooms where voucher-participating students have become commonplace and provide evidence in an understudied area of private school choice in an era of rapid policy expansion. Our paper is structured as follows. In Section II, we provide background on the ICSP and discuss extant literature on peer effects associated with school choice. In Section III we describe both the quantitative and qualitative data and sample used in this study. In Section IV, we discuss the research design for our mixed methods analysis. In Section V, we discuss the results, integrating both quantitative and qualitative findings as appropriate. In Section VI we discuss the implications and limitations of the findings.

II Background

II.A The Indiana Choice Scholarship Program

The Indiana Choice Scholarship Program (ICSP) is currently the one of the most expansive private school choice programs in the United States in terms of student participation (70,095 participants as of the 2023-24 school year), private school participation (357 schools statewide), and eligibility (about 97% of families with children are eligible)[2] (Indiana Department of Education, 2024). Enacted prior to the start of the 2011-12 school year, the ICSP began with a modest scope and student participation. For the first two years of the program, students needed to have been previously enrolled in a public school for at least one year prior to receiving a voucher and attending a private school. As such, nearly all early participants in the ICSP switched from a public to a private school

[2]There are three main types of private school choice programs including tax credit scholarships, education savings accounts, and voucher programs. The Indiana Choice Scholarship Program is the largest single statewide voucher program by enrollment (the collection of voucher programs across Ohio have higher total enrollment) and Indiana has the fifth highest total enrollment of students in private school choice programs across all states. Indiana is also sixth in terms of percentage of educational expenditures spent on private school programs (need citation–see KYPolicy brief for example).

at some point in their educational history. There were also caps on the number of total participants in the first two years, though these thresholds were not met as 3,911 students participated in the first year (2011-12) and 9,139 in the second year (2012-13) (Indiana Department of Education, 2016).

The first expansion of the ICSP prior to the 2013-14 school year eliminated participation caps and expanded eligibility pathways. These pathways include students whose siblings previously participated in the program, kindergarten students, students with special learning needs, and students living in failing school districts, among others (Indiana Department of Education, 2016). As a result, more students who were either previously enrolled in private schools or who enrolled in a private school at the start of their educational history (i.e. kindergarten) began participating in the program. This expansion greatly increased overall participation, with 36,290 students using a voucher statewide by the 2018-19 school year, of whom about 60% had never been previously enrolled in a public school (Indiana Department of Education, 2019).

In addition to students needing to qualify through one of the eligibility pathways, the ICSP is also a means-tested program based on household income. The income eligibility threshold is based on household size and is set as a percentage of the amount to qualify for the Federal Free or Reduced-Price Lunch (FRPL) Program. For the first ten years of the program, students at or below the threshold for FRPL were eligible for a voucher with a value up to 90% of per-pupil state funding attached to students in the school district of their residence, while students at or below 150% of the threshold for FRPL were eligible for a voucher up to 50% of per-pupil state funding for their district of residence (Indiana Department of Education, 2019). For example, in the 2018-19 school year, a family of four with household income up to $46,435 could be eligible for a 90% voucher and a family of four with household income up to $69,653 could be eligible for a 50% voucher.

The actual voucher amount distributed to the private school in which the student enrolled equals the minimum of school tuition and fees or the qualified voucher amount. During the 2018-19 school year, the average voucher amount for students in grades 1-8 was $4,965 for students qualifying for the 90% voucher and $2,923 for those receiving the 50% voucher with about 40 percent of all students receiving a voucher that fully covered tuition and fees at their participating private school (Indiana Department of Education, 2019). At the time, the more expansive inclusion of both low- and modest-income families made the ICSP unique in comparison to other private school choice programs across the country, which typically had lower income thresholds. Given these considerations, Indiana may be a context a context where we might expect to see larger impacts on existing students in private schools in the early years of a voucher program.

Following the COVID-19 pandemic, Indiana joined a recent and growing trend of states enacting or expanding their private school choice program to have universal or near-universal eligibility by

eliminating pathways and/or raising household income thresholds. Currently, 12 states have such expansive programs in operation, with programs in Georgia and Louisiana expected to start in the 2025-26 school year, and legislation pending in several others (e.g., Tennessee, Texas) (Stanford et al., 2024). In Indiana, several changes have taken place to expand the program. First, the 50% voucher threshold was eliminated, making all qualifying families eligible for a 90% voucher. Second, the income threshold was first raised to 300% of the FRPL threshold in the 2021-22 school year and further to 400% of the FRPL threshold in the 2022-23 school year to present. Third, the eligibility pathways were eliminated prior to the 2023-24 school year such that eligible students must simply (1) have legal residence in Indiana and (2) be between ages 5 and 22 as of October 1 of the school year. At present, this means that any school age child living in Indiana whose family earns below 400% of the FRPL threshold ($222,000 for a family of four in the 2023-24 school year) is eligible for a voucher to cover the cost of tuition at a private school of up to 90% of the state per pupil allocation in the district of their residence (an average voucher award of $6,264 as of the 2023-24 school year) (Indiana Department of Education, 2024).

Our inquiry focuses on the first seven years of the ICSP (the 2011-12 through the 2017-18 school years–inclusive of the initial enactment and first expansion) for multiple reasons. First, in the early years of the program, many participating students transitioned from public to private schools, creating greater potential for disruption to existing private school environments. In later years–especially after the most recent expansions–the vast majority of new voucher recipients were already enrolled in private schools (Indiana Department of Education, 2024). Second, Indiana changed its annual assessments starting in the 2018-19 school year and did not conduct any statewide assessments in the 2019-20 school year due to the COVID-19 pandemic. Third, we have complementary qualitative data from a sample of schools at two time points early in the program (2012-13 and 2017-18 school years) that can help to contextualize these findings. Even though the scope of our focus is on the voucher program with more constrained eligibility, we believe these findings will be relevant to any state implementing any new private school choice program–regardless of expansiveness–as private schools will likely face an influx of new students in the early years of the program. We will further discuss the extent to which we can generalize our findings in the conclusion.

II.B Peer Effects and School Choice

More information in this section is forthcoming.

III Data

III.A Indiana Department of Education Data

The quantitative data for this project come from the Indiana Department of Education's (IDOE) student longitudinal data system. We accessed these data through a longstanding data sharing agreement between the IDOE and the Center for Research on Educational Opportunity (CREO) at the University of Notre Dame. The IDOE database contains student-level data with information on the test scores, voucher take-up, and demographics of all students enrolled in a public, private, or charter schools in Indiana. The data span from the 2005-06 through present. However, our study sample only covers the 2011-12 through 2017-18 years to coincide with ICSP's initial implementation and first expansion but prior to the statewide test changing in 2018-19.

We focus on students in voucher-participating private schools that serve any students in grades 3-8. Standardized testing takes place annually in these grades in the subjects of mathematics and English/language arts. In our analyses, we standardized test scores are within year and grade, so that all estimates can be interpreted as standard deviations. Participation in annual testing and data reporting is required by voucher-participating private schools for not only voucher students, but also all non-voucher students in the school as well. These requirements are a contingent part of accepting vouchers and also required in order to remain accredited by the state (Indiana Code §20-32-5-17). Not only are the IDOE data unique because of the robust, comparable data in both public and private schools, but many private schools participated in annual statewide testing prior to the enactment of the voucher program (including most of the state's Catholic schools) for the purposes of accreditation, receiving a state accountability letter grade for marketing purposes, and participation in statewide athletics competitions. As such, for many private schools in our sample, statewide testing was not a concurrent shock as part of participating in the voucher program.

Demographic information in the IDOE data varies depending on whether a student in a private school uses a voucher. For all students, we have information on race, age, date of birth, free or reduced-price lunch status, Section 504 status, zoned school district, and standardized testing accommodations. For non-voucher private school students, we have information on whether they would qualify for a 90% voucher as it is the same cutoff for free or reduced-price lunch eligibility, which is recorded for each student. For students using a voucher, we also have information on their home address, the tuition they are charged, their pathway for qualifying, and the amount they receive. Our final dataset for the quantitative analysis consists of individual-level information on test scores and demographics for students in the third through eighth grades that were previously enrolled in a private school and did not use a voucher.

Table 1 reports the summary statistics of non-voucher and ever-voucher private school students. Only non-voucher private school students are in regression sample. Compared to students that use a voucher, non-voucher private school students are predominantly White (88% versus 66%), are much less likely to qualify for subsidized lunch (2.5% versus 47.4%), and use testing accommodations at lower rates (5% versus 11.4%). Furthermore, non-voucher students outperform ever-voucher students on standardized tests. Non-voucher students, on average, score half a standard deviation above all students in the state, while ever-voucher students perform around 5 percent below the average in Math and 1 percent above the average in English Language Arts. The differences between the two groups of students supports the idea that the ICSP introduced new groups of students into participating schools, suggesting a potential role for peer effects.

III.B Interview Sample and Data

We also use interview data from two waves of semi-structured interviews with principals, teachers, parents, and students conducted in voucher-participating private schools in Indiana. These data were collected by a larger project team at the University of Notre Dame initially during the 2012-13 school year (first wave) with a follow up spanning the 2017-18 and 2018-19 school years (second wave). The 2012-13 year corresponds to the second year after the voucher program implementation and schools were continuing to adjust to increasing enrollments of new students. The 2017-18 and 2018-19 years were well after the program's first expansion and when voucher enrollments reached a steady state of between 35,000 and 40,000 students statewide receiving vouchers annually.

As our inquiry focuses on the peer effects on non-voucher students, the most relevant interview subjects are teachers and non-voucher students. To select teachers, the project team stratified by grade level ensuring that at least one teacher was selected from grades 2-3, 4-5, and 6-8. All teachers were approved by the principal before the project team contacted them directly to volunteer to participate. If a teacher initially declined to participate, a different teacher within the same stratum was randomly chosen. To select students for participation, the project team relied on volunteers, sending home a flyer with students describing the study and seeking the approval of parents to participate. Interested parents and students then directly contacted the project team to schedule an interview. We provided teachers and families with a nominal gift card as remuneration for their participation.

We conducted interviews in nine schools serving students in grades 3-8. Eight of the nine schools were Catholic schools and the other school was Christian-affiliated, which aligned with nearly all voucher-participating schools in the state being religiously affiliated in the early years of the program. The schools were spread across geographic regions, including Fort Wayne, Indianapolis, and South

Bend[3]. Across these nine schools, we conducted interviews with 34 teachers in the first wave. In five of these schools, we also conducted interviews with 10 non-voucher students in the first wave. In the second wave of data, the same eight Catholic schools participated in teacher interviews (27 teachers total, 11 of whom were the same as the first wave). In six of these schools, we also conducted interviews with 13 non-voucher students. The Christian-affiliated school declined to participate in the second wave.

The content of the semi-structured interviews was focused on the implementation, early impacts, and later steady-state of the ICSP. The project team focused on themes such as changes in school culture or academics and aspects of voucher program satisfaction. Most relevant to this study, the interviewers asked teachers in both waves open-ended questions about instructional and curricular changes, changes to classroom dynamics, and impacts on existing students. The interviewers asked non-voucher students open-ended questions about peer interactions, integration of new students, and changes in classroom dynamics.

IV Research Design and Analysis

IV.A Quantitative Empirical Strategy

To estimate the effects of voucher students on their peers we use a fixed effects model that relies on plausibly exogenous variation in the proportion of students participating in ICSP in a school-grade-cohort. Measuring such effects has proven difficult because of both the reflection and selection problems. The reflection problem exists because student and peer outcomes occur simultaneously, making it difficult to distinguish between the effect of a group on an individual and the effect of an individual on a group (Manski, 1993). To overcome this problem, we define peer quality as the proportion of one's peers who use a voucher to attend the private school. Thus, we assume that a child's peers do not cause that child to use a voucher. This assumption is met as voucher eligibility is set by a child's past education and their family's income which cannot be changed by the presence of students that use a voucher.

The selection problem arises because students self-select into schools and peer groups that are similar to them (Hoxby, 2000). In the absence of being able to randomize students into peer groups, the main approach to overcome selection has been to exploit the natural variation in cohort compo-

[3]The schools reflected the broader population of religious private schools in Indiana in terms demographic composition. The project team also considered the number of voucher students enrolled at each school and the proportion of these students in total student enrollment. Catholic schools were much more likely to respond to and agree to participate in interviews.

sition across time within a given school (Bifulco et al., 2011; Carrell et al., 2018; Balestra et al., 2022; Hill et al., 2023; Figlio et al., 2024). We follow this approach and argue that while there is selection into schools, there is year-to-year variation in the proportion of peers using a voucher across cohorts within the same school because of legislated changes in the requirements for the Indiana Choice Scholarship Program. This is precisely the variation that we exploit in order to identify the impact of voucher peers.

Specifically, we estimate the following model:

$$Y_{igst} = \alpha + \beta_1 \frac{\sum_{k \neq i}^{K} Voucher_{kgst}}{n_{gst}} + X_{igst}^{'}\gamma + \lambda_{gs} + \sigma_{gt} + \epsilon_{isgt} \tag{1}$$

where i, g, s and t represent the individual, grade, school and academic year, respectively. Importantly, individuals included in the regression (denoted by i) are students that never use a voucher. Y_{igst} represents the outcome variables of interest - test scores (overall, Math, and English Language Arts). Overall test scores are calculated by taking the average of the standardized Math and English Language Arts (ELA) for each student in each grade. $\frac{\sum_{k}^{K} Voucher_{kgst}}{n_{gst}}$ is the proportion of peers in a school-grade-cohort that use a voucher to attend the private school.[4] We measure exposure to voucher peers as the share of students using a voucher that qualified because they had previously attended a public school. We denote these students as k in the regression. We focus on this group since voucher students that qualified via another track were likely already at the private school and it is unlikely that receiving a voucher (i.e., having the state pay for schooling) would impact non-voucher peers through any discernible mechanism. Students that use a voucher, no matter the track for qualification, are not included in the outcome analysis. X_{igst} is a vector of individual i's characteristics, including race, gender, subsidized lunch, and accommodation status. λ_{gs} and σ_{gt} are school-grade and grade-year fixed effects, respectively. All standard errors allow for arbitrary correlation in errors at the school level.[5]

To assuage concerns over selection into cohorts, Appendix Table A1 examines whether greater exposure to voucher peers is correlated with changes in student characteristics. Specifically, we regress test scores on the full set of fixed effects and controls, excluding voucher peer share, and use the estimated coefficients to predict a test score for each individual in the sample. This measure captures a linear combination of individual characteristics, where the weights are chosen to best predict test scores. As shown in column 1, predicted test scores are either in the opposite direction or uncorrelated with our two measures of exposure to voucher peers. Furthermore, within-school-

[4] We measure peer voucher use at the cohort level as opposed to the classroom level due to potential nonrandom selection of student into classroom within a school and grade.

[5] Appendix Table A2 shows the robustness of our results to the inclusion of controls and weights.

grade variation in voucher peers is uncorrelated with student characteristics including gender, race, subsidized lunch status, accommodation status, dropping out of the sample, changing schools, or missing test scores.

IV.B Qualitative Coding and Analysis

Our approach to coding and analyzing the teacher and non-voucher student interview data focuses on identifying major themes relevant to the changes experienced by existing non-voucher students in private schools resulting from the implementation and later growth of the ICSP. This open, inductive approach is meant to first surface the experiences of teachers and students and then to align these emergent themes with the findings from the quantitative analysis. In essence, the qualitative analyses help us understand the lived experiences of existing private school students and make sense of the quantitative findings (Creswell and Plano Clark, 2018). We will incorporate and discuss in the results below the ways in which the interview findings directly support or run counter to the quantitative findings.

V Results

V.A Main Effects on Non-Voucher Students

We begin by describing the estimated peer effects of the Indiana Choice Scholarship Program on non-voucher existing private school students. The results of our main analysis are reported in Table 2. Each cell of the table represents the coefficient on the proportion of voucher peers for separate regressions. Each column shows the results for an individual outcome of interest. Column (1) presents the results for overall standardized test scores, Column (2) presents the results for standardized Math scores, and Column (3) presents the results for standardized English Language Arts scores.

We find that higher shares of voucher peers in a school-grade cohort is negatively associated with academic performance of existing private school students. Moving from a cohort with no voucher students to a cohort entirely composed of voucher students reduces overall test scores by 27.4 percent of a standard deviation, math test scores by 28.3 percent of a standard deviation and ELA test scores by 20.9 percent of a standard deviation. The marginal effect of adding an additional voucher student to a cohort of 25 hovers around 1 percent of a standard deviation across each of these outcomes of interest.

Given the declines we find in test scores, we next examine differences in student characteristics

that might lead to a reduction in academic performance. Prior work has shown that attendance and discipline both influence academic outcomes of peers (Gottfried, 2011; Lavy and Schlosser, 2011). We, therefore, use attendance and discipline data in the IDOE-CREO database to evaluate differences in attendance and suspensions/expulsions by voucher status. Unfortunately, information on suspensions and expulsions is only available for public school students. Therefore, the comparisons we make in Panel (b) of Figure 1 are across public school students in third through eighth grade that either go on to use a voucher or never use a voucher.

Panel A of Figure 1 plots the distribution of school days attended by voucher status. We find that voucher students miss more days of school than existing private school students, suggesting that our results could be driven by the differences in attendance. Panel B of Figure 1 plots the share of students between third through eighth grade that are suspended or expelled in a given year by eventual voucher status. Specifically, in 2007 only 5 percent of students that eventually left a public school to use a voucher were suspended or expelled. That number increased to 16 percent in 2017. We see an opposite pattern for remaining students. In 2007, 12 percent of remaining public school students in the third through eighth grade were suspended or expelled and that number decreased to around nine percent in 2017. The increasing rate of suspensions/expulsions of eventual voucher students suggests that they may serve as increasingly disruptive peers, potentially explaining the declines in test scores of non-voucher private school students.

(*Future incorporation of qualitative findings will highlight some of the mixed reports from teachers that new voucher students were more disruptive, whereas others reported little to no changes in behavior of kids in the class. This appears to vary by school and will be touched upon further in the school heterogeneity section. Non-voucher students very seldom reported any issues with their new peers being disruptive.*)

Interestingly, we can rule out that our results are driven by changes in class sizes. Table 3 examines the relationship between the share of voucher peers and school-grade characteristics. We do not find a strong association between the share of voucher peers and total number of students in a cohort, suggesting that the declines in the academic achievement of existing private school students are not driven by increasing class sizes. This is reflected as well in the interview data, in that no teachers reported any concerns or issues with class sizes having increased to the degree that it is impacting their instruction. However, we do find that higher shares of voucher peers is associated with lower shares of White students, higher shares of Black students and higher shares of students that qualify for subsidized lunch. These findings align with the characteristics of voucher students themselves, and lead us to further probe variation in these findings by student subgroups.

V.B Heterogeneity by Student Characteristics

We have found consistent evidence that greater exposure to public school voucher peers is associated with declines in test scores. However, these average estimates across all students could differ across various subgroups. Therefore, we disaggregated the results by the following student characteristics: gender, race and prior test performance. We calculated these estimates by introducing interactions of the student characteristics with the $\frac{\sum_k^K Voucher_{kgst}}{n_{gst}}$ variable in Equation 1. Table 4 displays the results of our first heterogeneity analysis by student subgroup for overall test score, math test score, and ELA test score, respectively.

Panel A reports the differences in outcomes for male and female students. We find the effect of voucher peers greatly varies for boys and girls. Column (1) reports that the declines in academic achievement are almost entirely driven by boys, since the estimate on the interaction term for girls is positive, statistically significant and almost equal in magnitude to the overall estimate on the fraction of peers using a voucher. However, the estimate on overall test score hides important differing effects on Math and ELA scores. When examined separately, we find that that increased shares of voucher peers is associated with declines in math test scores, but increases in ELA test scores for females. Previous work shows that female students test scores are especially sensitive to peer groups within classrooms (Lu and Anderson, 2015). Therefore, one potential explanation behind these heterogeneous effects may be how higher shares of voucher students change the composition of students within classrooms. In a future iteration of this work, we will be able to further disentangle this effect by examining the impacts separately for male and female peers.

In Panel B, we examine the differences in outcomes by race. Across all of the columns, the estimate on the interaction term with identifying as non-White is negative and statistically significant. These findings suggest that the decline in academic performance is larger (more negative) for non-White students. Panel C reports the effect on test scores by previous academic performance.[6] Similarly to Panel B, the interaction term for being in the bottom tercile of the test score distribution in the prior year is negative and statistically significant, suggesting the drop in test scores was largest for students who were already performing poorly.

(*Future incorporation of qualitative findings will highlight reports from many teachers that they have needed to increase the amount of differentiation in their instruction and small group activities to address the needs of new voucher students being behind the rest of the class. This might be a potential mechanism through which certain students are receiving either less instructional time in total or less rigorous instructional time. This is especially a concern for students already in private*

[6] Because we only have previous test performance for those in the fourth grade and above, this analysis necessarily drops students in the third grade.

schools who may be behind in that there are now more peers in need of such attention. A handful of non-voucher students have mentioned they have less time with their teacher as well.)

V.C Heterogeneity by Program Timing

The Indiana Choice Scholarship Program was adopted and expanded in two separate academic years (2011-2012 and 2013-2014, respectively) during our sample period. One might then wonder if the different program structures had differential effects on existing private school students. We answer this question by splitting the sample by years before and after the expansion.

Table 5 reports the results by program timing for each outcome variable of interest. Odd columns report the coefficients when estimated using data from 2012 and 2013, while even columns report the coefficients when estimated using data from 2014 onward. We find that the association between the share of voucher peers and academic performance of existing private school students are concentrated in the first two years of ICSP. All coefficients in the years post-expansion are statistically indistinguishable from zero. Furthermore, even if we took the estimated coefficients seriously, they are nearly half the size of estimates in the pre-expansion time period.

One potential explanation for the reduced impact of voucher peers after the program's expansion is the idea that schools are able to adjust over time. As shown in Table 1, the Indiana Choice Scholarship Program brought in a new group of students into participating private schools. It may then be the case that schools had to learn how to best teach in these classrooms that comprised of different students from before.

Additionally, the composition of voucher students changed as the program expanded. Figure 2 plots the test score distribution of voucher students that entered participating private schools before and after the expansion of the Indiana Choice Scholarship Program. We find that voucher students entering participating private schools after the expansion out performed students that entered in the first two years. These results suggests that the type of students using the voucher plays a role in the impact they have on the existing private school students.

(*Future incorporation of qualitative findings will highlight the validity of these quantitative findings by comparing the first and second waves of interview data. There are many more reports from teachers on the "disruption of" and "adjustment to" instructional practices shortly after the onset of the voucher program when schools were still in the process of adjusting as compared to years after the program had been established. One aspect that cannot be ruled out in either the quantitative or qualitative findings is that schools may be doing a better job of "screening out" potentially disruptive students. However, credence should be given to the fact that private schools do mature in how they work with, integrate, and support new students after having more years of experience.*)

V.D Heterogeneity by School Characteristics

We next examine whether the impacts oh voucher peers differs across different school subgroups. To answer this question, we disaggregated the results by the following baseline school characteristics: enrollment of non-White students and FRPL students. We calculated these estimates by introducing interactions of the student characteristics with the $\frac{\sum_k^K Voucher_{kgst}}{n_{gst}}$ variable in Equation 1. In a future iteration of this work, we will expand the heterogeneity analysis to include a variable capturing the dissimilarity between the voucher students and the existing private school students. Table 4 displays the results of our first heterogeneity analysis by student subgroup for overall test score, math test score, and ELA test score, respectively.

Table 6 displays the results of our final heterogeneity analysis by school subgroup. Panel A displays the difference in outcomes for private schools with above- and below-median share of non-White enrollment in the 2011-2012 academic year. For both overall and ELA test scores, the estimate on the interaction term with above-median non-White enrollment is positive and statistically significant, suggesting that while the overall effect is still negative for students in this group of schools, it is reduced by around 50 percent.

Panel B reports the effects on test scores by the school's enrollment of students that qualify for free or reduced price lunch. This specification allows us to capture any differences in the results between private with initially high versus low shares of students with lower socioeconomic status. We find that the estimates on the interaction term with above-median FRPL share is statistically insignificant across all outcome variables of interest. These findings imply that students see similar declines in academic performance with increased shares of voucher peers regardless of whether their school initially had a high share of FRPL students.

(*Future incorporation of qualitative findings will highlight the variation in findings between schools which had previously enrolled students who were more similar to the incoming voucher population vs. those where the voucher population largely differed from the existing population. This was a stark and evident contrast across all interviews, in that general perceptions and reports of negative changes following the onset of the voucher program were concentrated in schools that had less experience serving diverse populations of students (by race/ethnicity, socioeconomic background, and ability).*)

VI Conclusion

In this paper, we show that greater shares of voucher peers within a school-grade cohort are negatively associated with academic performance. We also find that the size of the effect depends both on student characteristics and school attributes. Future iterations of this study will address some

limitations to our initial findings. First, to better integrate the quantitative and qualitative results it is important we confirm our findings hold when focusing on Catholic schools, since those are the only schools that agreed to be interviewed. Second, we can bolster our claim that the assumptions of our empirical strategy are met by including additional checks similar to Bifulco et al. (2011). Third, we will further explore heterogeneity in our results by examining whether subgroups of voucher peers have differential effects on existing private school students. For example, we will examine whether the share of female voucher peers has a differential effect then the share of male voucher peers.

Irrespective of these limitations, the results presented in this study have important policy implications. Specifically, our results show that the adoption and expansion of voucher programs affects the education outcomes of students not participating in the program. Therefore, previous studies the focus solely on students that used the voucher or students that remained in the public schools were unable to assess the total impact of these programs.

References

Abdulkadiroğlu, A., P. A. Pathak, and C. R. Walters (2018). Free to Choose: Can School Choice Reduce Student Achievement? *American Economic Journal: Applied Economics 10*(1), 175–206.

Adger, C. and B. Felegi (2023). Supply-Side Responses in School Choice. Working paper, Available at SSRN 4603968.

Balestra, S., B. Eugster, and H. Liebert (2022). Peers with Special Needs: Effects and Policies. *Review of Economics and Statistics 104*(3), 602–618.

Bifulco, R., J. M. Fletcher, and S. L. Ross (2011). The Effect of Classmate Characteristics on Post-Secondary Outcomes: Evidence from the Add Health. *American Economic Journal: Economic Policy 3*(1), 25–53.

Carrell, S. E., M. Hoekstra, and E. Kuka (2018, November). The Long-Run Effects of Disruptive Peers. *American Economic Review 108*(11), 3377–3415.

Chakrabarti, R. (2008). Can Increasing Private School Participation and Monetary Loss in a Voucher Program Affect Public School Performance? Evidence from Milwaukee. *Journal of Public Economics 92*(5-6), 1371–1393.

Chakrabarti, R. (2013). Vouchers, Public School Response, and the Role of Incentives: Evidence from Florida. *Economic Inquiry 51*(1), 500–526.

Chiang, H. (2009). How Accountability Pressure on Failing Schools Affects Student Achievement. *Journal of Public Economics 93*(9-10), 1045–1057.

Chingos, M. M. and P. E. Peterson (2015). Experimentally Estimated Impacts of School Vouchers on College Enrollment and Degree Attainment. *Journal of Public Economics 122*, 1–12.

Creswell, J. W. and V. L. Plano Clark (2018). *Designing and Conducting Mixed Methods Research (3rd ed.)*. SAGE Publications, Inc., Thousand Oaks, CA.

Epple, D. and R. Romano (1998). Competition between private and public schools, vouchers, and peer-group effects. *American Economic Review 88*(1), 33–62.

Figlio, D., P. Giuliano, R. Marchingiglio, U. Ozek, and P. Sapienza (2024). Diversity in Schools: Immigrants and the Educational Performance of US-born Students. *Review of Economic Studies 91*(2), 972–1006.

Figlio, D. and C. Hart (2014). Competitive Effects of Means-Tested School Vouchers. *American Economic Journal: Applied Economics 6*(1), 133–56.

Figlio, D. N. and C. E. Rouse (2006). Do Accountability and Voucher Threats Improve Low-Performing Schools? *Journal of Public Economics 90*(1-2), 239–255.

Gottfried, M. A. (2011). Absent Peers in Elementary Years: The Negative Classroom Effects of Unexcused Absences on Standardized Testing Outcomes. *Teachers College Record 113*(8), 1597–1632.

Greene, J. P. and R. H. Marsh (2009). The Effect of Milwaukee's Parental Choice Program on Student Achievement in Milwaukee Public Schools. SCDP Comprehensive Longitudinal Evaluation of the Milwaukee Parental Choice Program. Report# 11. Research report, School Choice Demonstration Project.

Hill, D. V., R. P. Hughes, M. A. Lenard, D. D. Liebowitz, and L. C. Page (2023). New Schools and New Classmates: The Disruption and Peer Group Effects of School Reassignment. *Economics of Education Review 92*, 102316.

Howell, W. G., P. J. Wolf, D. E. Campbell, and P. E. Peterson (2002). School Vouchers and Academic Performance: Results from Three Randomized Field Trials. *Journal of Policy Analysis and Management 21*(2), 191–217.

Hoxby, C. M. (2000). Peer Effects in the Classroom: Learning from Gender and Race Variation. Working paper 7867, National Bureau of Economic Research.

Hoxby, C. M. (2003). School Choice and School Competition: Evidence from the United States. In *School Choice and School Competition: Evidence from the United States*.

Hungerman, D. M. and K. Rinz (2016). Where Does Voucher Funding Go? How Large-Scale Subsidy Programs Affect Private-School Revenue, Enrollment, and Prices. *Journal of Public Economics 136*, 62–85.

Hungerman, D. M., K. Rinz, and J. Frymark (2019, 10). Beyond the Classroom: The Implications of School Vouchers for Church Finances. *The Review of Economics and Statistics 101*(4), 588–601.

Indiana Department of Education (2016). Choice Scholarship Program Annual Report, Participation and Payment Data. https://www.in.gov/doe/files/2015-2016-Annual-Report.pdf [Accessed: 2024-11-13].

Indiana Department of Education (2019). Choice Scholarship Program Annual Report, Participation and Payment Data. https://www.in.gov/doe/files/2018-2019-Annual-Report.pdf [Accessed: 2024-11-13].

Indiana Department of Education (2024). Choice Scholarship Program Annual Report, Participation and Payment Data. https://www.in.gov/doe/files/2023-2024-Annual-Choice-Report.pdf [Accessed: 2024-11-13].

Lavy, V. and A. Schlosser (2011, April). Mechanisms and impacts of gender peer effects at school. *American Economic Journal: Applied Economics 3*(2), 1–33.

Lu, F. and M. L. Anderson (2015). Peer Effects in Microenvironments: The Benefits of Homogeneous Classroom Groups. *Journal of Labor Economics 33*(1), 91–122.

Manski, C. F. (1993). Identification of Endogenous Social Effects: The Reflection Problem. *The Review of Economic Studies 60*(3), 531–542.

Mayer, D. P., P. E. Peterson, D. E. Myers, C. C. Tuttle, and W. G. Howell (2002). School Choice in New York City After Three Years: An Evaluation of the School Choice Scholarships Program. Final Report. Research report, Mathematica Policy.

Rinz, K. (2015). Undone by the Market? The Effects of School Vouchers on Educational Inputs. Unpublished Working Paper.

Rouse, C. E. (1998). Private School Vouchers and Student Achievement: An Evaluation of the Milwaukee Parental Choice Program. *The Quarterly Journal of Economics 113*(2), 553–602.

Rouse, C. E., J. Hannaway, D. Goldhaber, and D. Figlio (2013). Feeling the Florida Heat? How Low-Performing Schools Respond to Voucher and Accountability Pressure. *American Economic Journal: Economic Policy 5*(2), 251–81.

Stanford, L., M. Lieberman, and V. A. Ifatusin (2024). Which States Have Private School Choice? https://www.edweek.org/policy-politics/which-states-have-private-school-choice/2024/01 [Accessed: 2024-11-13].

Waddington, R. J. and M. Berends (2018). Impact of the Indiana Choice Scholarship Program: Achievement Effects for Students in Upper Elementary and Middle School. *Journal of Policy Analysis and Management 37*(4), 783–808.

Witte, J. F., P. J. Wolf, J. M. Cowen, D. E. Carlson, and D. J. Fleming (2014). High-Stakes Choice: Achievement and Accountability in the Nation's Oldest Urban Voucher Program. *Educational Evaluation and Policy Analysis 36*(4), 437–456.

Wolf, P., B. Gutmann, M. Puma, B. Kisida, L. Rizzo, N. Eissa, and M. Carr (2010). Evaluation of the DC Opportunity Scholarship Program: Final Report. NCEE 2010-4018. Research report, National Center for Education Evaluation and Regional Assistance.

VII Tables

Table 1: Descriptive Statistics

	Non-Voucher Students		Public School Voucher Students		
	Mean	SD	Mean	SD	**Difference**
Panel A: Demographic Characteristics					
White	0.880	(0.325)	0.477	(0.499)	0.403***
Black	0.016	(0.125)	0.168	(0.374)	-0.152***
Hispanic	0.048	(0.214)	0.264	(0.441)	-0.216***
Female	0.502	(0.500)	0.518	(0.500)	-0.016***
FRPL	0.025	(0.157)	0.638	(0.481)	-0.612***
Has Math Accommodation	0.050	(0.218)	0.122	(0.328)	-0.0719***
Has ELA Accommodation	0.050	(0.218)	0.121	(0.327)	-0.071***
Panel B: Education Outcomes					
Standardized Test Score	0.499	(0.823)	-0.224	(0.829)	0.724***
Standardized Math Score	0.417	(0.833)	-0.290	(0.837)	0.706***
Standardized ELA Score	0.525	(0.003)	-0.120	(0.851)	0.644***

Notes: Data on enrollment and test scores come from the IDOE-CREO database. Rest of Table Notes to follow.

Table 2: Results on Student Achievement

VARIABLES	Std. Test Score	Std. Math Score	Std. ELA Score
	(1)	(2)	(3)
Exposure to Voucher Peers			
Fraction Peers using Voucher	-0.274**	-0.283**	-0.209*
	(0.122)	(0.140)	(0.124)
	[-0.011]	[-0.011]	[-0.008]
Observations	107,619	107,619	107,619

Notes: Data on enrollment and test scores come from the IDOE-CREO database. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All standard errors are clustered at the school level. Each coefficient is the result of a separate estimation. All regressions include grade-year and school-grade fixed effects. Individual controls include gender, race, FRPL status, and accommodation status. Cohort controls include average gender, race, FRPL and size of cohort by school-by-grade-by-year. All regressions are weighted by the inverse number of times a student is observed in the sample. The marginal effect of adding one voucher peer to a class of 25 is shown in brackets, and is defined as the coefficient divided by 25.

Table 3: Results on Cohort Characteristics

	Percent Female	Percent White	Percent Black	Percent Hispanic	Percent FRPL	Percent ELL	Percent Special Education	Percent Section 504	Percent Math Acc.	Percent ELA Acc.	Total Number Students
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Exposure to Public School Voucher Peers											
Fraction Peers using Voucher	-0.006	-0.200***	0.058***	0.045	0.183***	0.018	-0.013	0.004	0.027	0.025	-0.172
	(0.040)	(0.035)	(0.019)	(0.028)	(0.055)	(0.040)	(0.021)	(0.016)	(0.022)	(0.022)	(3.245)
Observations	107,619	107,619	107,619	107,619	107,619	107,619	107,619	107,619	107,619	107,619	107,619
School-Grade FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grade-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weights	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Data on enrollment and test scores come from the IDOE-CREO database. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All standard errors are clustered at the school level. Each coefficient is the result of a separate estimation. All regressions include grade-year and school-grade fixed effects. Individual controls include gender, race, FRPL status, and accommodation status. Cohort controls include average gender, race, FRPL and size of cohort by school-by-grade-by-year. All regressions are weighted by the inverse number of times a student is observed in the sample. The marginal effect of adding one voucher peer to a class of 25 is shown in brackets, and is defined as the coefficient divided by 25.

Table 4: Heterogeneity Effects of Voucher Peers

VARIABLES	(1) Overall Test Score	(2) Math Test Score	(3) ELA Test Score
Panel A: Identifies as Female			
Fraction Peers Using Public School Voucher	-0.617***	0.245	-1.447***
	(0.131)	(0.151)	(0.156)
	[-0.025]	[0.010]	[-0.058]
Interaction with Identifies as Female	0.667***	-1.073***	2.472***
	(0.131)	(0.147)	(0.191)
	[0.027]	[-0.043]	[0.099]
Observations	107,619	107,619	107,619
Panel B: Identifies as non-White			
Fraction Peers using Voucher	-0.002	-0.026	0.040
	(0.129)	(0.147)	(0.128)
	[<-0.001]	[-0.001]	[0.002]
Interaction with Identifies as non-White	-1.515***	-1.495***	-1.324***
	(0.210)	(0.225)	(0.192))
	[-0.061]	[-0.060]	[-0.053]
Observations	107,619	107,619	107,619
Panel C: Prior Test Performance			
Fraction Peers using Voucher	-0.036	-0.048	0.247**
	(0.097)	(0.119)	(0.103)
	[-0.001]	[-0.002]	[0.010]
Interaction with Prior Year's Score in Bottom Tercile	-0.451***	-0.608***	-0.962***
	(0.110)	(0.113)	(0.129)
	[-0.018]	[-0.024]	[-0.038]
Observations	88,036	88,036	88,036

Notes: Tables Notes will go here.

Table 5: Heterogeneity by Program Expansion

VARIABLES	Test Score Pre-Expansion	Test Score Post-Expansion	Math Score Pre-Expansion	Math Score Post-Expansion	ELA Score Pre-Expansion	ELA Score Post-Expansion
	(1)	(2)	(3)	(4)	(5)	(6)
Exposure to Voucher Peers						
Fraction Peers Using Voucher	-0.362**	-0.154	-0.405**	-0.120	-0.272	-0.162
	(0.177)	(0.162)	(0.194)	(0.170)	(0.201)	(0.165)
	[-0.014]	[-0.006]	[-0.016]	[-0.005]	[-0.011]	[-0.006]
Observations	36,181	71,432	36,181	71,432	36,181	71,432

Notes: Data on enrollment and test scores come from the IDOE-CREO database. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All standard errors are clustered at the school level. Each coefficient is the result of a separate estimation. All regressions include grade-year and school-grade fixed effects. Individual controls include gender, race, FRPL status, and accommodation status. Cohort controls include average gender, race, FRPL and size of cohort by school-by-grade-by-year. All regressions are weighted by the inverse number of times a student is observed in the sample. The marginal effect of adding one voucher peer to a class of 25 is shown in brackets, and is defined as the coefficient divided by 25.

Table 6: Heterogeneity by School-Grade Attributes

VARIABLES	Std. Test Score	Std. Math Score	Std. ELA Score
	(1)	(2)	(3)
Panel A: Non-White Enrollment			
Fraction Peers Using Voucher	-0.098	-0.002	-0.194
	(0.216)	(0.233)	(0.212)
Interaction with Above	-0.255	-0.404	-0.027
Median Non-White Enrollment	(0.251)	(0.274)	(0.257)
Panel B: FRPL Student Enrollment			
Fraction Peers Using Voucher	-0.262	-0.270	-0.181
	(0.200)	(0.225)	(0.215)
Interaction with Above	-0.028	-0.032	-0.050
Median FRPL Enrollment	(0.247)	(0.280)	(0.259)
Panel C: Total School-Grade Enrollment			
Fraction Peers Using Voucher	-0.340***	-0.314**	-0.309**
	(0.129)	(0.151)	(0.128)
Interaction with Above	0.348	0.135	0.553
Median Total Enrollment	(0.326)	(0.345)	(0.352)
Panel D: School Identifies as Catholic			
Fraction Peers Using Voucher	-0.225	-0.293	-0.132
	(0.197)	(0.215)	(0.211)
Interaction with School	-0.088	0.004	-0.132
Identifies as Catholic	(0.244)	(0.273)	(0.254)
Panel E: Distance in Achievement Non-Voucher vs. Voucher			
Fraction Peers Using Voucher	-0.759***	-0.733***	-0.632***
	(0.183)	(0.196)	(0.207)
Interaction with Above	0.632***	0.584***	0.552***
Median Difference in Prior Test Score	(0.183)	(0.196)	(0.207)
Observations	106,462	106,462	106,462

Notes: Data on enrollment and test scores come from the IDOE-CREO database. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All standard errors are clustered at the school level. Each coefficient is the result of a separate estimation. All regressions include grade-year and school-grade fixed effects. Individual controls include gender, race, FRPL status, and accommodation status. Cohort controls include average gender, race, FRPL and size of cohort by school-by-grade-by-year. All regressions are weighted by the inverse number of times a student is observed in the sample. The marginal effect of adding one voucher peer to a class of 25 is shown in brackets, and is defined as the coefficient divided by 25.

Table 7: Falsification Test Using Non-Voucher New Students

VARIABLES	Std. Test Score	Std. Math Score	Std. ELA Score
	(1)	(2)	(3)
Fraction Non-Voucher New Students	-0.093	-0.068	-0.103
	(0.114)	(0.136)	(0.111)
	[-0.004]	[-0.003]	[-0.004]
Observations	85,882	85,882	85,882

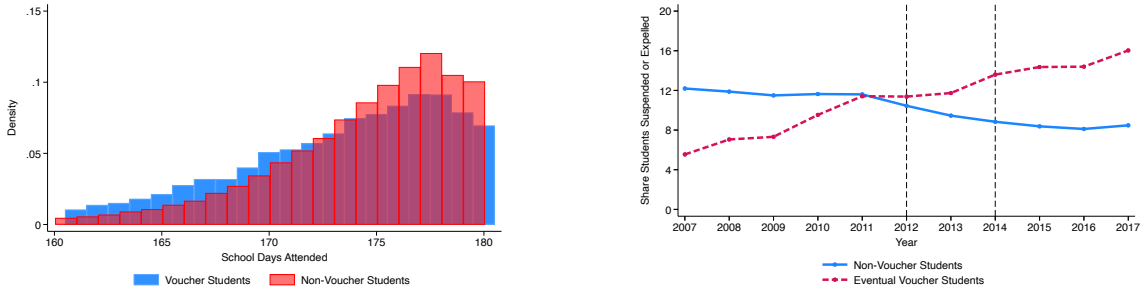
Notes: Data on enrollment and test scores come from the IDOE-CREO database. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All standard errors are clustered at the school level. Each coefficient is the result of a separate estimation. All regressions include grade-year and school-grade fixed effects. Individual controls include gender, race, FRPL status, and accommodation status. Cohort controls include average gender, race, FRPL and size of cohort by school-by-grade-by-year. All regressions are weighted by the inverse number of times a student is observed in the sample. The marginal effect of adding one voucher peer to a class of 25 is shown in brackets, and is defined as the coefficient divided by 25.

VIII Figures

Figure 1: Attendance and Discipline by Voucher Status

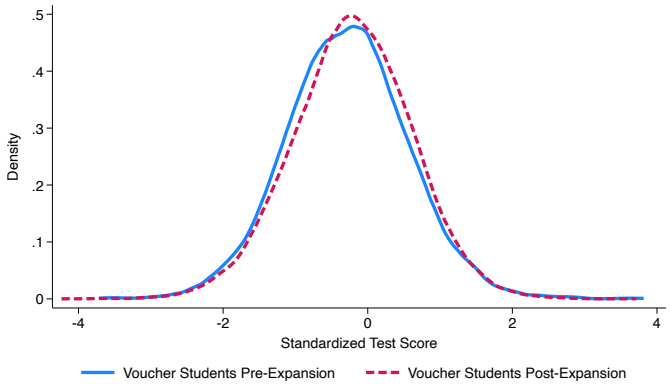
(a) Attendance

(b) Discipline



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Figure 2: Test Score Distribution of Voucher Students by Program Timing



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Table A1: Results on Exogenous Student Characteristics and Attrition

VARIABLES	Predicted Test Score	Female	White	Black	Hispanic	FRPL	Any Accomm.	Drop Sample	Change Schools	Missing Scores
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Exposure to Public School Voucher Peers										
Fraction Peers using Voucher	0.026	0.052	-0.046	0.004	0.035	0.033	0.052	0.078	-0.008	-0.005
	(0.066)	(0.055)	(0.043)	(0.020)	(0.034)	(0.041)	(0.031)	(0.062)	(0.008)	(0.016)
	[0.001]	[0.002]	[0.002]	[0.000]	[0.001]	[0.001]	[0.002]	[0.003]	[0.000]	[0.000]
Observations	107,619	107,619	107,619	107,619	107,619	107,619	107,619	112,383	107,619	113,157

Notes: Data on enrollment and test scores come from the IDOE-CREO database. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All standard errors are clustered at the school level. Each coefficient is the result of a separate estimation. All regressions include grade-year and school-grade fixed effects. Individual controls include gender, race, FRPL status, and accommodation status. Cohort controls include average gender, race, FRPL and size of cohort by school-by-grade-by-year. All regressions are weighted by the inverse number of times a student is observed in the sample. The marginal effect of adding one voucher peer to a class of 25 is shown in brackets, and is defined as the coefficient divided by 25.

Table A2: Stability of Results on Student Achievement

	Overall				Math				ELA			
	No Controls No Weights	Weights Only	Controls Only	Preferred	No Controls No Weights	Weights Only	Controls Only	Preferred	No Controls No Weights	Weights Only	Controls Only	Preferred
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Exposure to Public School Voucher Peers												
Fraction Peers using Voucher	-0.234**	-0.345***	-0.205*	-0.291**	-0.229*	-0.354**	-0.178	-0.287**	-0.193*	-0.271**	-0.187*	-0.237*
	(0.114)	(0.132)	(0.111)	(0.122)	(0.133)	(0.146)	(0.131)	(0.139)	(0.112)	(0.135)	(0.108)	(0.124)
Observations	107,619	107,619	107,619	107,619	107,619	107,619	107,619	107,619	107,619	107,619	107,619	107,619
School-Grade FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grade-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional Controls	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Weights	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Data on enrollment and test scores come from the IDOE-CREO database. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All standard errors are clustered at the school level. Each coefficient is the result of a separate estimation. All regressions include grade-year and school-grade fixed effects. Individual controls include gender, race, FRPL status, and accommodation status. Cohort controls include average gender, race, FRPL and size of cohort by school-by-grade-by-year. All regressions are weighted by the inverse number of times a student is observed in the sample. The marginal effect of adding one voucher peer to a class of 25 is shown in brackets, and is defined as the coefficient divided by 25.