

# Voucher Pathways and Student Achievement in Indiana's Choice Scholarship Program



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*This article examines the pathways that students can follow within the Indiana Choice Scholarship Program and the associations with their math and English language arts achievement in upper elementary and middle school. We analyze student-level longitudinal data by matching voucher and nonvoucher students to estimate the role of participating in the voucher program, taking advantage of the uniqueness of Indiana public and private schools taking the same standardized assessment over time. The different student pathways for using vouchers are related to student achievement with significant achievement losses for students who switch from a public to a private school with a voucher. Students who have always attended a private school, both before and after receiving a voucher, experience no significant changes in achievement.*

**Keywords:** parental choice scholarships, vouchers, student mobility, school effects, fixed effects

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© 2019 Russell Sage Foundation. Austin, Megan, R. Joseph Waddington, and Mark Berends. 2019. "Voucher Pathways and Student Achievement in Indiana's Choice Scholarship Program." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 5(3): 20–40. DOI: 10.7758/RSF.2019.5.3.02. Author order was determined randomly; each contributed equally to this paper. This paper was supported by Notre Dame's Center for Research on Educational Opportunity and Institute of Educational Initiatives, the Spencer Foundation, and the Walton Family Foundation. We are grateful to the Indiana Department of Education for providing access to the state administrative records and for supporting independent analyses. We are also grateful for the substantial feedback we have received from numerous colleagues, including David Agrawal, Bob Bifulco, Jo Blacketer, Kenneth Couch, Josh Cowen, Kenneth Dodge, John Elcesser, Joe Ferrare, Phil Gleason, Joshua Goodman, Doug Harris, Brian Jacob, Helen "Sunny" Ladd, Hank Levin, Maddy Mavrogordato, Andrew Penner, Ann Primus, Macke Raymond, Amy Ellen Schwartz, James Shuls, Erdal Tekin, Genia Toma, Patrick Wolf, Ron Zimmer, three anonymous reviewers, and participants at the Using Administrative Data for Science and Policy conference held in January 2018 at the Russell Sage Foundation headquarters in New York. All opinions expressed in this paper represent those of the authors and not necessarily the institutions with which they are affiliated. All errors in this paper are solely the responsibility of the authors. Direct correspondence to: Megan Austin at [maustin@air.org](mailto:maustin@air.org), 10 S. Riverside Plaza, Suite 600, Chicago, IL 60606.

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One school choice option for families is providing them with scholarships, or vouchers, to give parents the opportunity to send their children to the school of their choice. Using public funds otherwise spent on a student's public school education by the district or state, vouchers are allocated to families who use them to make partial or full tuition payments at private schools. The number of voucher bills that states have passed and the number of states introducing voucher bills increased dramatically in the last few years (Berends 2018). The number of students participating in voucher programs across the nation also increased significantly in the last decade, although the approximately 182,700 students receiving vouchers remains a small fraction of the total number of U.S. students (for a description of ongoing voucher programs, see EdChoice 2018). The Indiana Choice Scholarship Program (ICSP), authorized in 2011, provides vouchers to more than thirty-five thousand of these students—serving more than 20 percent of all voucher students nationwide, but only about 3 percent of the 1,139,822 K–12 students in Indiana (Indiana Department of Education 2018).

As vouchers have become more prominent as a form of school choice, they have been highly contested and debated in educational policy, the media, and research communities. Dating back to studies of the first voucher program in Milwaukee in the 1990s, researchers have used administrative data to evaluate the effects of vouchers on student outcomes, and although these analyses been central to our understanding of voucher effects, findings have been mixed (see Berends, Cannata, and Goldring 2011). Although policymakers expected that evaluation of the Milwaukee program and subsequent voucher programs in other locales would settle disputes about the effects of vouchers on student outcomes, the research findings instead have been nuanced and mixed with some positive, some negative, and some null effects on student academic achievement outcomes (for reviews, see Austin and Berends 2018; Epple, Romano, and Urquiola 2017; Shakeel, Anderson, and Wolf 2016; Zimmer and Bettinger 2015).

The use of Indiana Department of Education

(IDOE) administrative data—in particular, de-identified longitudinal student records linked to the schools students attended—has been central to the evaluation of voucher program effectiveness. Because the administrative data are comprehensive in that they include annual scores on the same accountability test for the population of students in both public and private schools in Indiana, these data allow us to use rigorous nonexperimental methods to assess the impact of the ICSP on student outcomes. Through a data-sharing agreement with IDOE established within a researcher-practitioner partnership, we have access to longitudinal information on students' test scores before and after moving to a new school using a voucher. Recently, we found that students who use an Indiana Choice Scholarship to move from a public to a private school do worse, on average, on math tests in their new private school than they did in their prior public school and about the same on English language arts (ELA) tests (Waddington and Berends 2018).

Administrative data, which include records for the full population of Indiana students, also enable us to evaluate one potential explanation for this negative outcome—the disruption of transitioning to a new school (Grigg 2012; Langenkamp 2010, 2011; Schwartz, Stiefel, and Cordes 2017; Xu, Hannaway, and D'Souza 2009). In addition, because we also collected qualitative interview data from principals, teachers, parents, and students from thirteen private schools in Indiana, we were able to identify the intended and unintended pathways that families took to enter the ICSP program (Austin 2019). Understanding the ICSP pathways other than the initial one where students switched from a public to a private school with a voucher is critical for assessing the ICSP because of the substantial numbers of students who take these additional pathways and the potential for heterogeneous effects of vouchers by pathway.

The administrative data are analyzed in the context of a researcher-practitioner partnership between the University of Notre Dame's Center for Research on Educational Opportunity and IDOE. Spanning several administrations, the partnership's mission is to conduct independent, rigorous research to inform educational

policy and decision making in Indiana (Berends and Austin 2017). Thus, analyses of IDOE administrative records are done in such a way to inform decision making at the state, district, and school levels.

### GROWTH AND EVOLUTION OF THE ICSP

Compared with other statewide programs in Ohio (Figlio and Karbownik 2016) and Louisiana (Abdulkadiroglu, Pathak, and Walters 2018; Mills and Wolf 2017), the Indiana voucher program is unique. First, important changes occurred over time in Indiana's voucher program, opening access to more families. In 2011, when the program began, students needed to attend a public school before using a voucher to attend a private school.<sup>1</sup> In 2013, the criteria for eligibility expanded to include kindergarten students, siblings of voucher students, special education students, and those located in the attendance zones of failing public schools; in addition, no cap was set on the number of eligible Indiana students who can receive a Choice Scholarship. With these additional pathways, in the 2017–2018 school year, 57 percent of students receiving a voucher have never attended a public school (Indiana Department of Education 2018). Moreover, compared with the 3,911 students participating when the voucher program began in 2011–2012, 35,458 students participated in 2017–2018, attending 318 private schools (Indiana Department of Education 2018).

Second, the administrative data on students, teachers, and schools in Indiana allow us to longitudinally track students over time with the same outcomes whether they are attending a public or a private school. Unlike other state administrative data used to analyze the effects of statewide voucher programs that only administer tests to students receiving a voucher (Louisiana, Ohio, and Washington, D.C.), the Indiana data include scores on the same tests for not only voucher students but also other students in public and private schools. Such comprehensiveness enables us to produce more

precise estimates of students' achievement as they move into and out of the ICSP and between public and private schools than would be possible without comprehensive achievement data on the population of Indiana test takers. Our data also differ from the data used in many articles in this issue: because all students are required by law to take the state standardized test, our data are comprehensive. The data also come from a single state agency. As a result, we do not have to merge data from multiple sources or address concerns about selection into the dataset itself.

Third, recent quasi-experimental findings of negative effects on students across voucher programs in Indiana, Ohio, Washington, D.C., and New Orleans have received a great deal of attention. For example, in Indiana, Joseph Waddington and Mark Berends find no change in ELA performance but significant losses in math performance in students' first two years after switching to a private school, which persisted for students through four years of participation in the program (2018). In Ohio, David Figlio and Krzysztof Karbownik find significant negative effects on students' math and reading scores following a move into a voucher school (2016). Atila Abdulkadiroglu, Parag Pathak, and Christopher Walters find significant negative effects on Louisiana students' math and reading performance in their first year after transitioning from a public to a private school in the Louisiana Scholarship Program (2018). Jonathan Mills and Patrick Wolf find that by their second year in a private school, Louisiana voucher recipients no longer had worse outcomes than their public school peers in reading, but that negative effects in math performance persisted (2017).

These studies provided only black-box estimates of the effects of the voucher programs across all students; to better understand these findings, additional research is needed that seeks to identify potential mechanisms and heterogeneous effects for different groups of students. This article takes that next step by

1. An additional pathway by which students could qualify for the voucher program during the 2011–2012 school year was by having previously received a corporate tax-credit scholarship through a scholarship granting organization (SGO). Most students receiving vouchers through the SGO scholarship pathway were previously enrolled in private schools and may not have spent any time in a public school.

disaggregating students according to the pathway by which they came to receive a voucher.

### LITERATURE REVIEW

Most studies of student transitions from public to private voucher schools evaluate overall voucher program effectiveness but do not contextualize students' transitions into a voucher school as a special case of school transitions more generally (Abdulkadiroglu, Pathak, and Walters 2018; Figlio and Karbownik 2016; Mills and Wolf 2017; Waddington and Berends 2018). School choice expands the number and type of schools in which students can choose to enroll. An expanded choice set of schools, along with the financial support provided by school voucher programs, may create incentives to move between schools and potentially increase the prevalence of school transfers as students move into schools that previously were not financially available to them (Lareau and Goyette 2014; Schwartz, Stiefel, and Cordes 2017).

Research on the effects of school transitions on student outcomes often finds that transitioning to a new school is associated with a decrease in student test performance, especially in the short term (Grigg 2012; Langenkamp 2010, 2011; Hanushek, Kain, and Rivkin 2004; Mehana and Reynolds 2004; Schwartz, Stiefel, and Cordes 2017; Xu, Hannaway, and D'Souza 2009). To better isolate the true effect of voucher programs on student outcomes, it is important to consider the school transitions that occur as part of a voucher program within the larger context of transitions between schools. Considering the impact on student achievement of making any school transition provides valuable insight into the potential consequences of transitions that take place in the context of a school voucher program. This study examines the extent to which the changes in student performance attributed to voucher programs in the studies cited may be intertwined with changes related to transitioning between any two schools, independent of voucher receipt.

*Transitions.* Students make transitions between schools for both structural reasons, such as transitioning from elementary to middle school, and nonstructural ones, such as residential moves or academic or social struggles (Benner 2011). Nationally, limited data on stu-

dent transitions show that transitions are most common among elementary school students and least common among high school students: in 2000, NAEP data showed that 35 percent of fourth-grade students, 21 percent of eighth-grade students, and 10 percent of twelfth-grade students had changed schools at least once in the past two years (Anderson 2017; Rumberger 2015). Among the kindergarten cohort of 1998, only 34 percent of students remained in the same school from kindergarten to fifth grade; 42 percent made one change; and 24 percent made two or more changes (Rumberger 2015).

Generally, research has suggested that transitions have a negative effect on student outcomes, especially in the first year following a move (Schwartz, Stiefel, and Cordes 2017). However, "strategic moves" between schools are associated with better outcomes than "reactive moves" (Rumberger 2015; Xu, Hannaway, and D'Souza 2009). It is difficult to disentangle the effects of any transition between schools from the effects of voucher school attendance, given the central role that the transition from public to private school plays in the estimation of voucher program effects (Waddington and Berends 2018). This article provides an initial step in disentangling the influence of these different types of transitions on students' academic achievement.

*Structural and nonstructural transitions at different grade levels.* Research on transitions does not always distinguish between structural and nonstructural transitions; when it does, it tends to focus on structural transitions—from middle school to high school or, to a lesser extent, from elementary school to middle school (Benner 2011; Langenkamp 2009, 2010, 2011; Langenkamp and Carbonaro 2018; Schiller 1999). However, recent causal research using New York City school administrative data that does distinguish between structural and nonstructural transitions finds different patterns by transition type: structural transitions have a significant negative short-term effect on ELA performance and significant negative medium-term effects on both ELA and math performance. In contrast, students who make nonstructural transitions show a significant positive increase in ELA performance (Schwartz, Stiefel, and Cordes 2017).

Some researchers have hypothesized that age at transition is an important factor in how successfully students navigate a transition (Eccles, Lord, and Midgley 1991). For example, for elementary school students, school transitions are associated with lower achievement and a higher likelihood of grade retention (Alexander, Entwisle, and Dauber 1996; Gruman et al. 2008). Some of these associations disappeared once family background characteristics were included, consistent with research showing that students who experience instability in other areas of their lives—family instability, residential moves—both are more likely to make school transitions and may be particularly vulnerable to negative effects of school transitions (Langenkamp 2010, 2011). Other research suggests that transitions during middle school are particularly hard on students (Herbers, Reynolds, and Chen 2013) and are associated with declines in math achievement and grade point average (Anderson 2017). However, other research finds consistent declines in student achievement associated with transitions across grades five through eight (Alspaugh and Harting 1995). The declines across all grade levels were concentrated in the first year following the transition, with student achievement recovering to pre-transition levels by the second year following the transition.

*School culture.* School transitions may lead to decreased performance for interpersonal or academic reasons. Students who transition to a new school must leave relationships with friends and teachers or other school staff and form new friendships and connections. Especially in the case of nonstructural moves, classes in students' new schools often do not align seamlessly with their prior coursework, leaving them ahead or behind their new peers academically (Rumberger 2015). In addition, voucher programs increase the incidence of transitions between school sectors—for example, the ICSP as originally written required that students move from a public school into a private school; other voucher programs similarly target students seeking to leave their public

schools to attend a private school. A transition to a school in a different sector requires students to adapt not only to a new school but also to a new type of school.

Students' ability to successfully adapt to their new schools is shaped by the school culture of both their prior school and the school they enter (Langenkamp 2009; Langenkamp and Carbonaro 2018). The school culture of both schools influences the effect of a transition on academic outcomes (Eccles, Lord, and Midgley 1991). A positive school climate, strong relationships with other students, and higher feelings of bonding with teachers in students' prior school all provide protection against a drop in student outcomes following a school transition—and in some cases are associated with higher performance following a transition.

School culture in the receiving school also influences students' outcomes following a transition (Langenkamp 2009; Langenkamp and Carbonaro 2018). Private schools, of which many in Indiana are Catholic, have a unique school culture that facilitates social bonding (Coleman and Hoffer 1987; Bryk, Lee, and Holland 1993; Hallinan 2006; Hoffer 2009). As a result, transitioning into a private school may influence students' transition experiences differently than transitioning between schools within a sector.

## DATA AND MEASURES

For this study, we used seven years (school years 2009–2010 through 2015–2016) of students' longitudinal demographic and test score records. We obtained these data through a data-sharing agreement with the Indiana Department of Education. Similar to those of Sean Reardon (2019), these records include the full population of students in grades three through eight who attended public (traditional, charter, and magnet) and private schools (including voucher and nonvoucher students) and who participated in the Indiana Statewide Testing for Educational Progress Plus (ISTEP+) program. Testing took place each spring in math and ELA.<sup>2</sup>

One unique feature of these data and of

2. The ISTEP+ is aligned to the Indiana Academic Standards and serves as the main accountability-linked assessment for Indiana students in grades three through eight. It is vertically equated across grades and consists of multiple choice, constructed response, and extended response items scored using item response theory

studying Indiana's voucher program is the sizeable number of private schools that participated in the ISTEP+ testing program and other state reporting (318 schools statewide as of 2018). Participation in statewide testing is required for private schools to participate in the voucher program.<sup>3</sup> However, many private schools, including nearly all K–8 Catholic schools, participated in statewide testing well before the start of the voucher program as part of their accreditation process. All students in voucher-participating private schools took the test, whether they received a voucher or not.

This robust participation in annual statewide testing by private schools results in a comprehensive set of administrative records that provide multiple advantages in analysis of voucher student outcomes. First, the robust data allow us to make apples-to-apples achievement comparisons over time, both between voucher private and nonvoucher public school students and between voucher and nonvoucher private school students. Second, the robust number of participating schools allows for more generalizability of our findings across a broader spectrum of Indiana's private schools. Third, because each student's testing records are longitudinally linked, we can observe changes in an individual student's achievement over time, both before and after receiving a voucher and regardless of school sector. Fourth, the longitudinal linking of student records between public and private schools also allows us

to estimate the impacts of transitioning between schools and sectors. Fifth, we can examine multiple pathways of entry into Indiana's Choice Scholarship Program, including students previously enrolled in private schools.

*Measures.* Students' ISTEP+ test scores in math and ELA are our outcomes of interest. We standardized each student's annual scaled test scores relative to the mean and standard deviation (SD) of students statewide within each subject, grade, and year of testing.<sup>4</sup> The units of our outcomes are SDs from the state average of all test takers within each tested grade.

We also created indicators for the following student-level demographic and background covariates: each student's sex, race-ethnicity, free or reduced-price lunch status, English-language learner (ELL) status, special education status, and grade level. We created an indicator for grade retention from the previous year. We also observed whether a student receives a voucher in each year, enabling us to construct an annual indicator of voucher receipt as well as indicators for the number of years since first receiving a voucher.

Along with voucher recipient status, we also observed the student's school of record within each year. We merged additional school-level data from the Common Core of Data and the Private School Universe Survey to augment and enhance the available school-level data from IDOE.<sup>5</sup> We then created binary indicators of the school type (public, charter, magnet, Catholic,

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methods. Reliability coefficients range from 0.88 to 0.94 in ELA and 0.88 to 0.95 in math (Indiana Department of Education 2011). Annual testing in grades three through eight occurs in math and ELA and less frequently in other subjects such as social studies or science.

3. The Indiana Department of Education holds private schools participating in voucher programs accountable through their performance on the ISTEP+ assessment by restricting their ability to enroll students receiving vouchers should the school have two consecutive years of poor testing performance.

4. Although the ISTEP+ is vertically equated, we do not use untransformed raw scaled scores for our outcome because the variation in scales differs between grade levels. This introduces additional measurement error; however, we adjust for differences between years and across tests by controlling for grade-by-year fixed effects in all models. We standardized scores across all test takers, whether public or private, voucher or nonvoucher.

5. The Common Core of Data (CCD) contains annual demographic and background information for the universe of public schools. Similarly, the biennial Private School Universe Survey (PSS) contains similar information for private schools. We applied CCD data to all public schools for each corresponding year, except 2015–2016, for which we use data from the 2014–2015 CCD. Similarly, we applied PSS data from the most recent prior year to all private schools. Private schools in the IDOE data from 2011–2012 through 2015–2016 contain PSS information from 2011–2012, the last year of publicly available data.

or other private) and manually entered any missing school type information from other IDOE public records and internet searches.

Using annual school records, we created a set of indicators for the types of move a student made into or out of the voucher program across several pathways. These pathways include first receiving a voucher and using it to transition from a public to a private school, first receiving a voucher while enrolled in a private school, first receiving a voucher in a private school and later transitioning to a public school, and first transitioning from a private to a public school (to become eligible to receive a voucher) and transitioning back to a private school with a voucher the subsequent year. These variables serve as the treatment indicators in all analyses.

We also created two student-level mobility indicators to identify any school changes students made. The structural move indicator is for students who change schools between years in the course of normal grade progression. The nonstructural move indicator is for students who switch schools for any other reason (we do not observe the underlying reasons). Both variables indicate a switch only in the year ( $t$ ) immediately after the switch, even though the switch takes place between years  $t-1$  and  $t$ .<sup>6</sup> We then created a set of interactions between each of the mobility indicators and the student's grade level at time ( $t-1$ ), the baseline year before a transition. For voucher students moving from public to private schools, this is the year prior to receiving a voucher. For voucher students moving from private to public schools, this is the final year of receiving a voucher before transitioning to a public school.

### SAMPLE AND ESTIMATION STRATEGY

Our main research questions involve unpacking the academic achievement gains that voucher students make and how the timing of receiving a voucher (which grade level) and the type of pathway alters that relationship. Ideally, we

would randomly assign vouchers for students to attend private schools and then draw comparisons between the treatment and control groups. However, in Indiana, vouchers were not randomly assigned as part of the ICSP. In addition, the numerous pathways through which a student can qualify for a voucher further complicate any research design to understand voucher outcomes in Indiana.

Without random assignment of vouchers or a natural experiment such as a lottery, any assessment of the effects of Indiana's voucher program is subject to selection bias due to the many unobservable factors that may influence whether (and when) a family may choose to apply for a voucher.<sup>7</sup> Thus, we cannot simply compare the achievement of voucher and non-voucher students. However, we can use the IDOE's robust longitudinal administrative dataset, which maximizes sample sizes in each pathway, in conjunction with our estimation approach and the creation of comparison groups to mitigate selection bias. For both the sample construction and estimation strategies, we drew upon important lessons from within-study comparison research that uses nonexperimental approaches to replicate experimental estimates (Bifulco 2012; Cook, Shadish, and Wong 2008; Fortson et al. 2014) and the implementation of those lessons in the nonexperimental evaluation of charter schools (Angrist, Pathak, and Walters 2013; Dobbie and Fryer 2013, 2017) and voucher programs (Waddington and Berends 2018).

We enforced several data restrictions prior to sample construction. These restrictions included requiring each student to have at least three years of test scores, including two years before receiving a voucher (a pre-baseline and baseline year), and thus exclude any voucher students we observed receiving a voucher beginning with their first observation in our data. After these restrictions, we had 9,955 voucher students available for our sample construction

6. The association between mobility and student achievement is negative (Schwartz, Stiefel, and Cordes 2017). These indicators help us parse out the impact of switching schools from any voucher impacts. This is particularly important for the groups of voucher students we investigate who change schools after receiving a voucher.

7. More than 97 percent of families who apply for a voucher for their child receive a voucher. Based on this high take-up rate along with qualitative interviews with parents and schools, we conclude that families apply for a voucher only if they know they are eligible.

approach, which we describe in the following section.

### Voucher Student Sample and Eligibility Pathways

A student must meet several eligibility criteria to qualify for a voucher in Indiana. One universal criterion is based on family income. The voucher income thresholds based on household size directly correspond to the thresholds for free or reduced-price lunch eligibility (Indiana Department of Education 2018).<sup>8</sup> Students in families at or below the income threshold for reduced-lunch eligibility can receive a “full” voucher for up to 90 percent of tuition at a private school. Students in families at or below 150 percent of the income threshold for reduced-lunch eligibility can receive a “half” voucher for up to 50 percent of tuition.

We focus on the results for students who receive full vouchers because we can construct a counterfactual group of nonvoucher recipients consisting of individuals who are voucher eligible by way of receiving free or reduced-price lunch. We refer to this group of voucher students as low income and include students who either receive a full voucher or had received free or reduced-price lunch in the two years prior to receiving a voucher.<sup>9</sup> By focusing on this low-income group of voucher and nonvoucher students, we can reduce issues with selection bias

in our empirical models and avoid introducing additional unobserved variation based on family income that pertains to voucher eligibility.<sup>10</sup>

A second criterion from the initial implementation of the policy required students to have attended a public school (either traditional public, charter, or magnet) for at least one year immediately prior to receiving a voucher. In our cleaned data, 5,219 students moved from a public to a private school for the first time after receiving a voucher.<sup>11</sup> In addition, we observed 199 students who were once enrolled in a private school without a voucher, then left for one year to attend a public school to qualify for a voucher, and then returned to a private school the following year after receiving a voucher. This is a unique group of students who, by our hypothesis, “game the system” to qualify for a voucher. However, this gaming process requires students to make at least two moves between different schools.

After the voucher eligibility criteria expanded beginning in the 2013–2014 school year, additional students became eligible to receive a voucher, including students who had never attended a public school.<sup>12</sup> We observe an additional 4,537 students who were enrolled in a private school without a voucher before receiving a voucher for the first time.<sup>13</sup> For all voucher students, whether previously enrolled in a public school or not, we can establish a baseline

8. Although free or reduced-price lunch status is a rough indicator of students’ family income levels, it is the criterion used in Indiana’s voucher policy, so we also use it in this study.

9. Because income fluctuates, we wanted to account for indications that a family is low income in either the year before receiving a voucher (baseline year) or the year after. We use a similar procedure for public school students.

10. Half voucher students have higher achievement before receiving a voucher and are less diverse demographically and academically. Because we do not have information about family income for nonvoucher recipients, a key voucher qualification criterion, we are unable to produce trustworthy estimates to compare all voucher and nonvoucher students. Further descriptive details for recipients of half voucher recipients are available on request.

11. Some of these students eventually exit a private school after receiving a voucher and return to a public school. We include both students who remain in a private school and those who return to a public school in our analysis.

12. From the start of the voucher program in the 2011–2012 school year, students who had previously received a scholarship from an SGO were also eligible to receive a voucher without having previously attended a public school. For our analysis, we do not distinguish this group of students from non-SGO students previously enrolled in private schools as the schooling context is no different (all SGO and non-SGO voucher qualifying students were previously enrolled in private schools).

13. As with the group of public school students receiving a voucher and attending a private school, some of the previously enrolled voucher students eventually exit a private school after receiving a voucher and attend a public school. We include both groups of students in our analysis.

year based on the year immediately prior to receiving a voucher for the first time.

### Comparison Student Sample

We constructed unique comparison groups for each of the pathways of voucher recipients to estimate the influence of receiving a voucher on student achievement. One important takeaway from the within-study comparison literature in education research and the broader quasi-experimental literature is that treatment and comparison groups should be drawn from the same geographic location and time frame—that is, the same school (Cook, Shadish, and Wong 2008). Therefore, we construct comparison groups for each group of voucher recipients that match students based on several geographic, time, and demographic criteria.

To match voucher and nonvoucher students, we develop matching cells that exactly match students based on being of the same race and sex and in the same grade, year, and school as a voucher student at baseline. For students using a voucher to transition from a public to a private school, we constrain the comparison sample to the group of public school students who never receive a voucher and are in the same matching cell as the voucher student's baseline year.<sup>14</sup> Thus, after baseline, our estimates compare voucher students who are attending a private school with a counterfactual group of peers who remained in a public school.

We use a similar approach for matching voucher students who were initially enrolled in a private school before receiving a voucher. This includes the group of students who initially left a private school without a voucher, always remained enrolled in a private school, or attended a public school for one year and then returned

to a private school after qualifying for and receiving a voucher. Here, we constrain the comparison sample to the group of private school students who never receive a voucher and are in the same matching cell as the voucher student's baseline year.<sup>15</sup> After baseline, we compare voucher students attending a private school with a counterfactual peer group who remained in a private school without a voucher.

Because voucher eligibility is based on family income, we include only low-income public and private comparison students. As described, these students are most likely to be eligible to receive a full voucher. We constrain our comparison sample to nonvoucher students who received free or reduced-price lunch in the baseline or first post-baseline year. This limits the number of nonvoucher comparison students in private schools who would be eligible for a full voucher, given that most low-income students in private schools apply for and receive a voucher once they met all the eligibility criteria.<sup>16</sup> Our estimates comparing students starting in private schools before receiving a voucher with their nonvoucher private school peers therefore have large standard errors.

The exact matching of students based on several criteria helps mitigate selection bias in terms of who does and does not receive a voucher when conducting our estimates. By matching students by school, grade, and year, the voucher and comparison students are compared, beginning at baseline, in the same schooling contexts. Also, matching exactly based on a student's race and sex further accounts for variation in the selection process. For example, if students of a certain race-ethnicity were more likely to participate in the voucher program, we are now comparing them

14. Some public school students have peers who leave to attend a private school with a voucher across several grades and years. To avoid replicating individual students in our sample, we randomly choose which of a given public school student's years serves as the baseline year.

15. Some private school students have peers who later receive a voucher in a private school across several grades and years. To avoid replicating individual students in our sample, we randomly choose which of a given private school student's years serves as the baseline year.

16. Not all students previously enrolled in a private school that are eligible for a voucher based on income meet the other eligibility criteria, which allows us to create a counterfactual group of private school students. The other eligibility criteria, without having spent the previous year in a public school, include being a sibling of a student who is receiving a voucher, receiving a voucher since kindergarten, being classified as a special education student, residing in a public school district with an F state rating, or having received an SGO scholarship.

with their same-race peers who should share the same likelihood of selection into the program based on the observable characteristic of race-ethnicity.

This approach shares characteristics with propensity score matching (Rosenbaum and Rubin 1983). Both approaches rely on the matching of students based on a finite set of observable criteria associated with the selection process. The exact matching process is more precise than propensity score matching; however, the number of matching criteria must be limited when using exact matching to achieve a desirable match rate. We believe that race-ethnicity, sex, and sharing a baseline year, grade, and school are a reasonable set of criteria to mitigate selection bias based on prior studies (see also Angrist, Pathak, and Walters 2013; Dobbie and Fryer 2017). Yet, as with propensity score matching, we are adjusting for key observable differences between voucher and nonvoucher students. Despite having a comparable sample, our estimates of the voucher program's effects remain subject to bias based on any unobservable characteristics that may drive selection into the program through any pathway. We further detail these concerns and our approach to estimation in the following section.

### Estimation Strategy

Our basic empirical models rely on the inclusion of matched cell fixed effects as an approach to mitigate unobserved, between-group confounding influences. We estimated these models for each individual year after treatment, resulting in a total of three individual models to estimate the voucher program associations with student achievement in the first, second, and third year after receiving a voucher. We also estimated separate models for each outcome subject (math and ELA), though the structure of the equation remained the same.

We begin with an ordinary least squares regression model with several covariates as shown in equation (1) for students starting in public schools.

$$\begin{aligned}
 Y_{icgt} = & \alpha + \beta_1 \text{PubtoPriv}_{icgt} + \beta_2 \text{PubtoPrivtoPub}_{icgt} \\
 & + \pi Y_{icg(t=0)} + \omega Y_{icg(t=-1)} + \delta \mathbf{X}_{icg(t=0)} + \theta_g \\
 & + \tau_c + \nu_{icgt}.
 \end{aligned} \tag{1}$$

Here, the achievement level ( $Y$ ) for each student ( $i$ ) in matching cell ( $c$ ) in grade ( $g$ ) and year ( $t$ ) is a function falling into one of three groups of students who received a voucher and attended a private school. This includes students who switch from public to private schools and remain there after receiving a voucher ( $\text{PubtoPriv}_{icgt}$ ), students who switch from public to private schools after receiving a voucher but later return to a public school ( $\text{PubtoPrivtoPub}_{icgt}$ ), and the matched public school comparison peers. We included in our preferred models two measures of a student's prior achievement in the same subject as the outcome, one at baseline ( $Y_{icg(t=0)}$ ) and one pre-baseline ( $Y_{icg(t=-1)}$ ). Because lagged achievement scores are endogenous in the post-baseline years, these controls remain as the baseline and pre-baseline achievement measures for our estimates in the second, and third years post-baseline. By controlling for prior achievement, we are netting out the differences between voucher and nonvoucher student achievement within any one matching cell that may drive selection into receiving a voucher. And, by accounting for baseline and pre-baseline achievement, we are accounting for pre-treatment trends in achievement that may drive selection into receiving a voucher. Thus, the voucher coefficients in this model ( $\beta_1$  and  $\beta_2$ ) represent the within-cell difference between voucher and nonvoucher students in the achievement gain (or loss) from baseline in a given post-baseline year.

If voucher students experienced a substantial drop in student performance, this could be a signal to parents to apply for a voucher, and in the case of students beginning in a public school, to change schools. This phenomenon is known in the job-training literature as Ashenfelter's Dip, and without adjusting for pre-treatment differences in achievement, our results may be biased (Ashenfelter 1978). We can test for differing pre-treatment trends between voucher and nonvoucher students by incorporating a series of interaction terms between the voucher student indicators and the prior achievement variables. If these estimates are not statistically significant, we should not be concerned about pre-treatment trends driving our estimated outcomes.

We also controlled for baseline student char-

acteristics ( $X_{icg(t=0)}$ ) that include ELL and special education status, structural and nonstructural school changes in year ( $t$ ) interacted with grade level ( $g$ ), public school type (magnet or charter versus traditional public), and school locale (suburban or town-rural versus urban). The matched cell fixed effect ( $\tau_c$ ) in the model accounts for unobserved differences between voucher and nonvoucher students within each race-sex-grade-year-public school cell at baseline. These also inherently account for systematic differences in exams across years as students within each cell take exams always within the same calendar year posttreatment. Grade fixed effects ( $\theta_g$ ) account for differences across exams and over time. The term  $\nu_{icgt}$  represents cluster-robust standard errors to account for serial correlation among students within the same baseline cohort (same grade, year, and school) and is used in all models.

Similarly, we estimate equation (2) for students starting in private schools.

$$Y_{icgt} = \alpha + \gamma_1 \text{PrivtoPub}_{icgt} + \gamma_2 \text{AlwaysPriv}_{icgt} + \pi Y_{icg(t=0)} + \delta X_{icg(t=0)} + \theta_g + \tau_c + \nu_{icgt}. \quad (2)$$

This equation is nearly identical to equation (1), but now only includes students who received a voucher while in a private school and later switched to a public school ( $\text{PrivtoPub}_{icgt}$ ), students who received a voucher while in a private school and remained there ( $\text{AlwaysPriv}_{icgt}$ ), and the matched private school comparison peers. The matched cell fixed effect ( $\tau_c$ ) in this model accounts for unobserved differences between voucher and nonvoucher students within each race-sex-grade-year-private school cell at baseline. Thus, in equation (2), the voucher coefficients ( $\gamma_1$  and  $\gamma_2$ ) represent the within-cell

difference in the achievement gain (or loss) from baseline in a given post-baseline year between voucher and nonvoucher student achievement.<sup>17</sup>

For the sample of voucher students starting in private schools, we only control for baseline achievement ( $Y_{icg(t=0)}$ ) and do not include a control for pre-baseline achievement. We do not have a large enough sample of students in private schools with two years of pre-baseline data without a voucher. To ensure the validity of these results, we conducted a robustness check with our public to private voucher sample and found no differences in our results with our preferred model (1) when we remove the control for pre-baseline achievement.

Across all voucher types, most of our estimates are constrained to students in grades five to eight.<sup>18</sup> We estimate varying voucher impacts by type of move (structural-nonstructural) and grade level by including interactions with the voucher pathway indicators in equations (1) and (2).

## RESULTS

Table 1 includes a descriptive comparison of all types of voucher students with their matched nonvoucher public and private school peers at baseline. The numbers of students reported in table 1 represent the matched students. Compared with traditional public school students, a higher proportion of students who switch from a public to a private school with a voucher are Latino/a or ELLs. These students have higher average math and ELA scores than their public school peers the year before receiving a voucher (baseline); they have lower math scores but higher ELA scores in the first year after receiving a voucher.

17. We used a modified version of equation (2) to separately estimate impacts for students who switched from private to public schools and then returned to a private school after qualifying for and receiving a voucher. This allowed us to obtain estimates for the year a student spent in a public school and the years after they returned to a private school with a voucher.

18. This could limit the generalizability of our findings, but we cannot yet estimate the relationship between achievement and students always observed receiving a voucher in our data. Since the Indiana voucher law change in 2013 to open pathways and not require students to previously attend a public school before receiving a voucher, “students always observed receiving a voucher” will appear in the data for the first time in the 2017–2018 school year. For example, first graders receiving a voucher and always attending a private school was only possible starting in the 2013–2014 school year; these students are now fifth graders in the 2017–2018 school year. Likewise, kindergartners in 2013–2014 will be fifth graders in the 2018–2019 school year.

**Table 1.** Descriptive Statistics for Voucher, Public Comparison, and Private Comparison Students

	Public Schools at Baseline				Private Schools at Baseline			
	Public to Voucher	Private with Voucher to Public	Public Comparison	Private with Voucher to Public	Always Private with Voucher	Private to Public to Private with Voucher	Private Comparison	
Students	3,288	686	42,835	126	616	151	326	
Female	0.528	0.522	0.521	0.492	0.502	0.596	0.506	
Black	0.211	0.311	0.244	0.341	0.170	0.080	0.114	
Latino/a	0.264	0.150	0.166	0.119	0.183	0.160	0.199	
Other race-ethnicity	0.074	0.080	0.029	0.032	0.037	0.086	0.012	
Free or reduced-price lunch	0.854	0.864	0.916	0.770	0.784	0.616	0.831	
English language learner	0.169	0.073	0.107	0.103	0.106	0.027	0.086	
Special education	0.081	0.089	0.119	0.087	0.080	0.060	0.040	
Nonstructural move to receive or stop receiving voucher	0.657	0.644	—	0.944	—	1.000	—	
Baseline math score	-0.208	-0.378	-0.322	-0.399	-0.155	-0.168	-0.154	
	[0.880]	[0.825]	[0.921]	[0.959]	[0.888]	[0.815]	[0.802]	
Baseline ELA score	-0.201	-0.325	-0.323	-0.354	-0.009	0.144	0.005	
	[0.876]	[0.876]	[0.905]	[0.922]	[0.950]	[0.854]	[0.787]	
Year 1 post-baseline math	-0.353	-0.538	-0.323	-0.662	-0.135	-0.221	-0.104	
	[0.863]	[0.793]	[0.928]	[0.965]	[0.860]	[0.756]	[0.765]	
Year 1 post-baseline ELA	-0.201	-0.325	-0.311	-0.436	-0.013	0.097	0.041	
	[0.826]	[0.849]	[0.902]	[0.936]	[0.898]	[0.797]	[0.761]	

Source: Authors' compilation based on administrative data provided by the Indiana Department of Education.

Note: Table displays matched students with at least three years of test scores. Proportions reported for demographic characteristics; means and standard deviations [in brackets] reported for test scores in baseline year. For voucher students, this only includes students with at least two years of test scores prior to receiving a voucher for the first time. For public and private school comparison students, only students of the same sex and race/ethnicity in the same grade, school, and baseline year of voucher students are included.

Students who were previously enrolled in private schools without a voucher, received a voucher, and later switched to public schools are somewhat more likely to be African American and less likely to be Latino/a than are students who always attended private schools with or without a voucher. They have lower achievement at baseline and in the first post-baseline year.

Students whose families “game” the system—moving them from a private to a public school (to become eligible for a voucher) and then back to a private school after receiving a voucher—are more likely to be female, less likely to be ELL, and less likely to be black than students who have always attended a private school with a voucher. These private to public to private movers have lower average math but higher ELA achievement than students who always attended a private school at baseline and in the first year after receiving a voucher.

### Regression Model Results

We next describe the change from baseline in a student’s math (table 2) and ELA (table 3) achievement gains after receiving a voucher across the four voucher pathways. Students who made an initial switch into a private school after receiving a voucher experienced an average math achievement loss from baseline of  $-0.146$  SD ( $p \leq .001$ ) the first year after receiving a voucher. This decline in math achievement increases to  $-0.163$  SD ( $p \leq .001$ ) in the second year from baseline and is similar in year three ( $-0.156$  SD,  $p \leq .001$ ).

Meanwhile, students who initially were enrolled in a public school, later received a voucher to attend a private school, and then eventually left to attend a public school experienced greater average losses in math in year one from baseline ( $-0.192$  SD,  $p \leq .001$ ), year two ( $-0.197$  SD,  $p \leq .001$ ), and year three ( $-0.333$  SD,  $p \leq .01$ ). These students’ losses accumulate to one-third of a SD loss in math in year three from baseline before this group of students returned to a public school. We found that students who switched from private (with a voucher) to public schools and students who remained always

enrolled in a private school after receiving a voucher experienced no significant gains or losses from baseline in math.

We observed a different pattern between the groups of voucher students when looking at students’ average ELA achievement gains from baseline. Most of the estimates in table 3 are statistically insignificant and small in magnitude, indicating no average ELA achievement differences from baseline for most of the student groups. Students who initially switched from a public into a private school after receiving a voucher, students who received a voucher while in a private school then switched to a public school, and students who remained always enrolled in a private school after receiving a voucher did not differ in the ELA achievement compared with the comparison groups. Students who switched from a public to a private school with a voucher and then returned to a public school experienced a statistically significant average achievement loss from baseline to year two in ELA ( $-0.130$  SD,  $p \leq .01$ ), which increased in magnitude to  $-0.161$  SD ( $p \leq .05$ ) in year three from baseline.

Beyond the main estimates of receiving a voucher in tables 2 and 3, we disaggregated the findings based on both whether students made structural (versus nonstructural) switches between schools and the year from baseline, as well as the grade level at baseline immediately before students first received a voucher. This set of results helps us better understand the relationship between the type and timing of student mobility and voucher-related achievement changes. Due to small cell sizes for structural movers, these results cannot be estimated for students who made private (with voucher) to public switches.<sup>19</sup>

In math, for students who switched from public to private schools with a voucher, the average achievement loss from baseline was similar one and two years from baseline for students who made nonstructural moves ( $-.152$  SD,  $p \leq .001$  in year 1;  $-0.160$ ,  $p \leq .001$  in year 2) compared to students who made structural moves ( $-0.133$  SD,  $p \leq .001$  in year 1;  $-0.168$ ,  $p \leq .001$  in year 2). However, students who made structural

19. We also report disaggregated results by baseline grade level only for voucher students always enrolled in private schools, as nearly all students do not change schools (that is, make a structural or nonstructural move).

**Table 2.** Changes from Baseline in Student Math Achievement for Voucher Recipients

	Public to Private with Voucher	Public to Private with Voucher to Public	Private with Voucher to Public	Always Private with Voucher
Pre-baseline achievement level	0.101*** (0.017)	-0.017 (0.035)	—	—
Baseline achievement level	0.121*** (0.016)	-0.036 (0.032)	-0.025 (0.232)	0.178** (0.062)
Voucher year 1	-0.146*** (0.012)	-0.192*** (0.026)	0.025 (0.098)	0.015 (0.038)
Voucher year 2	-0.163*** (0.015)	-0.197*** (0.044)	-0.112 (0.232)	-0.018 (0.057)
Voucher year 3	-0.156*** (0.022)	-0.333*** (0.104)	—	-0.086 (0.102)
Voucher year 1*structural	-0.133*** (0.020)	-0.163*** (0.043)	—	—
Voucher year 2*structural	-0.168*** (0.023)	-0.306*** (0.072)	—	—
Voucher Year 3*structural	-0.226*** <sup>(s)</sup> (0.034)	-0.467** (0.182)	—	—
Voucher year 1*nonstructural	-0.152*** (0.014)	-0.208*** (0.032)	—	—
Voucher year 2*nonstructural	-0.160*** (0.020)	-0.151*** (0.054)	—	—
Voucher year 3*nonstructural	-0.108*** <sup>(s)</sup> (0.027)	-0.272* (0.122)	—	—
Voucher year 1*grade four baseline	-0.193*** <sup>(s)</sup> (0.023)	-0.248*** (0.040)	0.115 (0.226)	0.036 (0.074)
Voucher year 1*grade five baseline	-0.132*** <sup>(s)</sup> (0.021)	-0.157*** (0.040)	0.005 (0.140)	-0.171 <sup>(s)</sup> (0.091)
Voucher year 1*grade six baseline	-0.109*** <sup>(s)</sup> (0.024)	-0.130* (0.060)	-0.133 (0.155)	0.095 <sup>(s)</sup> (0.085)
Voucher year 1*grade seven baseline	-0.129*** (0.025)	—	—	0.059 <sup>(s)</sup> (0.063)

Source: Authors' compilation based on administrative data provided by the Indiana Department of Education.

Note: Overall results reported from preferred models 1 and 2. To parse out subgroup effects, we include interactions between mobility indicators or grade indicators, and the voucher indicator. We computed separate models by number of years after receiving a voucher and between students starting in public schools versus private schools. ISTEP+ Math scores measured in standard deviation units, relative to the Indiana statewide mean and standard deviation within each grade and year (across all public and private school test takers). Robust standard errors, adjusted for the clustering of students within schools, are in parentheses. <sup>(s)</sup>Indicates significant differences between subgroups from F-test of estimates ( $p \leq .050$ ). Missing cells indicate fewer than fifteen students or inability to estimate subgroup differences (no structural or nonstructural school transitions for always private voucher students).

\* $p \leq .05$ ; \*\* $p \leq .01$ ; \*\*\* $p \leq .001$

**Table 3.** Changes from Baseline in Student ELA Achievement for Voucher Recipients

	Public to Private with Voucher	Public to Private with Voucher to Public	Private with Voucher to Public	Always Private with Voucher
Pre-baseline achievement level	0.095*** (0.016)	0.009 (0.034)	—	—
Baseline achievement level	0.109*** (0.016)	0.010 (0.035)	-0.086 (0.257)	0.060 (0.062)
Voucher year 1	0.005 (0.011)	-0.026 (0.024)	0.178 (0.135)	0.084 (0.047)
Voucher year 2	-0.011 (0.015)	-0.130** (0.043)	-0.105 (0.265)	0.115 (0.064)
Voucher year 3	0.021 (0.020)	-0.161* (0.081)	—	0.118 (0.102)
Voucher year 1*structural	0.032 (0.020)	-0.018 (0.037)	—	—
Voucher year 2*structural	0.006 (0.023)	-0.038 (0.064)	—	—
Voucher year 3*structural	-0.015 (0.032)	-0.200 (0.137)	—	—
Voucher year 1*nonstructural	-0.008 (0.014)	-0.030 (0.031)	—	—
Voucher year 2*nonstructural	-0.023 (0.020)	-0.170** (0.054)	—	—
Voucher year 3*nonstructural	0.046 (0.026)	-0.143 (0.100)	—	—
Voucher year 1*grade 4 baseline	-0.057**(s) (0.021)	-0.036 (0.036)	0.245 (0.244)	-0.075(s) (0.101)
Voucher year 1*grade 5 baseline	-0.030(s) (0.022)	-0.037 (0.038)	0.419 (0.253)	-0.061(s) (0.105)
Voucher year 1*grade 6 baseline	0.087***(s) (0.023)	0.012 (0.057)	-0.124 (0.275)	0.228**(s) (0.085)
Voucher year 1*grade 7 baseline	0.057*(s) (0.024)	—	—	0.211**(s) (0.079)

Source: Authors' compilation based on administrative data provided by the Indiana Department of Education.

Note: Overall results reported from preferred models 1 and 2. To parse out subgroup effects, we include interactions between mobility indicators or grade indicators, and the voucher indicator. We computed separate models by number of years after receiving a voucher and between students starting in public schools versus private schools. ISTEP+ ELA scores measured in standard deviation units, relative to the Indiana statewide mean and standard deviation within each grade and year (across all public and private school test takers). Robust standard errors, adjusted for the clustering of students within schools, are in parentheses. <sup>(s)</sup>Indicates significant differences between subgroups from F-test of estimates ( $p \leq .05$ ). Missing cells indicate fewer than fifteen students or inability to estimate subgroup differences (for example, no structural/non-structural school transitions for always private voucher students).

\* $p \leq .05$ ; \*\* $p \leq .01$ ; \*\*\* $p \leq .001$

moves experienced even greater math losses three years from baseline ( $-0.226$  SD,  $p \leq .001$ ) than students who made nonstructural moves ( $-0.108$  SD,  $p \leq .001$ ). We tested the statistical significance of the difference between these groups at the 5 percent level using an F-test and denoted any significant differences with an (s) in table 2.

When examining the grade level at which students received a voucher and switched from a public to a private school, we generally found greater math losses in the first post-baseline year for students transitioning at lower than higher grade levels. For example, table 2 shows that students who first received a voucher and switched from a public to a private school immediately following fourth grade experienced an average math loss of  $-0.193$  SD ( $p \leq .001$ ), which was a statistically greater loss than for students who made a similar move immediately following fifth ( $-0.132$  SD,  $p \leq .001$ ) or sixth grade ( $-0.109$  SD,  $p \leq .001$ ). We also see a similar pattern in ELA, whereby students who transition from public to private schools after fourth ( $-0.057$  SD,  $p \leq .01$ ) and fifth grade ( $-0.030$  SD, not significant) have statistically lower ELA achievement in the first year post-baseline than their older peers. Students experienced gains in ELA achievement when transitioning after sixth ( $0.087$  SD,  $p \leq .001$ ) and seventh grade ( $0.057$  SD,  $p \leq .05$ ).

For students who transition from public to private schools and then return to a public school, we did not find statistically different impacts between students who initially make structural moves and their peers who make nonstructural moves. Similarly, we did not observe differences in first-year impacts by the grade level of transition. We also did not observe any grade-level heterogeneity in the first-year impacts of receiving a voucher for students who were initially enrolled in a private school with a voucher before exiting to attend a public school.

We observed meaningful grade-level differences in first-year impacts of receiving a voucher for students who were always enrolled in a private school. Students who received a voucher for the first time in sixth ( $0.095$  SD, not significant) and seventh grade ( $0.059$  SD, not significant) have statistically higher achieve-

ment in math than their peers who received a voucher for the first time after fifth grade ( $-0.171$  SD, not significant). In ELA, we see a similar pattern, whereby students who first received a voucher in later grades experienced a statistically significant achievement gain (after sixth grade,  $0.228$  SD,  $p \leq .01$ ; after seventh grade,  $0.211$  SD,  $p \leq .01$ ) relative to their peers in lower grades who experienced null gains (after fourth grade,  $-0.075$  SD, not significant; after fifth grade,  $-0.061$  SD, not significant).

In a separate set of analyses, displayed in table 4, we examined the relationship between achievement and students who moved from private to public schools and then returned to a private school after receiving a voucher. In their interim year in a public school, this group of students experienced an average gain from their baseline score, measured when previously enrolled in a private school, in ELA ( $0.299$  SD,  $p \leq .001$ ) and no change in math achievement from baseline. After returning to a private school (controlling for their performance in the public school year), this group of voucher students experienced no change in achievement in either subject. The results look similar to the group of voucher students consistently enrolled in private schools. Variation by the grade level in which these switches occurred is minimal, except for students who completed their transition back to private schools between seventh and eighth grade, who experienced a statistically significant loss in math ( $-0.210$  SD,  $p \leq .01$ ). This loss was also statistically different from their peers who transitioned back to private schools between fifth and sixth grade ( $0.018$  SD, not significant).

## DISCUSSION

In this article, we analyze the pathways students can take in the Indiana voucher program, including voucher students who switched from public to private schools, from private to public schools, from private to public to private schools, or always attended a private school. Students who always attend private schools experience no differences in achievement gains before or after receiving a voucher. This is unsurprising because these students do not change school context and therefore have consistent experience in a private school environ-

**Table 4.** Impacts of Receiving Voucher for Students Moving from Private to Public to Private Schools with a Voucher

	Math	ELA
Baseline achievement level	-0.087 (0.071)	-0.112 (0.074)
Year in public school	0.104 (0.072)	0.299*** (0.075)
Voucher year 1	-0.072 (0.045)	-0.002 (0.049)
Voucher year 2	-0.015 (0.063)	-0.066 (0.069)
Voucher year 3	-0.047 (0.087)	0.113 (0.124)
Voucher year 1*grade 4 baseline	0.018 <sup>(s)</sup> (0.079)	-0.120 (0.086)
Voucher year 1*grade 5 baseline	-0.029 (0.073)	0.065 (0.095)
Voucher year 1*grade 6 baseline	-0.210** <sup>(s)</sup> (0.079)	0.054 (0.071)

Source: Authors' compilation based on administrative data provided by the Indiana Department of Education.

Note: Overall results reported from preferred model 2, exclusive to voucher students moving from private to public and back to private schools. We computed separate models for the year a student spent in a public school and for each of the years after receiving a voucher. Baseline grade reported for year enrolled in private school before transition to public school. ISTEP+ math and ELA scores measured in standard deviation units, relative to the Indiana statewide mean and standard deviation within each grade and year (across all public and private school test takers). Robust standard errors, adjusted for the clustering of students within schools, are in parentheses. <sup>(s)</sup>Indicates significant differences between subgroups from F-test of estimates ( $p \leq .050$ ).

\* $p \leq .05$ ; \*\* $p \leq .01$ ; \*\*\* $p \leq .001$

ment. However, it also indicates that students may not experience a stigma associated with beginning to receive a voucher, or at least that any potential stigma experienced does not influence their academic performance.

The negative findings in math for students who switch from a public to a private school with a voucher mirror what we have found using other estimation strategies (Berends and Waddington 2018; Waddington and Berends 2018). Here, we are able to compare the losses of these students with those of other groups of voucher students. It appears that students who have no experience in private schools experience a larger decline in their math scores than their counterparts enrolled in private schools for at least part of their schooling. These losses are largest for students who transition in earlier

grades. Similarly, transitions from public to private schools with a voucher after fourth grade are associated with achievement loss in ELA, but transitions in the middle school years are associated with gains. The pattern of more negative outcomes following earlier transitions is one that additional research should examine (Langenkamp and Carbonaro 2018). In our future research, we also will examine further how these achievement losses vary by school context, such as racial-ethnic and socioeconomic composition and school climate.

Students who start in a public school, transition to a private school with a voucher, and then subsequently transition back to public school generally experienced larger achievement losses than students who start in a public school, transition to a private school with a

voucher, and remain in a private school with a voucher. These students are a group that our future research will examine to test two hypotheses: perhaps the low-performing students are being pushed out of private schools, or perhaps their families are motivated to pull them out because their child may not be performing well in private schools (as evidenced by some of the subgroup outcomes for nonstructural movers). These hypotheses are important to examine because some opponents of school choice argue that if private schools retain the ability to expel students for disciplinary or academic reasons, they should not receive public funds (Ravitch 2010).

Families who gamed the system early in the voucher program and moved their children from a private to a public and back to a private school to become eligible for a voucher may be a more motivated group. Their potential motivation may help explain why these students' achievement losses are more mitigated compared with other groups of voucher students.

Most voucher programs are designed to provide new learning opportunities, particularly for low-income students. Because of changes in the ICSP over time, students have taken different pathways to receiving a voucher. Our results here reveal variation in the association between these pathways and academic achievement scores. Moving from public to private schools with a voucher results in decreasing test scores, at least in math and especially for students who transition in earlier grades. Students who always attended private schools have higher math achievement at baseline experience no changes in their achievement before and after receiving a voucher. The achievement losses for public to private movers may be cause for concern for policymakers advocating for voucher programs. However, how students come to receive a voucher is as important to consider as the impact of receiving a voucher *per se*.

Although the results presented here are not causal estimates, they point to some potential considerations for parents considering using a voucher to move their child from a public to a private school and for policymakers considering a new or revised voucher program. Parents should be aware that research on transitions in

general suggests that students often experience a decline in achievement in the first year following a transition to a new school of any type. Our findings suggest that attending a private voucher school generally does not compensate for that achievement loss. In addition, parents considering the timing of such a transition should note that transitions at earlier grades are associated with larger achievement losses, but that both structural and nonstructural transitions are associated with achievement loss in math for students who start in a public school and transition to a private school with a voucher, regardless of whether they ultimately transition back to a public school or remain in a private school.

The association between voucher transitions and achievement changes in ELA is weaker; achievement losses in ELA are concentrated in year two post-baseline following both structural and nonstructural changes and following a move after fourth grade. Students who transition to a private school with a voucher following sixth or seventh grade in a public school experienced average achievement gains.

Policymakers considering voucher policies should consider how voucher eligibility criteria shape the timing of students' school transitions and the pathways through which they make those transitions. Qualitative research in Indiana suggests that elementary and middle school students have more trouble adjusting to school expectations when they transition from a public to a private school in older grades (Austin 2019). However, recent quantitative analyses of the Washington, D.C., voucher program are consistent with our findings (Dynarski et al. 2017). Analyses of administrative data like those presented here will continue to inform policymakers as they weigh these and other important considerations for voucher policy design.

In addition, Indiana's K-12 administrative records can now be linked with data from the Indiana Commission on Higher Education and the National Student Clearinghouse through a statewide longitudinal data system. Future research will be able to explore the relationships between receiving a voucher and high school graduation, college readiness, and educational attainment. To date, forty-seven states have received at least one federal grant to support

building their statewide longitudinal data system, the information from which will provide social scientists with valuable data to assess program impacts, various student and adult outcomes, and educational inequality more generally. As the articles in this issue highlight, access to and use of such data can be burdensome, frustrating, and time consuming. Establishing researcher-practitioner partnerships not only promotes the use of research findings to inform practices, programs, and policies but also builds strong relationships with agency staff who know the data well and may help address some of the challenges of using administrative data. Addressing such challenges is key as data systems expand by adding data from state agencies, such as workforce data, child services, criminal justice and corrections. Such developments will enable researchers to connect individuals' schooling experiences to a variety of adult outcomes that will inform research and policy—making societal contributions far into the future.

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