Responses to Negative Information Shocks: Insights from Grade Repetition

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Roadmap

– Motivation + Contribution

– Data

– How is repetition decided?

– How are outcomes impacted by repeating?

– Through what mechanisms are these outcomes changing?

– Conclusion

Motivation

- Each year, 25 million children around the world repeat at least one grade while obtaining their education (UNESCO).
    - 24 million of these students are in developing countries.
    - 600,000 are in Pakistan.

- These numbers are huge, yet they are almost surely an underestimation due to missing data on private schools and multi-grade classrooms.

- Most of the analysis that studies the effects of grade repetition focuses on:
    1. Students in high income countries.
    2. Total average effects on academic achievement.

- Given the prevalence of repetition in low-income countries, it is important to understand what the effects are in this setting, and what channels these effects are operating through.

Grade Repetition in Pakistan

Schools in our sample:

- Many students repeat a grade ($\sim 9\%$ in our sample) and teachers are mainly responsible for deciding who is retained.

- Multi-grade classrooms (some classes have four year gaps between the youngest and oldest student).

- Classes and schools are small on average (~ 15 students).

- Large low-cost private school sector (40% of schools in our sample, cost $<$ dime a day).

- Parents have fairly low educational attainment: 36% of students have a mother who received any schooling, 28% completed primary school.

Research Question

How do parents, students, and schools respond to grade repetition in a setting with no centrally-determined repetition rule?

To answer this question:

- Use rich administrative panel data to analyze students repeating 4th grade in Pakistan
- Answer the questions:
    - ► How is repetition decided?
    - ► What are the effects of repeating?
    - ► What are the mechanisms?

Literature

- Effects of grade repetition <small>(Eren, Lovenheim and Mocan (2018), Figlio and Özek (2019), Jacob (2005), Jacob and Lefgren (2004), Jacob and Lefgren (2009), Eide and Showalter (2001), Koppensteiner (2014), Manacorda (2012), and Gomes-Neto and Hanushek (1994))</small>
    - This paper: (1) evidence on how households, students, and teachers respond (2) in a developing country with no centrally-determined repetition rule

- Parent and student beliefs about ability
    - Reinforcing vs compensating for differences <small>(Becker and Tomes (1976), Tomes (1981), Griliches (1979), Behrman, Rosenzweig and Taubman (1994), Behrman, Pollak and Taubman (1986), Pitt, Rosenzweig and Hassan (1990), Rosenzweig and Zhang (2009))</small>
    - Parental beliefs responsiveness to information about their children <small>(Dizon-Ross (2019), Gan (2021), Barrera-Osorio et al. (2020), Bergman (2021))</small>
    - Student beliefs and self-agency <small>(Chevalier et al. (2009), Stinebrickner and Stinebrickner (2012), Walton and Cohen (2011), Yeager et al. (2016), Dobronyi, Oreopoulos and Petronijevic (2019), Oreopoulos and Petronijevic (2019))</small>
   - This paper: repetition is a real-world, high-stakes information signal about learning/ability

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LEAPS Data

- Learning and Education Achievement in Punjab Schools project.

- Five-year survey (2004-2009, 2011) of schools, teachers, school-children, and households.

- 112 villages with at least one private school sampled from Attock, Faisalabad, and Rahim Yar Khan districts of Punjab province.

- Initially, 13,735 students were surveyed in 804 schools (public and private) which offered third grade instruction.

- Today we will focus on years 2 and 3 of the survey (majority of students repeat between 4th and 5th grade).
  - February 2006 to February 2007.
  - Looking at repetition between 4th and 5th grade.
  - This also allows us to use two years of lagged test scores.

Our Sample
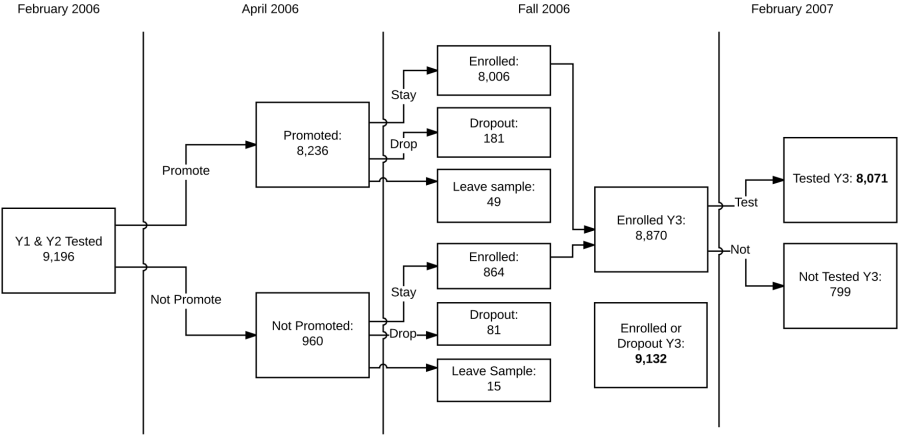
Important Variables

Test Scores

- Math, Urdu, and English tests.
- Test were IRT and administered and designed by the research team.
- Teachers do not receive the test scores.

Child Survey

- Sex, age, health information (height, weight), feelings and attitudes towards school.

Teacher Survey

- "On a scale of 1 to 10, how good would you say that this student is in his/her studies?"

Household Survey

- Parent education, perceptions of child, asset-based wealth index, detailed educational expenditures, assessments of their child's teachers quality, expectations of child ability.

Our Sample

We focus on students who are retained after year 2 (usually grade 4).

- To be included in our analysis, we need information on these students in year 1 and 2 for controls, and then in year 3 for outcomes.

Achievement analysis - need test scores in year 3

- Full sample: students tested in all three years (N=8,071)

- Also have detailed child and teacher survey (N=5,529)

- Also have detailed household survey (N=698)

Our Sample

We focus on students who are retained after year 2 (usually grade 4).

- To be included in our analysis, we need information on these students in year 1 and 2 for controls, and then in year 3 for outcomes.

Dropout analysis - need enrollment decision in year 3

- Full sample: students tested in years 1-2 and dropped out or enrolled in year 3 (N=9,132)

- Also have detailed child and teacher survey (N=6,222)

- Also have detailed household survey (N=760)

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How is repetition decided?

On average, repeaters do worse on tests and are rated worse by their teachers compared to students who do not repeat, before the retention.

|	Promoted	Not Promoted	Difference
English score	.3 (.921)	-.563 (1.092)	-.864***
Math score	.26 (1.092)	-.961 (1.392)	-1.221***
Urdu score	.367 (.946)	-.637 (1.156)	-1.005***
N	10463	1249	11712

Table: Test scores in year 2

	Promoted	Not Promoted	Difference
Rating by teacher	6.148 (2.27)	4.296 (2.421)	-1.852***
N	6458	594	7052

Table: Teacher ratings in year 2

Identification – how is repetition decided?

- Although the average difference in test scores is significant, there is no centrally-determined repetition rule in this setting, so there is no minimum score required to pass to the next grade.
  - The result is considerable overlap in the pre-retention test score distribution of repeaters and non-repeaters.

- There are two types of variation present in the data when considering the teachers:
  1. Across teachers: differences in "standards for repetition"
  2. Within teacher: lack of consistency

- We make use of the rich panel data and this overlap in distributions to compare plausibly similar students who face different retention decisions.
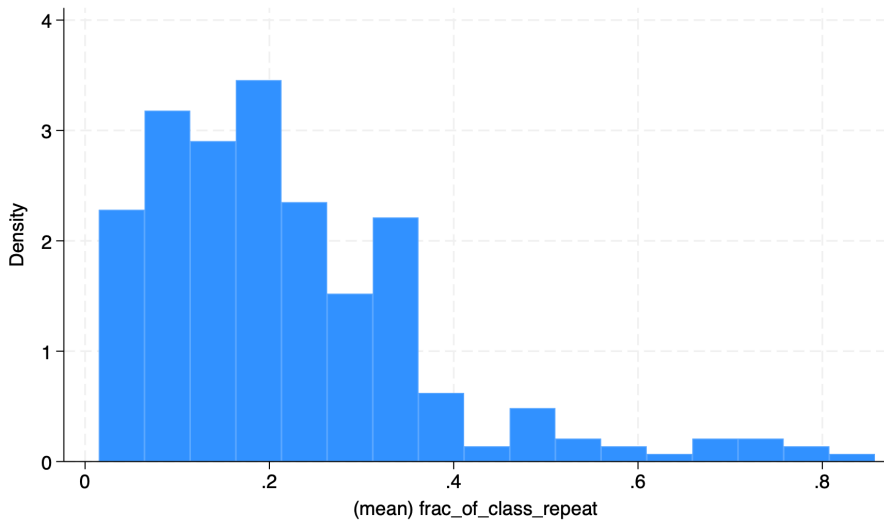
Raw pre-repetition test scores of retained and promoted students
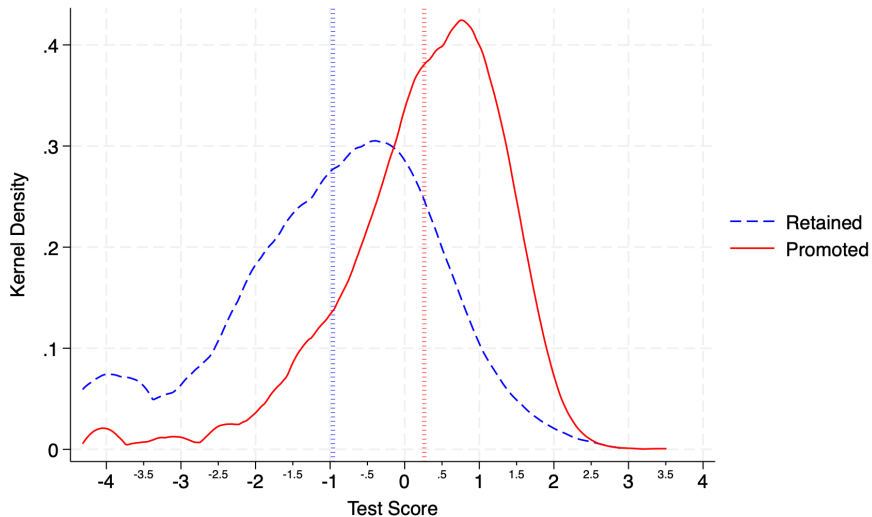
Consider the teachers - what fraction of their classroom is each one retaining?
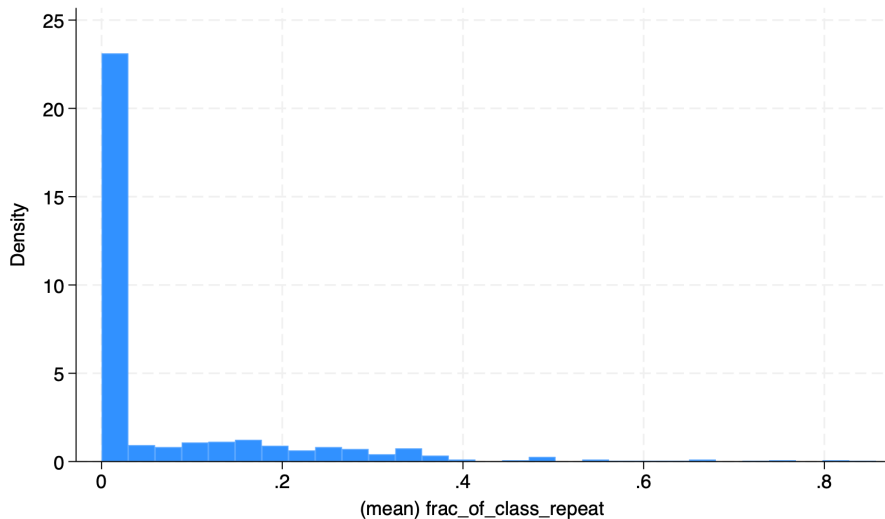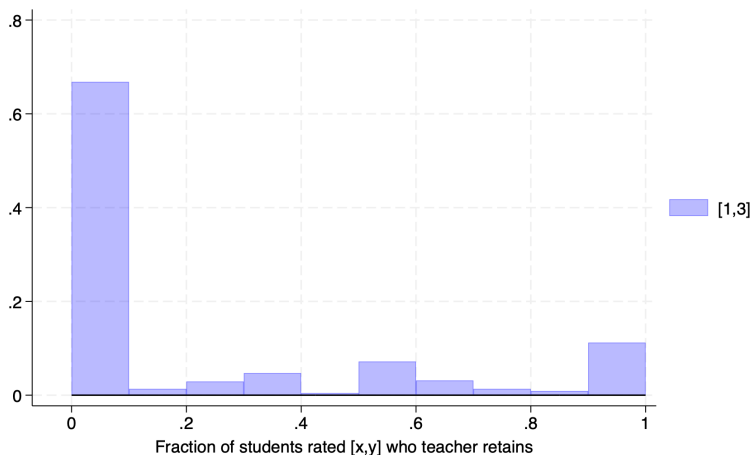
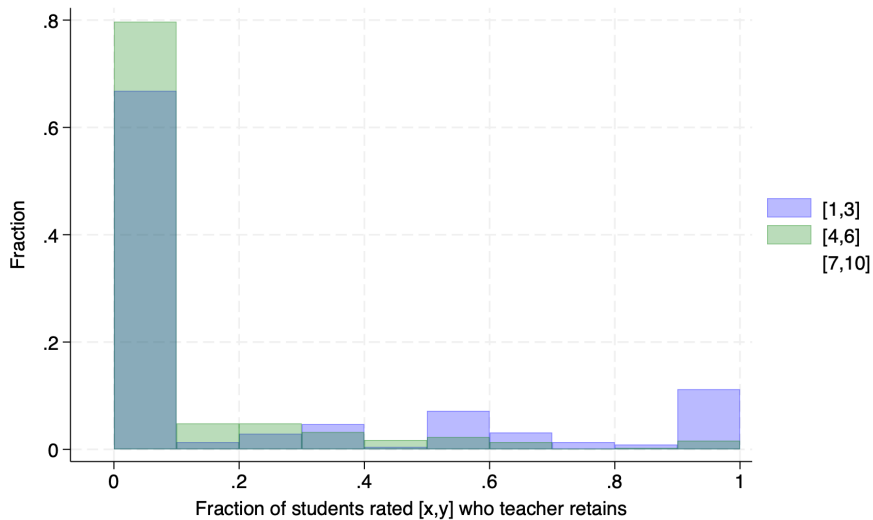# Many teachers don't retain anyone, but zooming in on those who do...

Variation remains even after conditioning on teacher rating

- Consider the subset of students in each class that a teacher rates poorly. What fraction of them are retained?

[1,3]

Fraction of students rated [x,y] who teacher retains

Variation remains even after conditioning on teacher rating

Variation remains even after conditioning on teacher rating

Legend:
- [1,3]
- [4,6]
- [7,10]

Y-axis: Fraction
X-axis: Fraction of students rated [x,y] who teacher retains
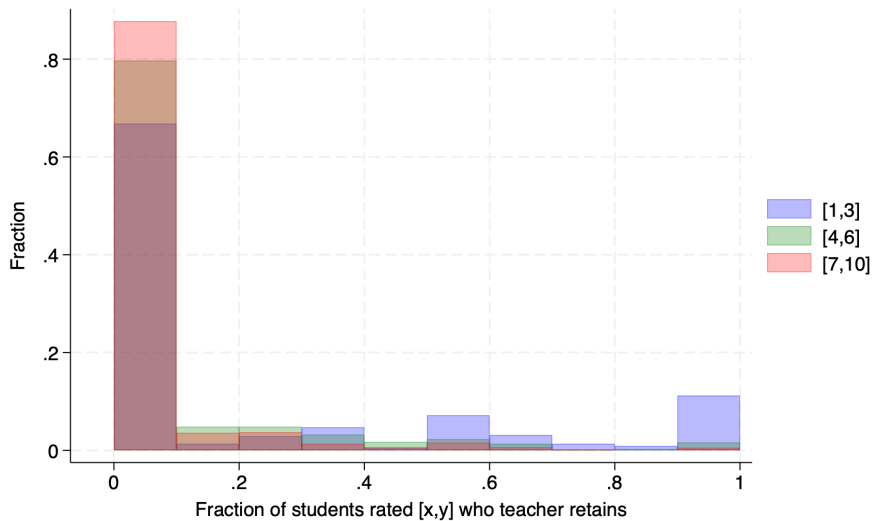
Within-teacher identifying variation (Example)

- Even within a teacher, there is overlap in that teacher's ratings of students who they retain and promote.
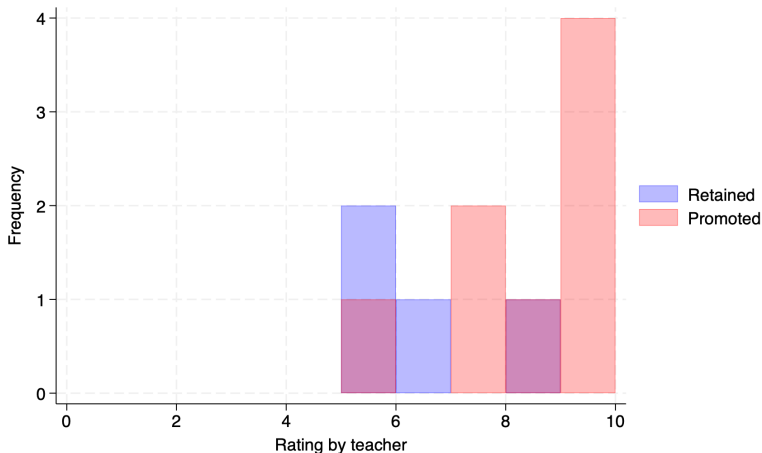
Within-teacher identifying variation

- The pattern illustrated by the example on the previous slide holds across all teachers.
- Compute difference between lowest teacher-rating of a promoted student and highest teacher-rating of a retained student given by the same teacher.
- Substantial mass of teachers (those with negative values) are retaining students who they rated higher than students who they promote.
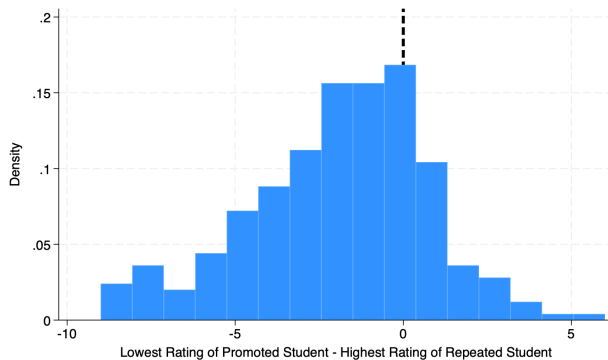
Can we predict who is going to be retained?

- We estimate a logit with the outcome variable equal to 1 if the student repeats.
- Using all of our data, do not get an R^2 higher than 0.52.

Controls	R^2
Child	.18
Child + Teacher	.2
Child + Teacher + Parent	.35
(Child×Test Scores) + (Teacher×Test Scores)	.2
(Child×Test Scores) + (Teacher×Test Scores) + (Parent×Test Scores)	.43
(Child×Test Scores) + (Teacher×Test Scores) + (Parent×Test Scores) + (Parent×Teacher)	.52

Notes:
All regressions include two lags of test scores.
"Child" includes age, gender, and mother's education.

What if we look within classrooms?

- We re-estimate the regression using OLS and teacher fixed effects (869 teachers).
- Even looking within a classroom, there is a lot of unexplained variation.

Controls	R^2	Adjusted R^2
Child	.35	.28
Child + Teacher	.39	.29
Child + Teacher + Parent	.74	.24
(Child×Test Scores) + (Teacher×Test Scores)	.4	.29
(Child×Test Scores) + (Teacher×Test Scores)		
+ (Parent×Test Scores)	.81	.29
(Child×Test Scores) + (Teacher×Test Scores)		
+ (Parent×Test Scores) + (Parent×Teacher)	.83	.29

Notes:

All regressions include two lags of test scores.

"Child" includes age, gender, and mother's education.

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Estimating the effect of grade repetition

- Student i's test score in year $t+1$ is likely a function of time-invariant student characteristics which have both permanent and time-varying effects, a school effect (permanent and time-varying), and an individual student effect (permanent and time-varying).

- We assume that:
  1. Permanent effects and time-varying effects from the prior year can be captured by the lagged test score.
  2. Learning speed can be approximated by $\eta_{i,t+1} \approx y_{i,j,t} - y_{i,j,t-1}$.

- The education production function can then be rewritten as a function of twice-lagged scores, student characteristics, a school fixed effect, and an idiosyncratic error term:

$$y_{i,j,t+1} = \beta R_i + f(y_{i,j,t}, y_{i,j,t-1}) + X_i \gamma + \mu_j + \epsilon_{ijt}$$

- $f(\cdot)$ is 4th order polynomial

The Impact of Repetition on Educational Outcomes

- Repetition significantly decreases test scores and increases probability of dropping out.
- The effects on test scores persist for at least two years.

	Math		English		Urdu		Dropout	
	(1) 1 yr	(2) 2 yrs	(3) 1 yr	(4) 2 yrs	(5) 1 yr	(6) 2 yrs	(7) 1 yr	(8) 2 yrs
Not Promoted	-0.438***	-0.323***	-0.271***	-0.332***	-0.369***	-0.368***	0.071***	0.007
	(0.055)	(0.076)	(0.036)	(0.050)	(0.043)	(0.056)	(0.015)	(0.019)
Age + Gender	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Teacher Rating	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lag Polynomial	4th Order	4th Order	4th Order	4th Order	4th Order	4th Order	4th Order	4th Order
N	5529	3992	5529	3992	5529	3992	6222	4633
R^2	0.72	0.70	0.78	0.75	0.75	0.73	0.19	0.25

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Households

When parents learn that their child has been retained, they choose how to react to this negative information shock.

- Will they mitigate the negative shock or reinforce it?

We find that for repeating students:

1. Households decrease educational expenditures.
   - Short-term expenditures: school fees, transport, private tuition, pocket money.
   - Long-term expenditures: annual fees, uniforms and shoes, textbooks, school supplies, other.
   - The decrease persists one year later.
   - Still statistically significant when we control for lagged expenditures.

Households (continued)

2. Households decrease beliefs and this decrease persists for at least two years.
   - Statistically significant decrease in responses to the questions: how intelligent is your child, how hardworking is your child, and do you think you child is performing well at school.

3. Four years later, parents still expect repeaters to answer fewer questions correctly on a test.
   - Parents were asked to consider a hypothetical test with 100 points, and to indicated the maximum, minimum, and average number of questions their child would get correct.

4. Parents do not decrease their perceptions of the teacher who retained their child and have a higher rating of the teacher the following year.
   - Looking at responses to the question how good would you say that the class-teacher is overall, there is no difference in the repetition year, and a positive estimate for the year after.

Students

When students are retained, their educational outcomes suffer, but do their attitudes towards school change as well?

We find that repeating students:

- Are not discouraged from attending school ...
  - Positive effect on the question "Do you feel like attending school?"

- ... but are discouraged about their agency in school.
  - Significant decrease in agreeing with the statement "If I study hard at school I will be rewarded by a better job in the future."
  - No impact on questions relating to trying hard in general or making plans for studies and work in the future.

Teachers

Once a student has been retained, do teachers have a negative bias against them for the remainder of their education?

We find that:

- After controlling for test scores, next-year teachers do not rate retained students differently than their classmates.
  - Conversely, the teachers who made the retention decision do rate the repeaters significantly lower than their classmates, even after controlling for test scores.

- Repeaters also do not report any increase in punishment from their teacher.

Conclusion

- In a schooling system with no centrally-determined repetition rule, teachers have considerable power in deciding who repeats a grade.
  - We find substantial overlap in the test score distribution of retained and promoted students.
  - Even after controlling for test scores, child characteristics, parent and teacher beliefs, there is a lot of unexplained variation in the repetition decision $\rightarrow$ we are assuming that this variation is quasi-random.

- Following retention, repeaters have lower test scores and a higher probability of dropping out of school.

- Households and students both react to repetition by reducing expectations and beliefs, decreasing household investment and student self-efficacy.

- Having to repeat a grade, a decision that is often not based on ability, but instead a quasi-random negative shock, has long-lasting negative consequences on a child's life.

appendix

References I

Barrera-Osorio, Felipe, Kathryn Gonzalez, Francisco Lagos, and David J Deming. 2020. "Providing performance information in education: An experimental evaluation in Colombia." Journal of Public Economics, 186: 104185.

Becker, Gary S, and Nigel Tomes. 1976. "Child endowments and the quantity and quality of children." Journal of political Economy, 84(4, Part 2): S143–S162.

Behrman, Jere R, Mark R Rosenzweig, and Paul Taubman. 1994. "Endowments and the allocation of schooling in the family and in the marriage market: the twins experiment." Journal of political economy, 102(6): 1131–1174.

Behrman, Jere R, Robert A Pollak, and Paul Taubman. 1986. "Do parents favor boys?" International Economic Review, 33–54.

Bergman, Peter. 2021. "Parent-child information frictions and human capital investment: Evidence from a field experiment." Journal of political economy, 129(1): 286–322.

Chevalier, Arnaud, Steve Gibbons, Andy Thorpe, Martin Snell, and Sherria Hoskins. 2009. "Students' academic self-perception." Economics of Education Review, 28(6): 716–727.

Dizon-Ross, Rebecca. 2019. "Parents' beliefs about their children's academic ability: Implications for educational investments." American Economic Review, 109(8): 2728–2765.

Dobronyi, Christopher R, Philip Oreopoulos, and Uros Petronijevic. 2019. "Goal setting, academic reminders, and college success: A large-scale field experiment." Journal of Research on Educational Effectiveness, 12(1): 38–66.

Eide, Eric R, and Mark H Showalter. 2001. "The effect of grade retention on educational and labor market outcomes." Economics of Education review, 20(6): 563–576.

Eren, Ozkan, Michael F Lovenheim, and Naci H Mocan. 2018. "The Effect of Grade Retention on Adult Crime: Evidence from a Test-Based Promotion Policy." National Bureau of Economic Research.

Figlio, David N, and Umut Özek. 2019. "An Extra Year to Learn English? Early Grade Retention and the Human Capital Development of English Learners." National Bureau of Economic Research.

Gan, Tianqi. 2021. "How Parental Educational Investments Respond to Changes in Ability Belief: An Application of Big Data Techniques in Education." Working Paper.

Gomes-Neto, Joao Batista, and Eric A Hanushek. 1994. "Causes and consequences of grade repetition: Evidence from Brazil." Economic Development and Cultural Change, 43(1): 117–148.

References II

Griliches, Zvi. 1979. "Sibling models and data in economics: Beginnings of a survey." Journal of political Economy, 87(5, Part 2): S37–S64.

Jacob, Brian A. 2005. "Accountability, incentives and behavior: The impact of high-stakes testing in the Chicago Public Schools." Journal of public Economics, 89(5): 761–796.

Jacob, Brian A, and Lars Lefgren. 2004. "Remedial education and student achievement: A regression-discontinuity analysis." Review of economics and statistics, 86(1): 226–244.

Jacob, Brian A, and Lars Lefgren. 2009. "The effect of grade retention on high school completion." American Economic Journal: Applied Economics, 1(3): 33–58.

Koppensteiner, Martin Foureaux. 2014. "Automatic grade promotion and student performance: Evidence from Brazil." Journal of Development Economics, 107: 277–290.

Manacorda, Marco. 2012. "The cost of grade retention." Review of Economics and Statistics, 94(2): 596–606.

Oreopoulos, Philip, and Uros Petronijevic. 2019. "The remarkable unresponsiveness of college students to nudging and what we can learn from it." National Bureau of Economic Research.

Pitt, Mark M, Mark R Rosenzweig, and Md Nazmul Hassan. 1990. "Productivity, health, and inequality in the intrahousehold distribution of food in low-income countries." The American Economic Review, 1139–1156.

Rosenzweig, Mark R, and Junsen Zhang. 2009. "Do population control policies induce more human capital investment? Twins, birth weight and China's "one-child" policy." The Review of Economic Studies, 76(3): 1149–1174.

Stinebrickner, Todd, and Ralph Stinebrickner. 2012. "Learning about academic ability and the college dropout decision." Journal of Labor Economics, 30(4): 707–748.

Tomes, Nigel. 1981. "The family, inheritance, and the intergenerational transmission of inequality." Journal of Political Economy, 89(5): 928–958.

Walton, Gregory M, and Geoffrey L Cohen. 2011. "A brief social-belonging intervention improves academic and health outcomes of minority students." Science, 331(6023): 1447–1451.

Yeager, David S, Gregory M Walton, Shannon T Brady, Ezgi N Akcinar, David Paunesku, Laura Keane, Donald Kamentz, Gretchen Ritter, Angela Lee Duckworth, Robert Urstein, et al. 2016. "Teaching a lay theory before college narrows achievement gaps at scale." Proceedings of the National Academy of Sciences, 113(24): E3341–E3348.