Do Motivated Classmates Matter for Educational Success?

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Does your personality affect your peers?

Large literature in psychology, growing literature in economics: personality matters for educational and labor market success.

- Recent work: large-scale, targeted school-based interventions can boost beneficial aspects of personality, such as patience and grit, in children and thus improve their school performance. First similar results for adult workers.

Open question: does individuals' personality affect their peers?

- Large literature in economics: peers' *ability and performance* matter for own performance in school and in the workplace.
- If personality affects others in the social environment, the benefits of school- and workplace-based interventions could be severely miscalculated.

This paper: academic motivation and educational success

Study how children's *academic motivation* shapes their own and their peers' educational success in the short and long run.

- Research in psychology: motivation as one of the four core domains of personality, seen as distinct from (but potentially correlated with) personality traits ("Big Five").

Use data from Project STAR with two key avantages:

- Longitudinal study which measured elementary school students' academic motivation using a *validated psychological scale*. Can relate this to a large number of measures of educational success collected up until the end of high school.
- *Random assignment* of students to classes generated exogenous variation in peers' predetermined motivation $\Rightarrow$ can estimate causal peer effects.

Preview of main results

Academic motivation predicts own long-term educational success: test scores in elementary and middle school, classroom behavior, HS graduation, college test-taking, ...

Students randomly assigned to classes with more motivated peers show higher reading achievement at the end of the school year.

- Holds when controlling for peers' past achievement and socio-demographic composition $\Rightarrow$ a *personality* peer effect.
- But peer motivation has no effect on own motivation and longer-term outcomes.

Related literature and contribution

Previous literature: peer effects operate in education.

- Focus on peers' academic ability and demographic background.
- Only previous paper on personality peer effects (Golsteyn et al. JPE 2021): positive spillovers from being assigned to *persistent* peers in college.
- Contribution: school-aged children; effects on own personality.

Previous literature: personality predicts own educational success.

- Big Five (e.g. Gensowski 2018), grit (e.g. Duckworth et al. 2007), motivation (e.g. Wong and Csikszentmihalyi 1991, Steinmayr and Spinath 2009), among many others.
- Contribution: spillover effects, which matter for interventions.

Talk outline

1. Introduction

2. Data from Project STAR

3. Own motivation predicts educational success

4. Positive learning spillovers from motivated peers
   - Empirical challenges and solutions
   - Summary statistics and results
   - Potential mechanisms

5. Conclusion

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Project STAR: a study of class size effects

STAR = a study of class size effects on student achievement.

- RCT conducted from 1985 to 1989 in Tennessee.
- Single cohort of 11,601 children in grades K-3 at 79 schools.
- Half the students joined at the start of kindergarten. Others joined in later grades due to kindergarten not being mandatory and normal residential mobility.

Students and teachers randomized into classes within schools.

- Students are randomized at the school-by-entry grade level.
- Class size differs: small (15 students) or regular-sized (22 students).

Experiment ended after grade 3, but **observe outcomes until age 18.**

An assessment of students' academic motivation (1)

Spring of grades 1-3: students' academic motivation assessed using the Self-Concept and Motivation Inventory (SCAMIN; Milchus et al. 1968).

The SCAMIN is a validated psychological scale which conceptualizes academic motivation as consisting of two facets:

- **Achievement needs:** in economic terms, this is the utility that a child derives from learning and the associated social appreciation.
- **Failure avoidance:** in economic terms, this is the disutility that a child gets from low school achievement and the associated embarrassment.

An assessment of students' academic motivation (2)

Measurement via a self-assessment questionnaire (completed in the classroom):

- Class teacher asks students *"what face they would wear"* in 12 different situations.
- Answer sheet with five faces ranging from sad to happy for each question. ▸ sheet
- Example: *"What face would you wear if you could read like a grown-up?"*. ▸ all questions

Some further details on the SCAMIN:

- Half of the questions measure achievement needs, and half measure failure avoidance.
- Outcome is a single overall **motivation score** for each student.
- SCAMIN also measures academic self-concept, which I study as an outcome.

Project STAR: measures of educational success

Standardized test scores in reading and math in early elementary school (grades 1–3) and middle school (grades 5–8). Mean 0, SD 1.

High school graduation (for selected sample) and **ACT/SAT test-taking** (for everyone).

Teacher ratings of classroom behavior. 28 items in grade 4 + 13 items in grade 8 combined into four scales per grade (mean 0, SD 1):

- Effort: pays attention, completes assigned work, is persistent, ...
- Initiative: asks questions, does more than assigned work, ...
- Discipline: does NOT distract peers, need reprimanding, ...
- Value: thinks school is important, ...

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Does own motivation predict educational success?

Purpose: confirm results from previous psychology literature using the SCAMIN and establish the instrument's predictive validity.

Construction of the sample and the motivation measure:

- Select all students with a motivation score in at least one of grades 1-3 ($N = 9{,}072$).
- Average motivation scores across grades 1-3 and standardize with mean 0, SD 1 to maximize sample size and reduce measurement error.
- Motivation is lower for male students but is not correlated with race and free-lunch eligibility (an indicator for low income). ▸ details

Estimating equation

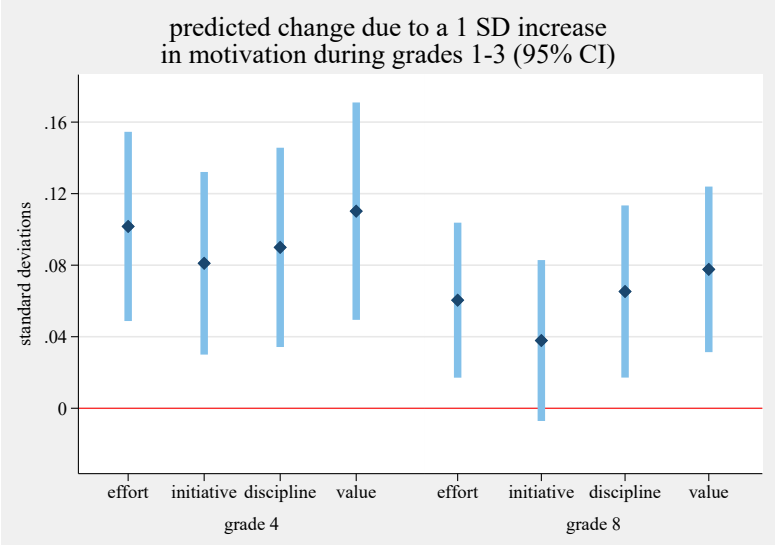
Estimate ordinary least squares regressions of the form:

$$y_{is} = \alpha + \beta \mathrm{MOTIV}_i^{G1-G3} + X_i\gamma + \lambda_s + \varepsilon_{is}$$

- MOTIV_i^{G1-G3} = average motivation of student i during grades 1-3.
- X_i = student covariates (gender, free lunch, Black, age, old for grade).
- λ_s = dummies for school-by-entry-grade (randomization blocks).

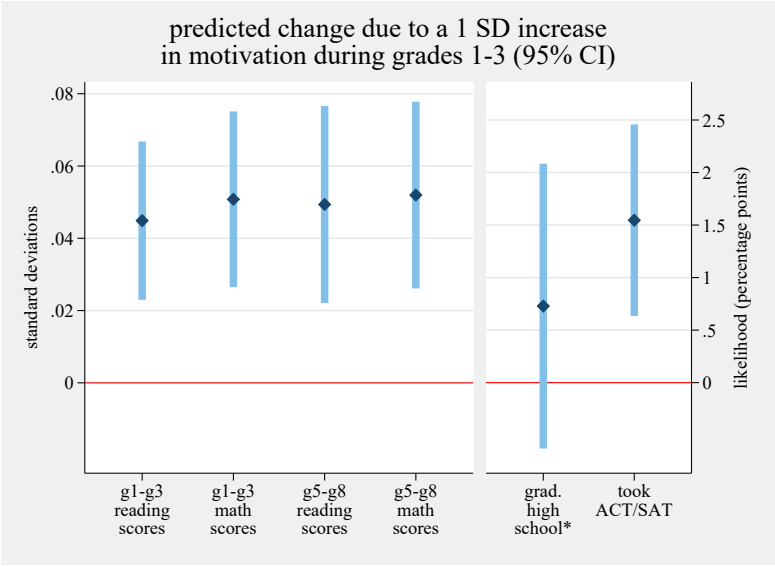
Estimates do not necessarily reflect causal effects of motivation due to possibly correlated unobserved factors (cognitive ability, ...).

Motivation predicts classroom behavior



Motivation predicts educational success

▸ results for motivation in specific grades



Summary of findings

Motivation in grades 1-3 predicts good classroom behavior in later grades.

- Coefficients correspond to about 22 percent of the girl-boy gap on average.

Motivation predicts short- and long-term educational success.

- Coefficients correspond to about 10 percent of the free-lunch gap on average.

Results are almost unchanged when I control for grade 1-3 achievement.

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Does exposure to motivated peers affect learning?

Tough empirical challenge: nobody chooses their peers randomly.

- Example: parents of high-achieving children might place them in a school with very academically motivated other children.
- Would imply a *correlation* between school peers' motivation and achievement. But this could be purely due to selection $\Rightarrow$ no *causal* effect.

The STAR setting allows me to overcome this challenge: students entering the experiment were randomly assigned to classes, creating *truly random* variation in the composition of their classmates (= peers).

- Focus on students who first entered in grade 2 or 3 (N = 2,868).
- For these students, I observe their new classmates' *predetermined* motivation at the end of the previous school year (spring of grade 1 or 2).

A linear-in-means model of peer effects

Estimate a linear-in-means models of peer effects:

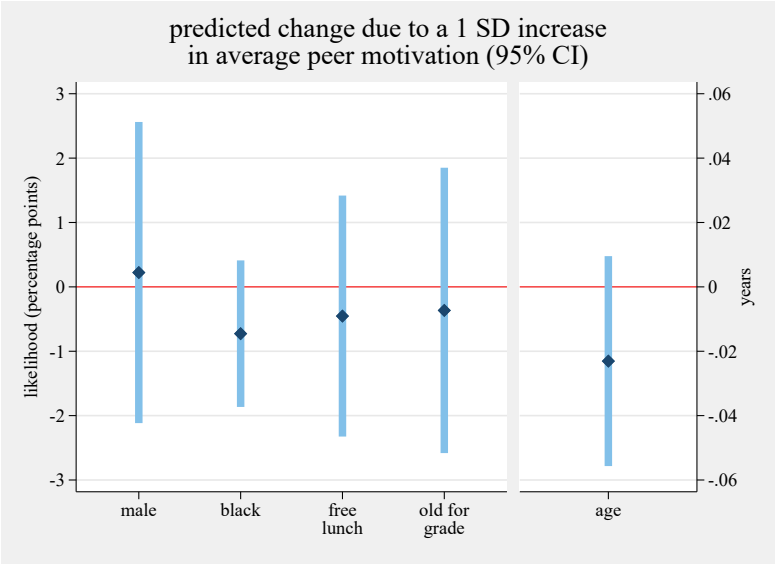
$$y_{ics} = \theta \overline{\mathrm{MOTIV}}_c^{G-1} + \phi \mathrm{SMALL}_c + X_i\eta + \overline{Z}_c\rho + \omega_s + \mu_{ics}$$

- $\overline{\mathrm{MOTIV}}_c^{G-1}$ = average motivation of entrant i's classmates (in class c), measured at the end of the previous school year ($G-1$). Mean 0, SD 1.
- Control for assignment to a small class SMALL_c (the original STAR treatment), student covariates X_i, and randomization-block dummies s.

Specification identifies the causal effect of exposure to motivated peers as long as assignment to classes is truly random.

Peer motivation doesn't predict entrants' characteristics

more evidence



Effects of peer motivation or peer background?

The regression identifies the causal effect of *exposure to motivated peers*. But is this due to peers' motivation or some correlated characteristic?

- Address this question by adding controls $\overline{Z}_c$, which include measures of (1) peers' past achievement and (2) peers' socio-demographic composition.
- Cannot control for other, correlated aspects of peer personality.

Main outcomes of interest: achievement in reading and math at the end of entrants' first year in STAR (when they are actually in class with peers). Additionally:

- Own motivation and self-concept at the end of first year in STAR.
- Long-term outcomes (measured when peers no longer randomly assigned).

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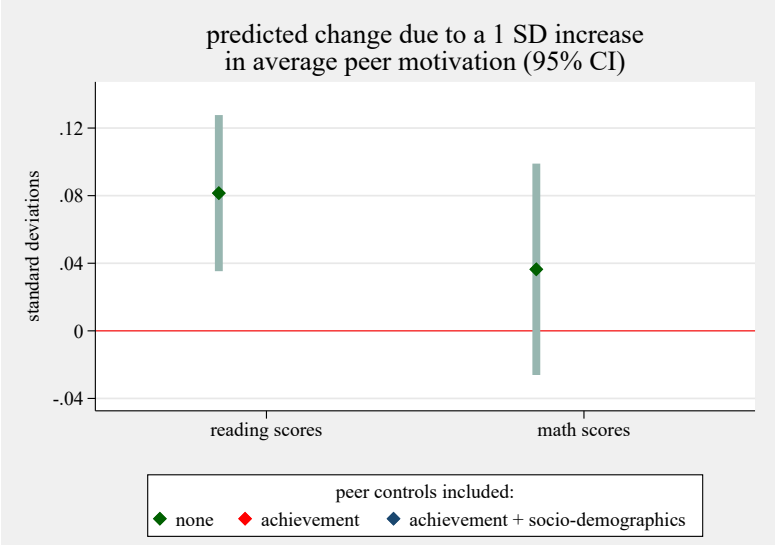
Summary statistics for second- and third-grade entrants

	Mean	SD	N
Socio-demographic characteristics			
Male	0.55	0.50	2,861
Black	0.42	0.49	2,766
Free lunch	0.66	0.47	2,730
Old for grade	0.47	0.50	2,845
Peer motivation			
Peer motivation	0.00	1.00	2,868
Entry-grade achievement and own motivation			
Reading score	0.00	1.00	2,185
Math score	0.00	1.00	2,196
Own motivation	0.00	1.00	2,276
Long-term educational outcomes			
Reading scores in grades 5-8	0.00	1.00	2,118
Math scores in grades 5-8	0.00	1.00	2,119
High school GPA (0-100)	81.50	7.46	665
High school graduation	0.73	0.44	1,018
Took ACT/SAT	0.26	0.44	2,868

Peer motivation boosts achievement

regression table



Peer motivation boosts achievement

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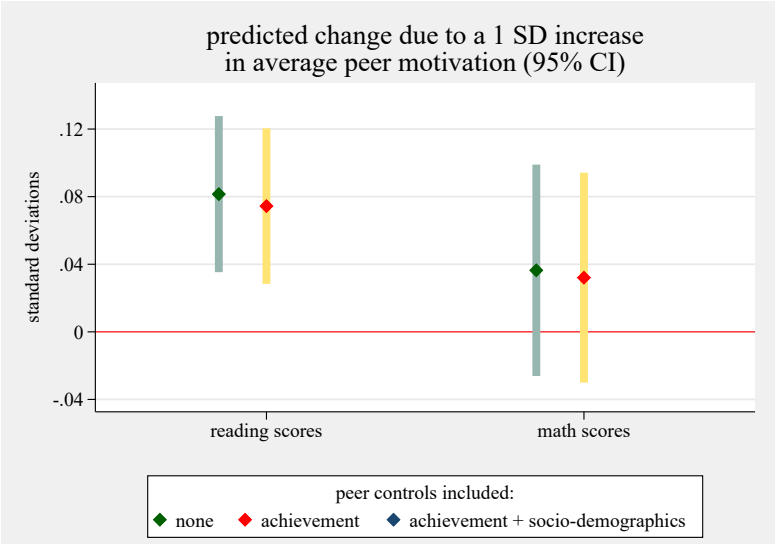

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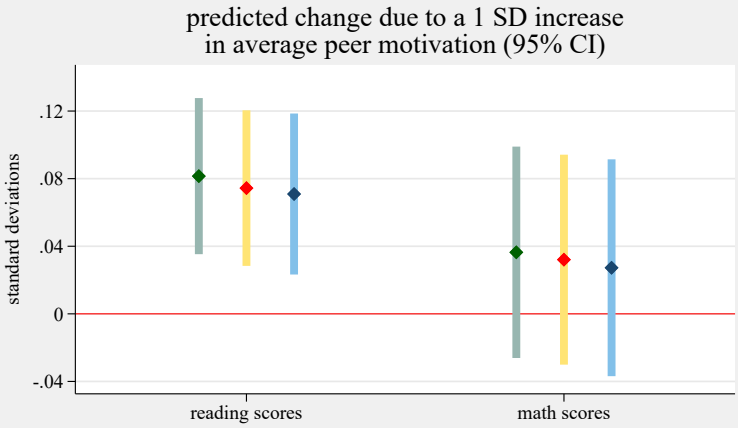
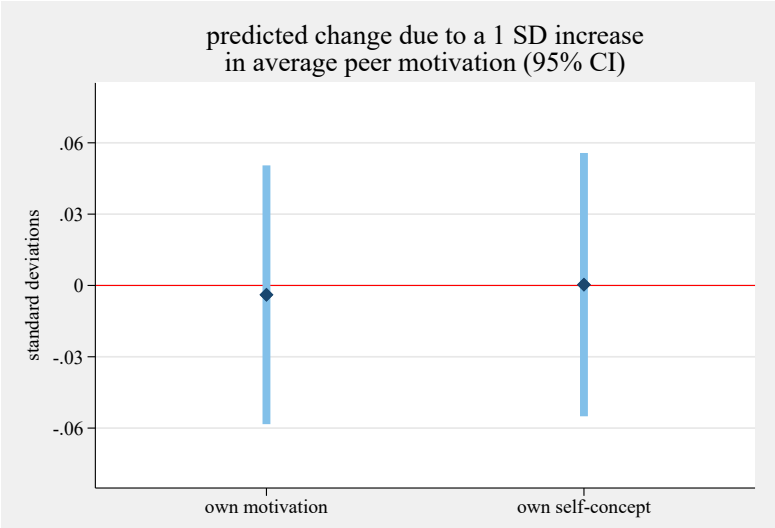


Peer motivation does not affect own motivation and self-concept



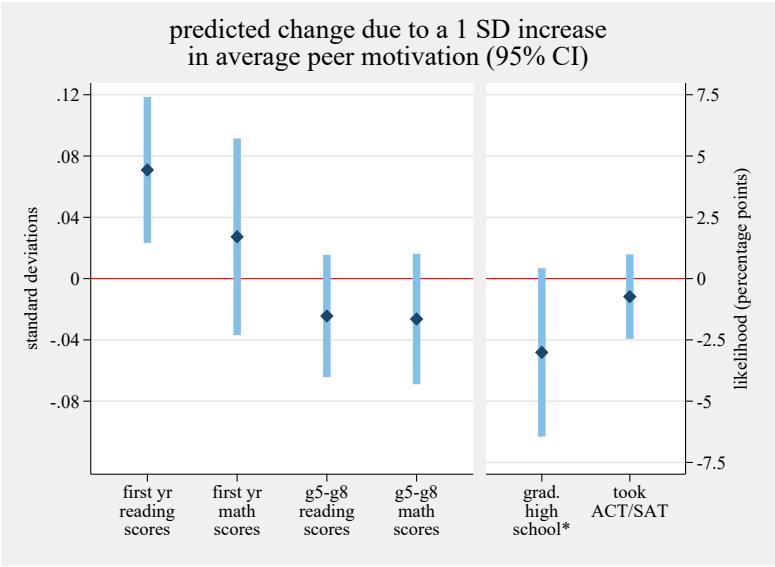
Do spillovers from motivated peers persist?

Study whether peer motivation affects long-term educational success.

Important to keep in mind: treatment captures short-term exposure to more motivated peers for 1-2 school years during elementary school.

- Project STAR ended after grade 3 and students were redistributed to ordinary classes.
- Implication: peer motivation in second and third grade likely at most weakly correlated with peer motivation in later grades (which I cannot observe).

Peer motivation does not affect long-term educational success



Heterogeneity and robustness

Effect of peer motivation on contemporaneous achievement is

- larger for boys, Blacks, and in regular-sized classes, although these differences are not statistically significant at conventional levels. show
- driven by (the absence of) peers with very low motivation. show
- consistent with gender homophily. show

Robustness checks show that results

- are not driven by selective attrition from the sample. show
- are not affected much by missing values on peer motivation.
- are robust to adjusting p-values for multiple hypothesis testing.

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Suggested mechanism: a better classroom environment

Motivated peers make for a better learning environment: teachers report that they distract their classmates less and are generally better behaved $\Rightarrow$ this could explain the positive short-term spillovers on achievement.

Can rule out alternative explanations related to selection (into peer groups, into the sample, and to teachers). Moreover, I find **no evidence that results are driven by a change in own personality.**

Why are there no long-term effects?

Previous literature: childhood interventions often boost long-term outcomes via affecting personality or non-cognitive skills (e.g. Heckman et al. 2013).

Here, own motivation is unaffected. Short-term gains in reading by themselves are perhaps too small to generate long-term boost.

In the end, cannot pin down the exact mechanisms underlying the short- and (lack of) long-term effects.

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Motivation matters for educational success

Academic motivation matters for educational success:

- Motivation in early elementary school predicts own educational success.
- Peer motivation raises contemporaneous reading achievement. Effect is distinct from spillovers due to peers' ability or socio-demographic composition $\Rightarrow$ likely reflects a personality spillover.

Policy implication: interventions that raise children's motivation could potentially have large effects, including spillover effects.

- Psychology literature: can increase motivation with interventions that help students set goals or instruct teachers to relate material to students' daily lives.
- Wider implication: spillovers from personality interventions at the workplace?

APPENDIX

SCAMIN student answer sheet

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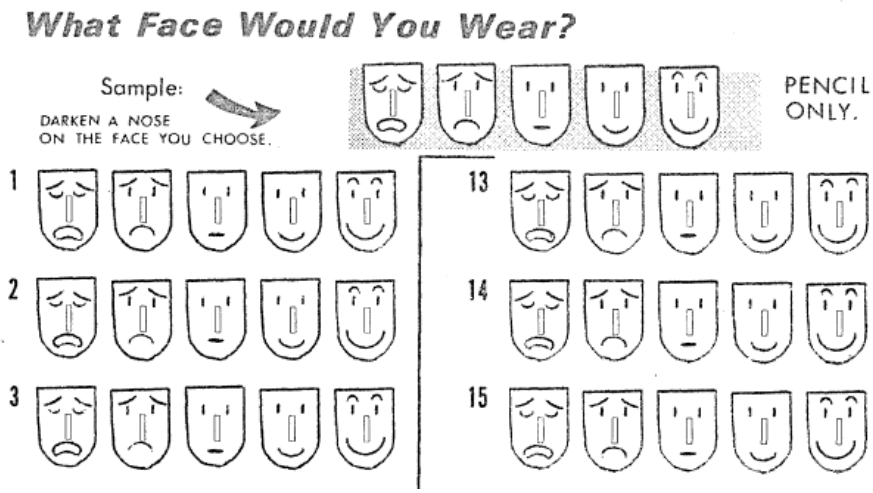


SCAMIN motivation questions back

Questions not shown due to copyright restrictions.

Correlates of motivation

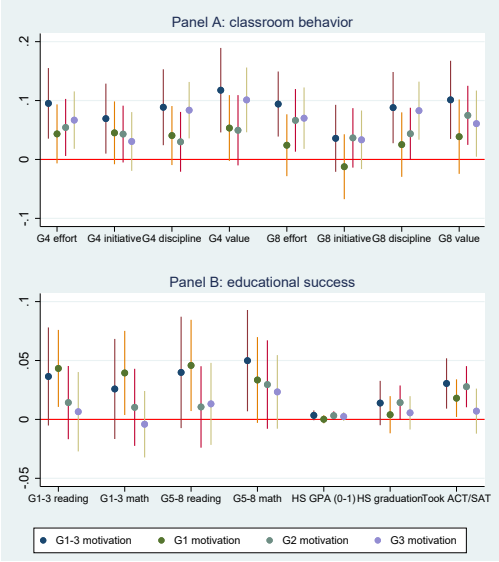
back

	Grades 1-3 motivation				
	(1)	(2)	(3)	(4)	(5)
Male	−0.292***				−0.285***
	(0.023)				(0.023)
Black		−0.026			−0.023
		(0.046)			(0.050)
Free lunch			−0.002		0.011
			(0.026)		(0.027)
Age in years				0.065*	0.078**
				(0.034)	(0.033)
Old for grade				−0.214***	−0.190***
				(0.047)	(0.047)
Small class	−0.000	−0.001	−0.001	−0.004	−0.003
	(0.027)	(0.028)	(0.028)	(0.028)	(0.027)
Observations	9,072	9,072	9,072	9,072	9,072

Notes: All regressions control for school-by-entry-grade fixed effects. Standard errors in parentheses clustered by school-by-entry-grade. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Grade-specific motivation and own educational success

back



Peer motivation doesn't predict entrant background

back

	Male (1)	Black (2)	Free lunch (3)	Age (4)	Old f. g. (5)	Pred. ach. (6)
Panel A: separate regressions for each peer variable						
Peer motivation	0.002	−0.007	−0.005	−0.023	−0.004	0.014
	(0.012)	(0.006)	(0.009)	(0.017)	(0.011)	(0.018)
Peer reading achievement	0.017	−0.008	−0.014	−0.024	−0.005	0.024
	(0.015)	(0.009)	(0.021)	(0.023)	(0.015)	(0.029)
Peer math achievement	0.024	−0.012	−0.028*	−0.020	−0.010	0.038
	(0.015)	(0.010)	(0.016)	(0.028)	(0.019)	(0.031)
Panel B: joint regressions for all peer variables						
Peer motivation	0.002	−0.007	−0.004	−0.022	−0.004	0.014
	(0.012)	(0.006)	(0.010)	(0.016)	(0.011)	(0.018)
Peer reading achievement	−0.000	0.002	0.009	−0.015	0.003	−0.006
	(0.021)	(0.010)	(0.029)	(0.029)	(0.019)	(0.038)
Peer math achievement	0.024	−0.013	−0.033	−0.009	−0.012	0.042
	(0.021)	(0.012)	(0.020)	(0.036)	(0.025)	(0.039)
p-value (joint sign.)	0.44	0.37	0.22	0.42	0.95	0.59
Observations (both panels)	2,861	2,766	2,730	2,845	2,845	2,868

Notes: Standard errors in parentheses clustered by school-by-entry-grade. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Peer motivation boosts achievement

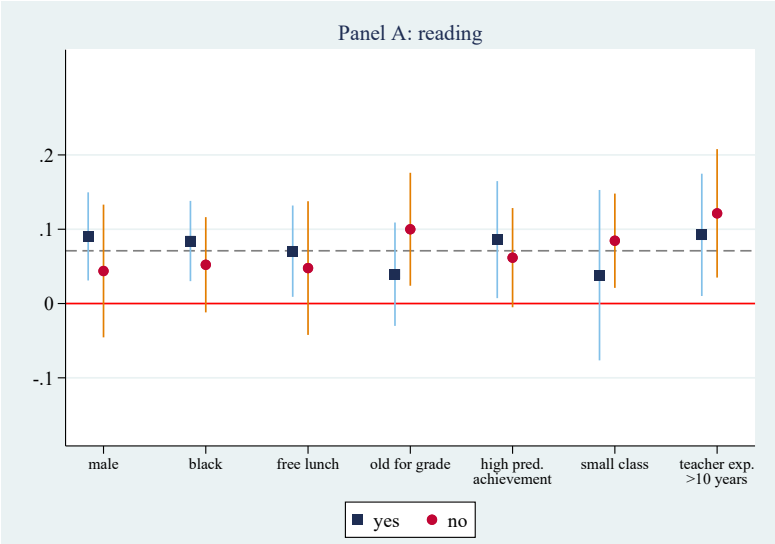
back

	Reading			Math		
	(1)	(2)	(3)	(4)	(5)	(6)
Peer motivation	0.081***	0.074***	0.071***	0.036	0.032	0.027
	(0.023)	(0.023)	(0.024)	(0.032)	(0.031)	(0.032)
Peer reading achievement		0.154**	0.152**		0.150**	0.134**
		(0.064)	(0.066)		(0.067)	(0.067)
Peer math achievement		0.038	0.042		0.051	0.062
		(0.058)	(0.059)		(0.057)	(0.058)
KG repeater peer in class		−0.069	−0.077		0.004	−0.003
		(0.073)	(0.073)		(0.086)	(0.088)
Peer share male			−0.194			−0.421*
			(0.271)			(0.233)
Peer share free lunch			0.146			0.006
			(0.252)			(0.282)
Peer share black			0.158			0.036
			(0.307)			(0.333)
Observations	2,185	2,185	2,185	2,196	2,196	2,196

Notes: Standard errors in parentheses clustered by school-by-entry-grade. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

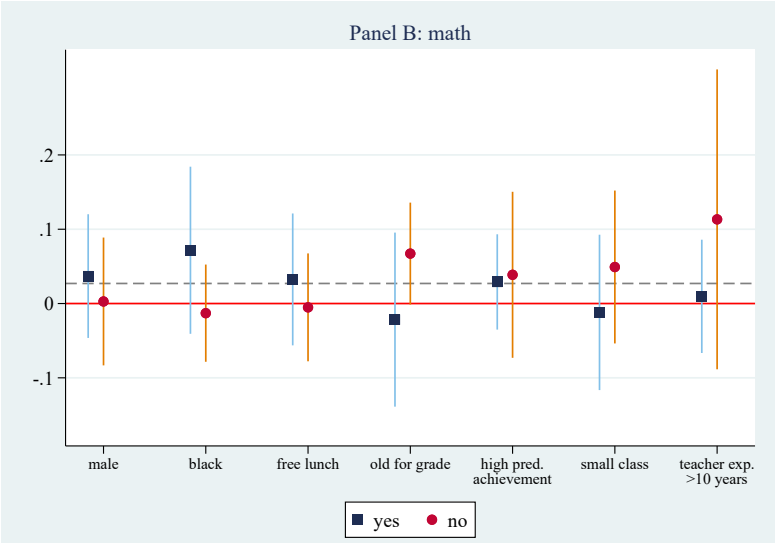
Peer motivation raises reading achievement: heterogeneity

back



Peer motivation raises math achievement: heterogeneity

back



Impact of peers with very low vs very high motivation

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	Reading			Math		
	All students	By pred. achievement		All students	By pred. achievement	
		low	high		low	high
	(1)	(2)	(3)	(4)	(5)	(6)
% peers with top 33% motiv.	0.136	0.054	0.432	0.074	0.250	0.066
	(0.187)	(0.285)	(0.289)	(0.295)	(0.475)	(0.315)
% peers with bottom 33% motiv.	−0.429***	−0.459**	−0.310	−0.222	−0.290	−0.109
	(0.157)	(0.218)	(0.278)	(0.174)	(0.285)	(0.244)
Peer achievement controls	Yes	Yes	Yes	Yes	Yes	Yes
Peer demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,185	1,143	1,042	2,196	1,142	1,054

Notes: Standard errors in parentheses clustered by school-by-entry-grade. * p<0.10, ** p<0.05, *** p<0.01.

Impacts of motivated male vs female peers, by own gender

back

	Reading			Math		
	All students	By gender		All students	By gender	
		female	male		female	male
	(1)	(2)	(3)	(4)	(5)	(6)
Motivation of male peers	0.075**	0.020	0.119***	0.023	0.004	0.045
	(0.038)	(0.066)	(0.045)	(0.047)	(0.069)	(0.060)
Motivation of female peers	0.066	0.085	0.058	0.033	0.014	0.027
	(0.044)	(0.075)	(0.058)	(0.049)	(0.064)	(0.071)
Peer achievement controls	Yes	Yes	Yes	Yes	Yes	Yes
Peer demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,185	976	1,207	2,196	974	1,220

Notes: Standard errors in parentheses clustered by school-by-entry-grade. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Results for students observed with most outcomes ($N = 1{,}510$)

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