ICFES Referrals

20-minute internal presentation for data analysis

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Selection into the experiment

- Higher performing students and Low-SES overrepresented
- High-SES underrepresented

	Admin Data	**Sample**	**p**
Reading score	62.651	65.183	< 0.001
Math score	63.973	67.477	< 0.001
GPA	3.958	4.012	< 0.001
Low-SES	0.343	0.410	< 0.001
Med-SES	0.505	0.499	0.763
High-SES	0.153	0.091	< 0.001
Observations	4,417	734	5,151
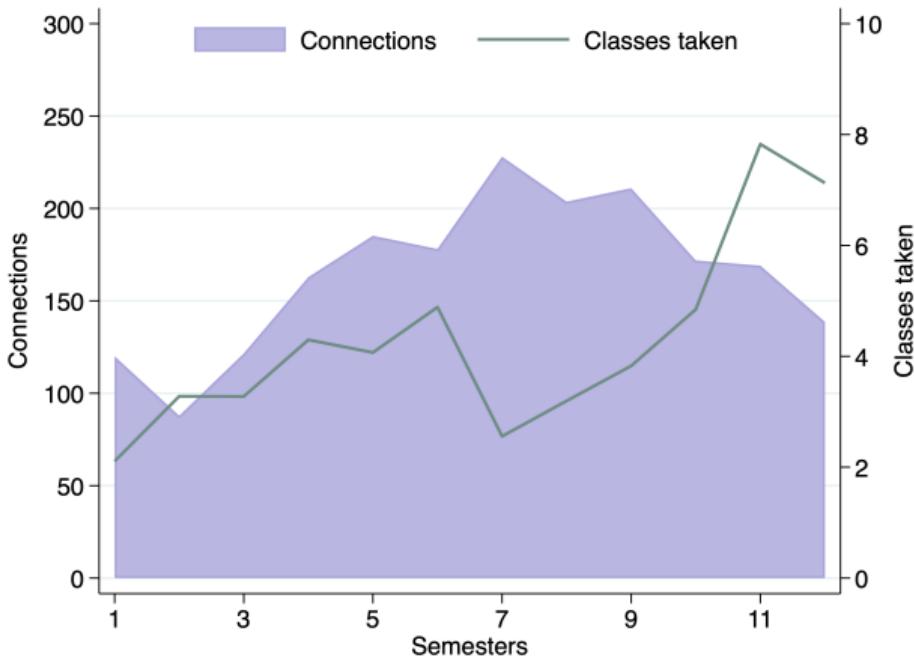
Balance between treatments

◦ Successful randomization

|	**Baseline**	**Bonus**	**p**
Reading score	64.712	65.693	0.134
Math score	67.366	67.597	0.780
GPA	4.003	4.021	0.445
# connections	173.40	176.88	0.574
Tie strength	3.939	3.719	0.443
Low-SES	0.419	0.401	0.615
Med-SES	0.492	0.506	0.714
High-SES	0.089	0.094	0.824
Observations	382	352	734
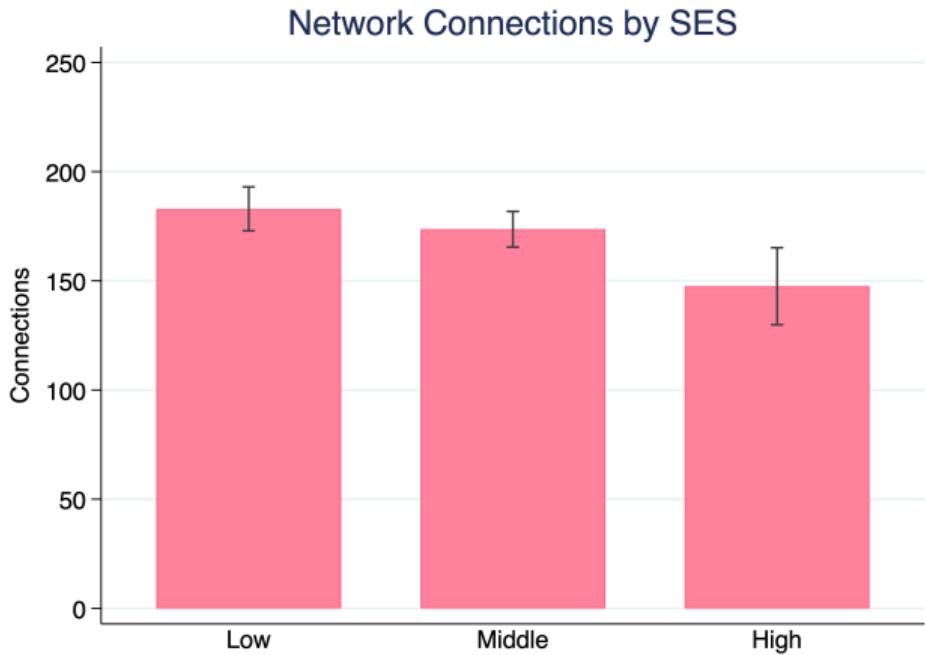
Referrer network size and tie strength

- Classes taken with peers increase over time
- Connections peak around 7 semesters and decline as students change majors or graduate
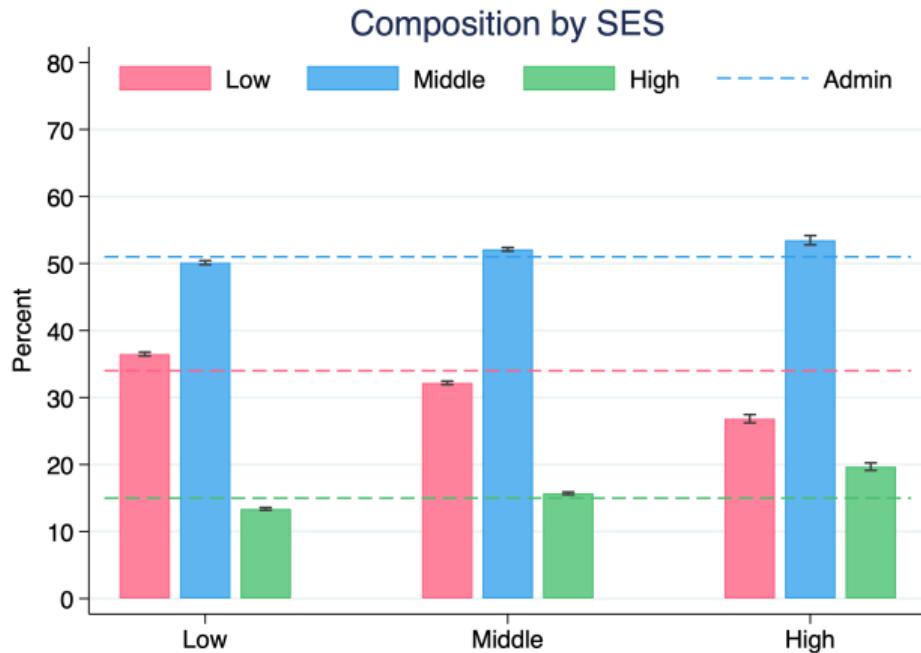
Referrer network connections

○ Connections decrease as SES increases

Network Connections by SES
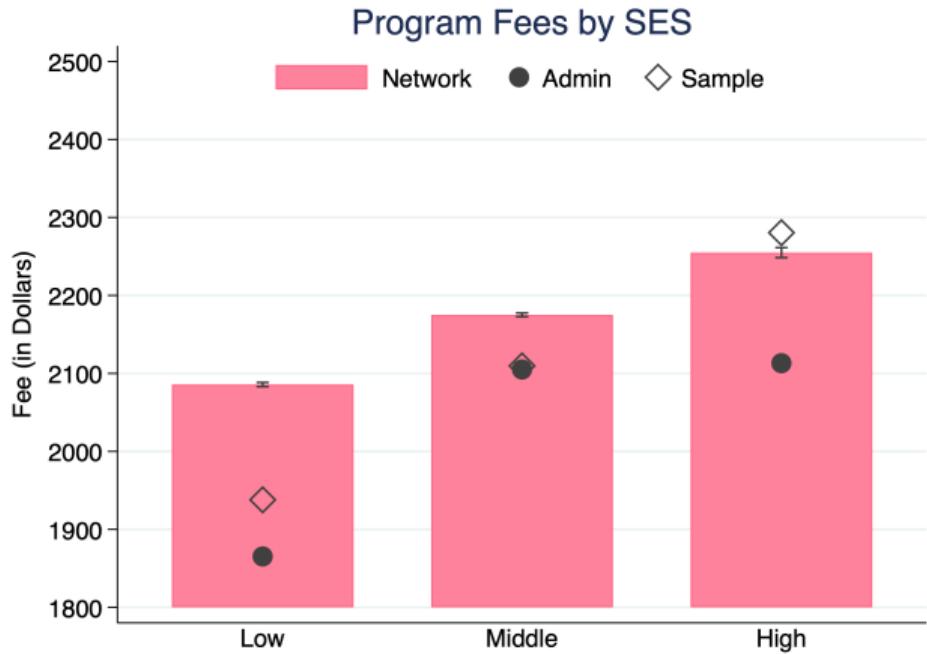
Referrer network SES composition

- Monotonic increase in Middle and High SES shares as SES increases

Composition by SES
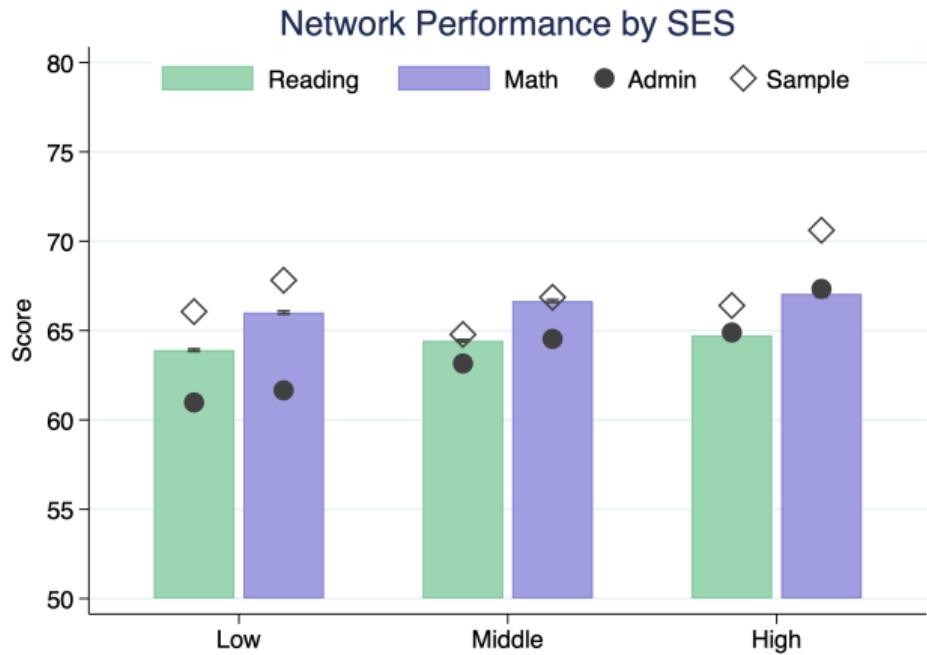
Network-level program sorting

- Net average monthly salary $350 in Colombia
- Networks of Low-SES sort into more affordable programs

Program Fees by SES
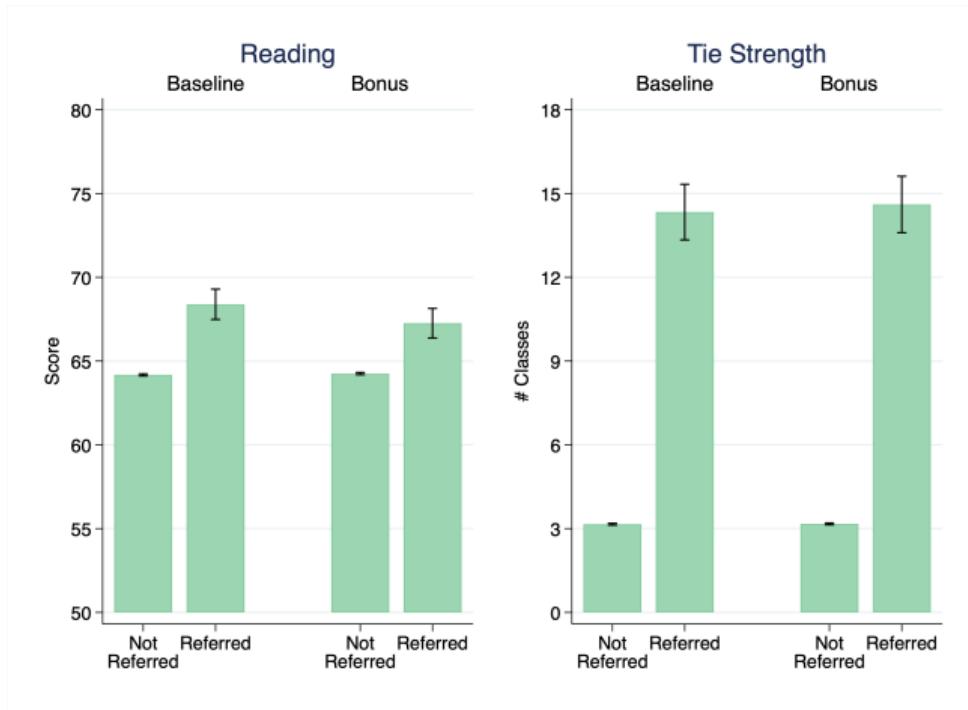
Referrer network performance

- Strongest selection w.r.t. performance for the Low-SES
- Network performance represents selection
- Comparable performance across SES

Network Performance by SES
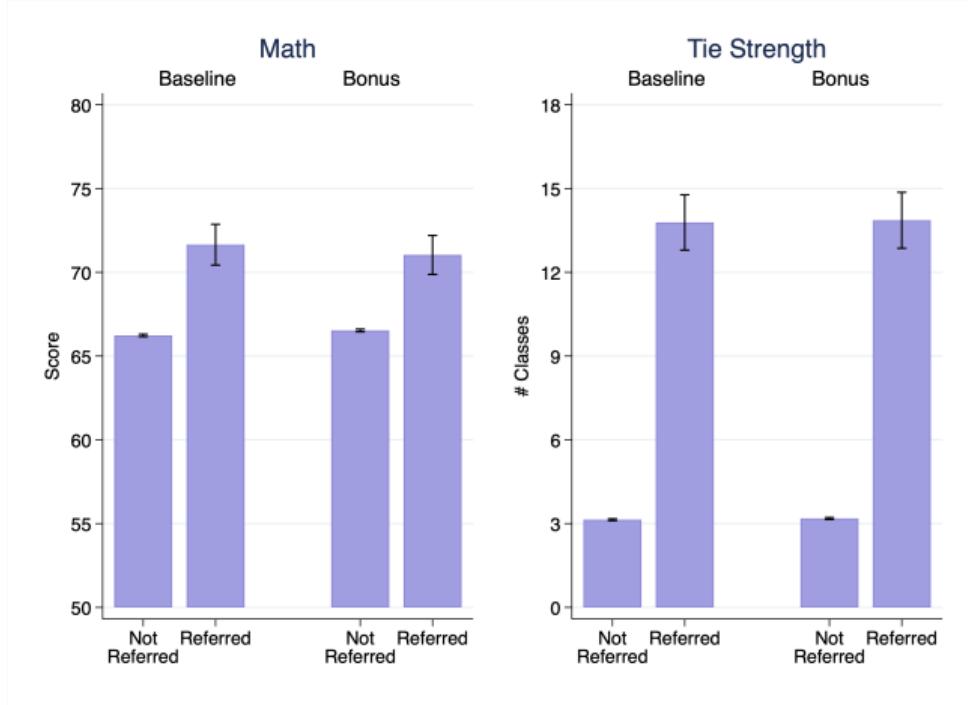
Referrals for Reading

- Referrals have higher reading scores and much higher tie strength
- No treatment effect on the referred (both $p > 0.08$)
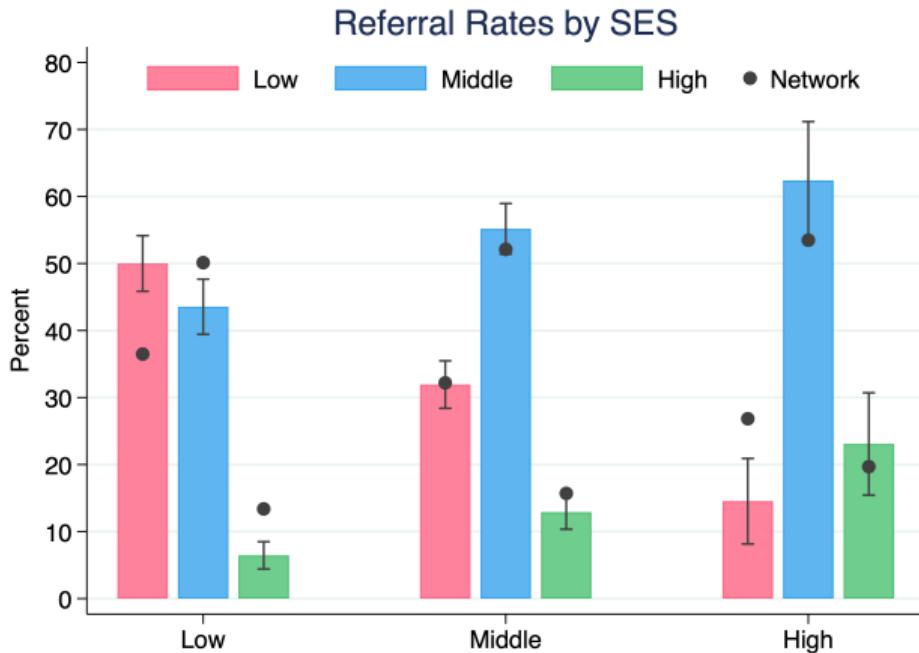
Referrals for Math

- Referrals have higher math scores and much higher tie strength
- No treatment effect on the referred (both $p > 0.1$)
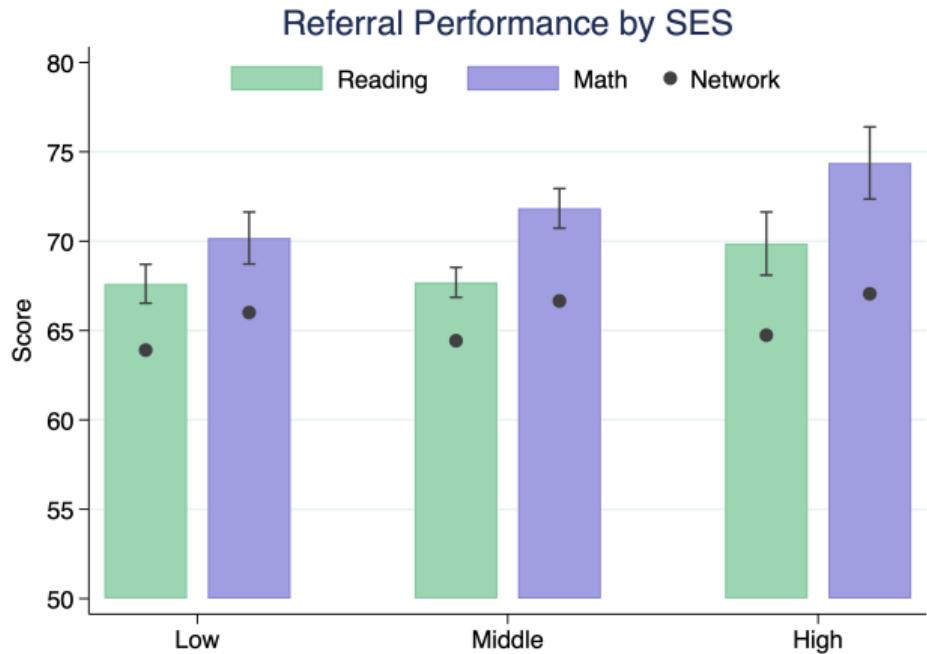
Referral SES composition

○ Large monotonic differences in referral shares as SES increases (all $p < 0.1$)

Referral Rates by SES
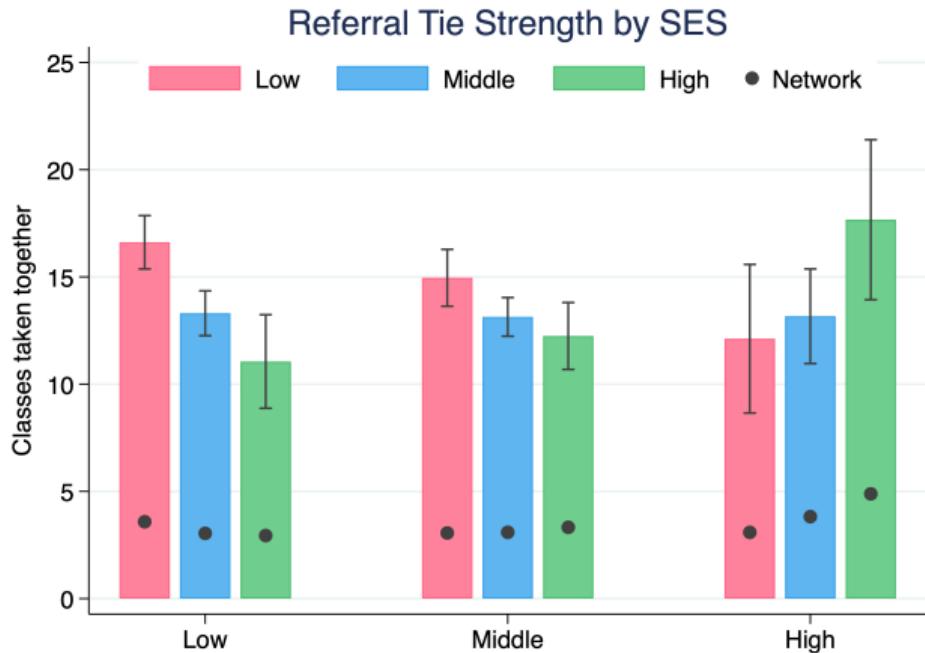
Referral performance

- Small differences in referral performance across SES (all $p > 0.08$)

Referral Performance by SES
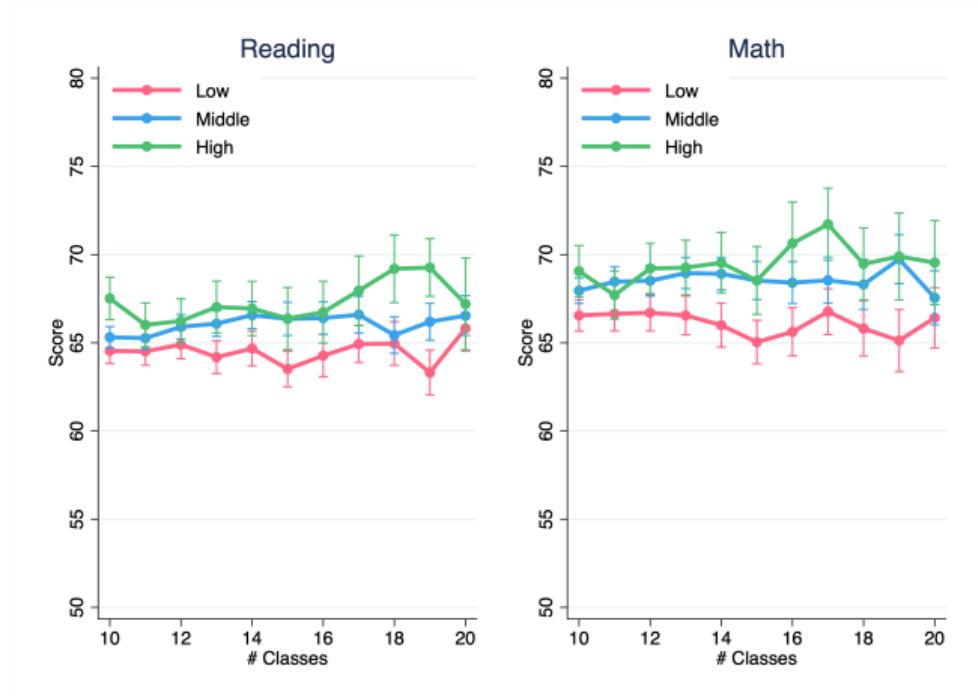
Referral tie strength

○ Low and High SES take more classes with their own SES

○ Low and High SES refer from those with whom they take more classes

Referral Tie Strength by SES

Referral performance and tie strength

○ High-SES referrers access slightly higher performing nominees

Is there a Low-SES bias in referrals?

Conditional Logit Model:

$$\Pr(\text{Refer}_{ij} = 1) = \Lambda\left(\beta_1 \text{SES}_j + \beta_2 \text{Score}_j + \beta_3 \text{Tie}_{ij} + \beta_4 \text{Score}_j \times \text{Tie}_{ij} + \alpha_i\right)$$

- Refer_{ij}: Binary outcome indicating whether individual i refers individual j
- SES_j: Referral j is Low, Middle, or High SES
- Score_j: Math or Reading z-score of referral j
- Tie_{ij}: z-score of number of classes taken together for i and j
- α_i: Individual fixed effect for referrer i

Features:

- Control for referrer networks other unobservables with FE
- Estimate separately for Math and Reading scores

Reading

- Reading score and tie strength are strong predictors of referrals
- No interaction between reading score and tie strength
- No evidence for a Low-SES bias (Alt. Specification)

	(1)	(2)	(3)
Middle-SES	-0.143*	0.007	0.007
	(0.086)	(0.101)	(0.102)
High-SES	-0.436***	-0.264*	-0.268*
	(0.134)	(0.155)	(0.156)
Reading Score		0.566***	0.513***
		(0.044)	(0.048)
Tie		0.949***	0.939***
		(0.031)	(0.032)
Score × Tie			0.030
			(0.018)
Observations	128,847	128,847	128,847
Individuals	673	673	673

Math

- Math score and tie strength are strong predictors of referrals
- Significant but small interaction between math score and tie strength
- No evidence for a Low-SES bias Alt. Specification

	(1)	(2)	(3)
Middle-SES	-0.161*	0.013	0.015
	(0.086)	(0.099)	(0.100)
High-SES	-0.470***	-0.331**	-0.346**
	(0.136)	(0.154)	(0.156)
Math Score		0.662***	0.546***
		(0.040)	(0.042)
Tie		0.885***	0.851***
		(0.029)	(0.029)
Score × Tie			0.089***
			(0.019)
Observations	128,150	128,150	128,150
Individuals	669	669	669

Reading across SES

- Restrict sample by referrer SES
- Low-SES bias against other SES
- No evidence for a bias against Low-SES Alt. Specification

	Low-SES (1)	Middle-SES (2)	High-SES (3)
Middle-SES	-0.266*	0.202	0.275
	(0.155)	(0.149)	(0.369)
High-SES	-0.572**	-0.052	-0.236
	(0.285)	(0.216)	(0.469)
Reading Score	0.548***	0.483***	0.553***
	(0.076)	(0.067)	(0.179)
Tie	0.873***	0.991***	0.986***
	(0.046)	(0.046)	(0.128)
Score × Tie	0.019	0.021	0.145**
	(0.027)	(0.027)	(0.072)
Observations	54,611	64,596	9,640
Individuals	275	340	58

Math across SES

- Restrict sample by referrer SES

- Low-SES bias against High-SES

- High-SES bias against Low-SES `Alt. Specification`

	Low-SES (1)	Middle-SES (2)	High-SES (3)
Middle	-0.208	0.101	0.986**
	(0.150)	(0.145)	(0.469)
High	-0.827***	-0.212	0.718
	(0.288)	(0.220)	(0.576)
Math Score	0.540***	0.526***	0.730***
	(0.064)	(0.060)	(0.128)
Tie	0.814***	0.870***	0.929***
	(0.041)	(0.043)	(0.128)
Score × Tie	0.067**	0.096***	0.160
	(0.028)	(0.029)	(0.097)
Observations	55,531	62,492	10,127
Individuals	283	327	59

Conclusion

- Referrers pick nominees based on performance and tie strength
- No support for a bias against Low-SES

Reading (Alt.)

- Alternative specification with binary Low-SES
- No evidence for a Low-SES bias
- Consistent with main model
  Return

	(1)	(2)	(3)
Low-SES	0.199**	0.041	0.042
	(0.083)	(0.100)	(0.100)
Reading Score		0.561***	0.509***
		(0.044)	(0.048)
Tie		0.951***	0.941***
		(0.031)	(0.032)
Score × Tie			0.029
			(0.018)
Observations	128,847	128,847	128,847
Individuals	673	673	673

Math (Alt.)

- Alternative specification with binary Low-SES
- No evidence for a Low-SES bias
- Consistent with main model
  Return

	(1)	(2)	(3)
Low-SES	0.220***	0.049	0.050
	(0.083)	(0.097)	(0.098)
Math Score		0.653***	0.538***
		(0.040)	(0.041)
Tie		0.887***	0.854***
		(0.029)	(0.030)
Score × Tie			0.088***
			(0.019)
Observations	128,150	128,150	128,150
Individuals	669	669	669

Reading across SES (Alt.)

- Alternative specification with binary Low-SES
- Low-SES bias against other SES
- No evidence for a bias against Low-SES
- Consistent with main model Return

	Low-SES (1)	Middle-SES (2)	High-SES (3)
Low-SES	0.312**	-0.155	-0.156
	(0.153)	(0.147)	(0.365)
Reading Score	0.545***	0.479***	0.539***
	(0.076)	(0.066)	(0.180)
Tie	0.876***	0.993***	0.987***
	(0.046)	(0.046)	(0.128)
Score × Tie	0.019	0.020	0.137**
	(0.027)	(0.027)	(0.069)
Observations	54,611	64,596	9,640
Individuals	275	340	58

Math across SES (Alt.)

- Alternative specification with binary Low-SES
- Low-SES bias against High-SES
- High-SES bias against Low-SES
- Consistent with main model
  Return

	Low-SES (1)	Middle-SES (2)	High-SES (3)
Low-SES	0.296**	-0.041	-0.916*
	(0.147)	(0.143)	(0.472)
Math Score	0.533***	0.517***	0.721***
	(0.063)	(0.060)	(0.129)
Tie	0.820***	0.872***	0.924***
	(0.042)	(0.043)	(0.129)
Score × Tie	0.064**	0.095***	0.158*
	(0.028)	(0.029)	(0.095)
Observations	55,531	62,492	10,127
Individuals	283	327	59