

ICFES Referrals

20-minute internal presentation for data analysis

Reha Tuncer - University of Luxembourg

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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

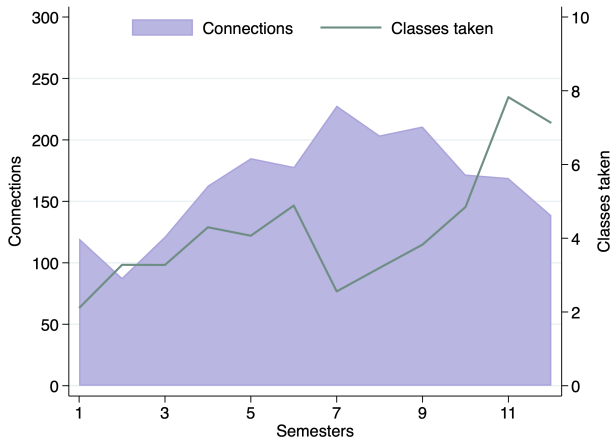
Balance between treatments

- 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

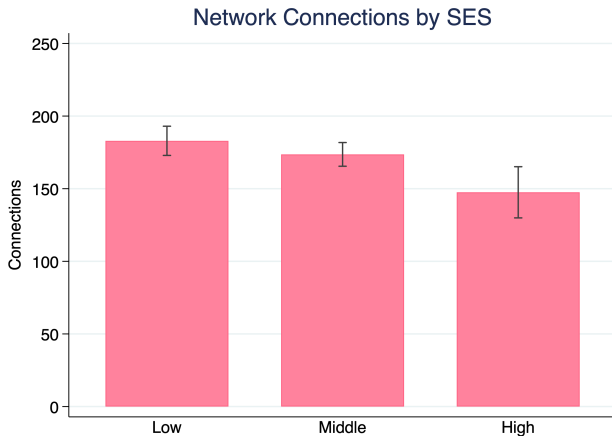
Referrer network size and tie strength

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



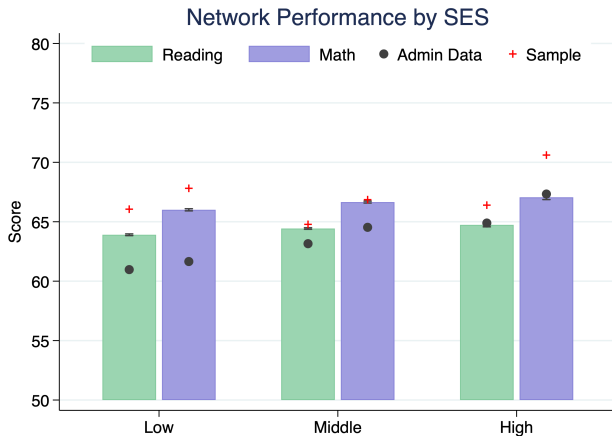
Referrer network connections

- Connections decrease as SES increases



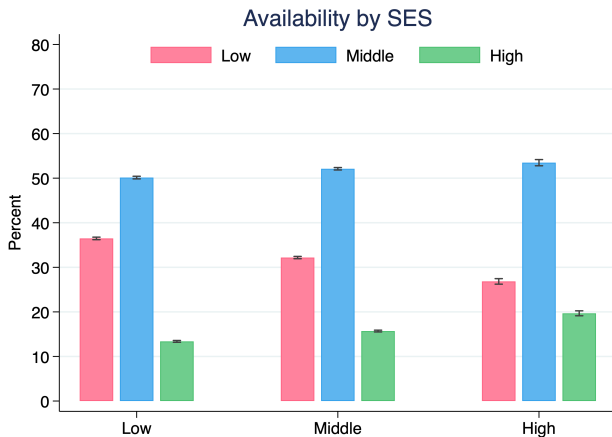
Referrer network performance

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



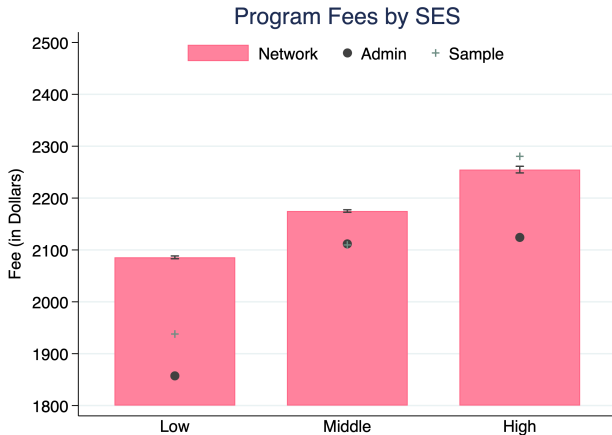
Referrer network SES composition

- Admin data shows 34% Low, 51% Med, and 15% High-SES
- Monotonic increase in availability across SES
- All differences are statistically significant ($p < 0.001$)



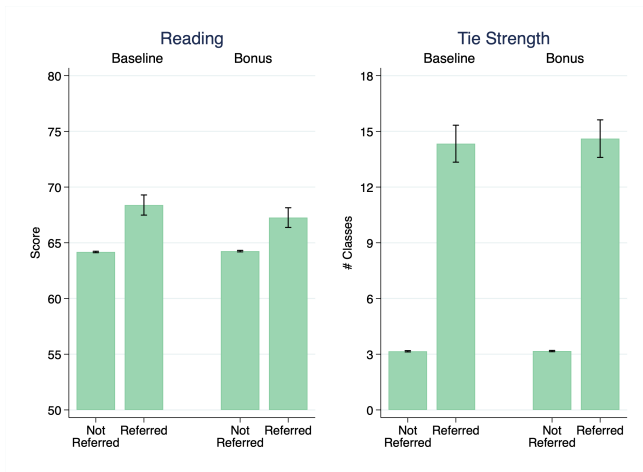
Network-level program sorting

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



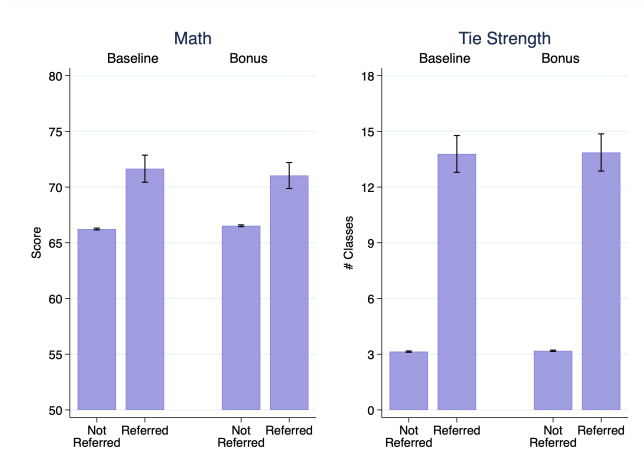
Referrals for Reading

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



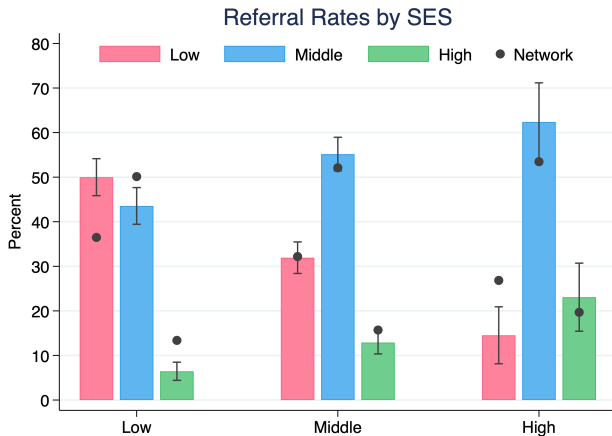
Referrals for Math

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



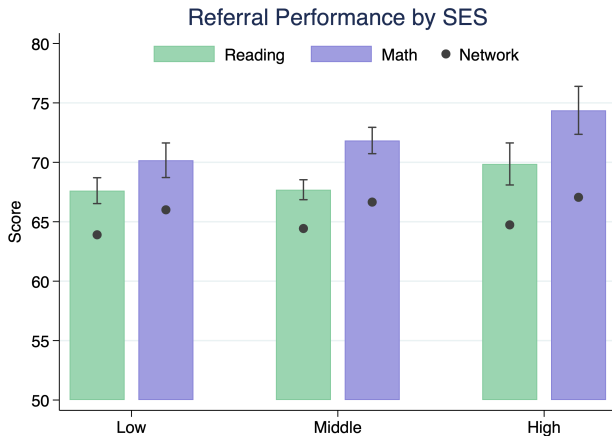
Referral SES composition

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



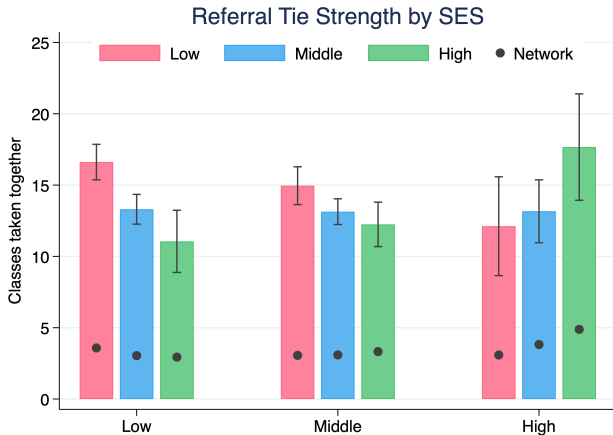
Referral performance

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



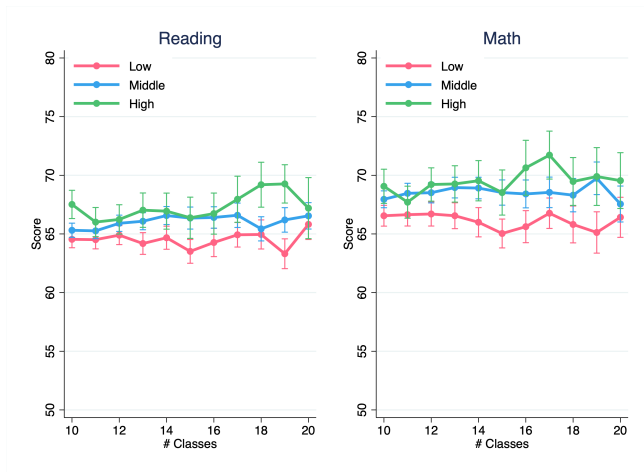
Referral tie strength

- 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 performance and tie strength

- High-SES referrers access slightly higher performing nominees



Regression Analysis

Empirical specification: referral decision

Conditional Logit Model:

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

- 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

Is there a Low-SES bias in Reading referrals?

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

Is there a Low-SES bias in Math referrals?

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

Is there a Low-SES bias in Reading referrals?

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

Alt. Specification

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

Is there a Low-SES bias in Math referrals?

- Restrict sample by referrer SES
- Low-SES bias against High-SES
- High-SES bias against Low-SES

Alt. Specification

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

Conclusion

- Referrers pick nominees based on performance and tie strength
- Evidence for a bias against Low-SES only in Math referrals from High-SES

Is there a Low-SES bias in Reading referrals? (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** (0.083)	0.041 (0.100)	0.042 (0.100)
Reading Score		0.561*** (0.044)	0.509*** (0.048)
Tie		0.951*** (0.031)	0.941*** (0.032)
Score x Tie			0.029 (0.018)
Observations	128,847	128,847	128,847
Individuals	673	673	673

Is there a Low-SES bias in Math referrals? (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*** (0.083)	0.049 (0.097)	0.050 (0.098)
Math Score		0.653*** (0.040)	0.538*** (0.041)
Tie		0.887*** (0.029)	0.854*** (0.030)
Score x Tie			0.088*** (0.019)
Observations	128,150	128,150	128,150
Individuals	669	669	669

Is there a Low-SES bias in Reading referrals? (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)	Med-SES (2)	High-SES (3)
Low-SES	0.312** (0.153)	-0.155 (0.147)	-0.156 (0.365)
Reading Score	0.545*** (0.076)	0.479*** (0.066)	0.539*** (0.180)
Tie	0.876*** (0.046)	0.993*** (0.046)	0.987*** (0.128)
Score x Tie	0.019 (0.027)	0.020 (0.027)	0.137** (0.069)
Observations	54,611	64,596	9,640
Individuals	275	340	58

Is there a Low-SES bias in Math referrals? (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)	Med-SES (2)	High-SES (3)
Low-SES	0.296** (0.147)	-0.041 (0.143)	-0.916* (0.472)
Math Score	0.533*** (0.063)	0.517*** (0.060)	0.721*** (0.129)
Tie	0.820*** (0.042)	0.872*** (0.043)	0.924*** (0.129)
Score x Tie	0.064** (0.028)	0.095*** (0.029)	0.158* (0.095)
Observations	55,531	62,492	10,127
Individuals	283	327	59