

Preferential Biases in Referrals: Class differences in social networks

1 hour internal presentation

Reha Tuncer - University of Luxembourg

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Motivation

- Understand persistent class differences in labor market outcomes, like the underrepresentation of Low-SES researchers in academia [Stansbury and Rodriguez, 2024]
- Focus on social class biases in referrals
 - Numbers 1
 - Numbers 2

Procedures

- Recruited participants by emailing 4500 students (>1 st year)
- Online experiment in Qualtrics
- Average time spent 30 minutes
- Randomly select 1 of every 10 for pay
- Average payment of 80 USD (includes show-up fee)
- 840 complete responses
- Final sample 734 participants who referred someone they took a class with

Selection into the experiment

- Higher performing students overrepresented
- 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	

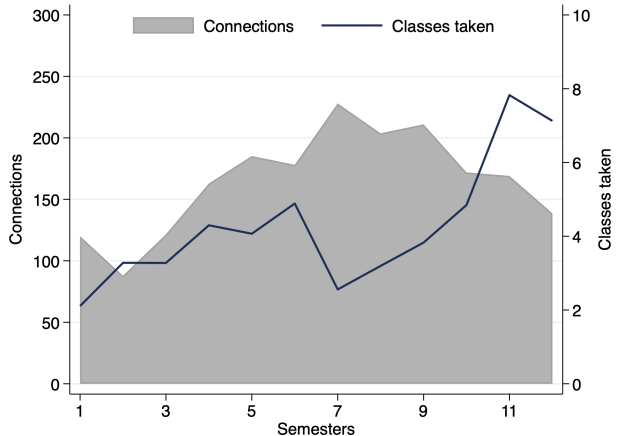
Balance between treatments

- 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

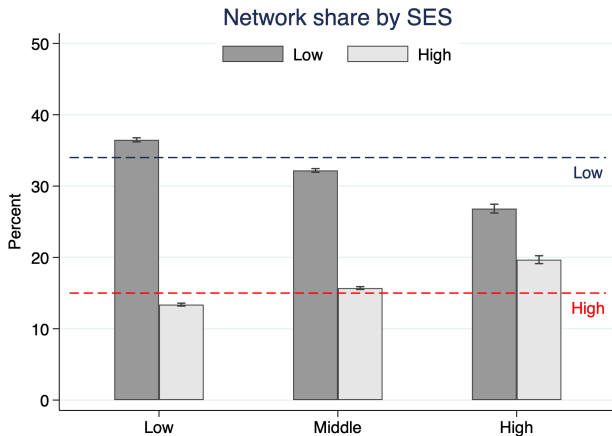
Network size and tie strength

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



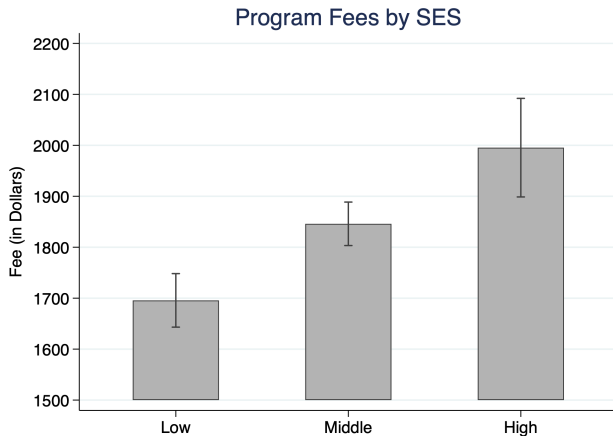
Network-level SES shares

- 35 % of UNAB is Low-SES, and 15 % High-SES
- Network shares are very different from the population
- Why?



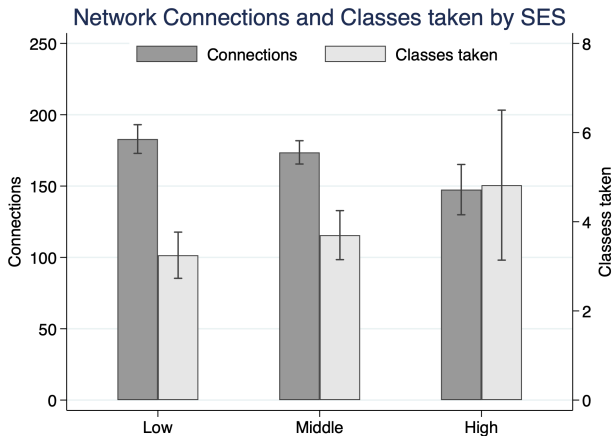
Selection into programs

- Low-SES study in more affordable programs
- Large difference as net average monthly salary around \$350



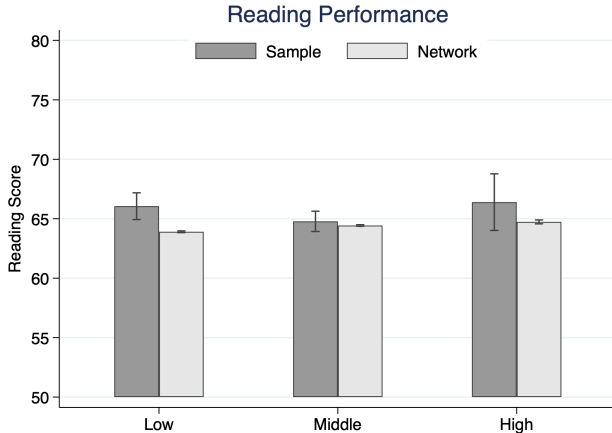
Selection into programs

- Program selection affects the network dynamics
- Connections decrease with SES
- Classes taken with peers increases with SES
- How about entry exam performance?



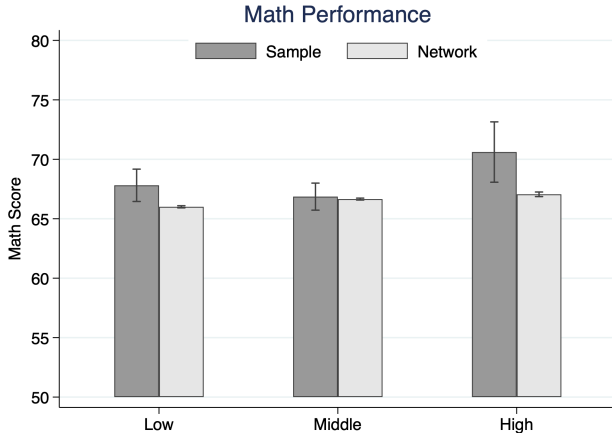
Reading performance

- Similar performance across SES
- Network averages are close to the referrer sample



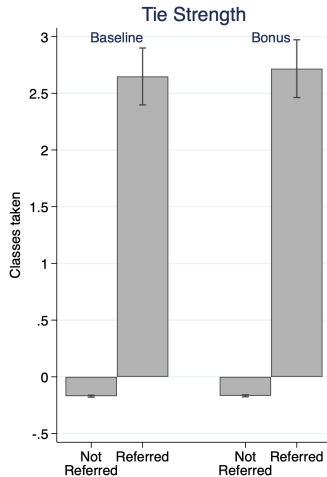
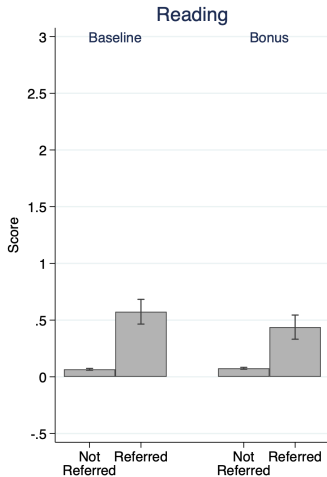
Math performance

- Similar performance for Reading and Math
- Who gets a referral?



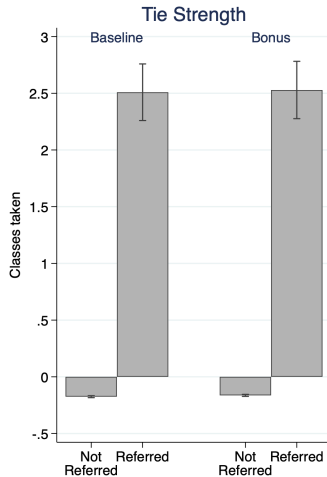
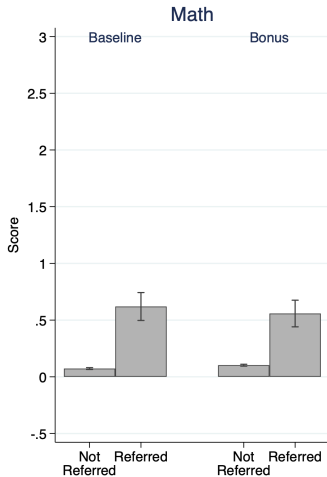
Referrals for Reading

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



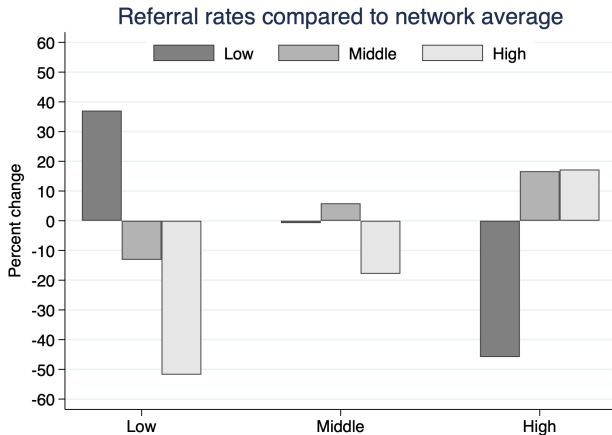
Referrals for Math

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



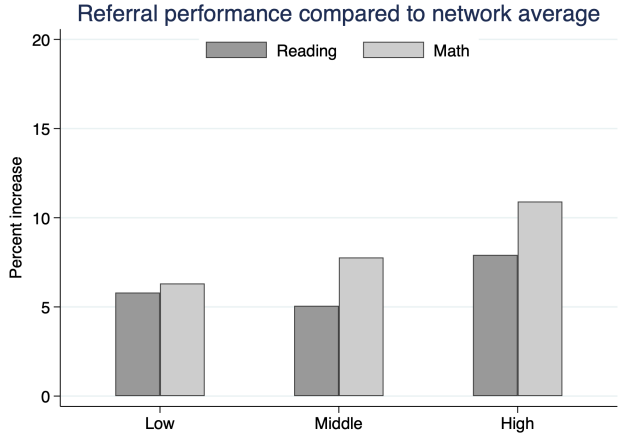
Referral SES composition

- Stark differences in referral rates considering network compositions were imbalanced to begin with
- Do differences impact scores and tie strength?



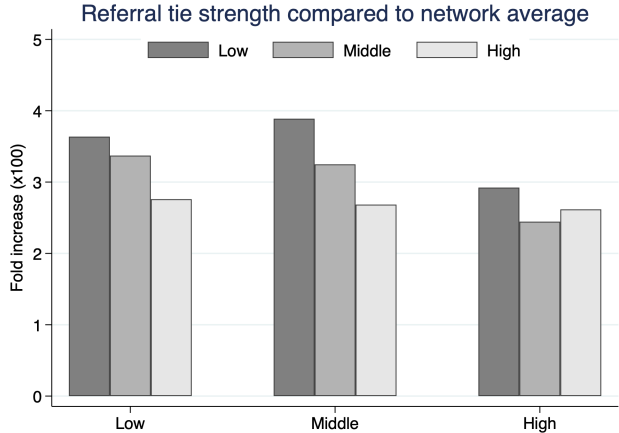
Referral performance

- Consistent performance increase in referrals
- High-SES seem to refer slightly better



Referral tie strength

- Very large but consistent increase in referral tie strength



Is there a SES bias in referrals?

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 : Standardized Math or Reading score of referral j
- Tie_{ij} : Standardized number of classes taken together for i and j
- α_i : Individual fixed effect for referrer i

Features:

- FE controls for referrer network structure and other unobservables

Bias against High-SES in aggregate

- Bias against High-SES
- Score and tie strength are strong predictors of referrals
- Small interaction between score and tie strength
- How about by referrer SES?

	(1)	(2)	(3)
Low	0.152** (0.070)	-0.013 (0.080)	-0.013 (0.080)
High	-0.300*** (0.108)	-0.306*** (0.115)	-0.315*** (0.116)
Nominee score		0.618*** (0.034)	0.527*** (0.035)
Tie		0.916*** (0.026)	0.894*** (0.026)
Score x Tie			0.059*** (0.015)
Observations	256997	256997	256997
Ind.	734	734	734
Chi-test	17.44	1602.42	1640.06

SES extremes reveal origin of the bias

- Low-SES referrers are biased against High-SES and vice-versa
- Mid-SES show smallest bias to either extreme
- Does the bias impact referral performance?

	Low-SES (1)	Middle-SES (2)	High-SES (3)
Low	0.237* (0.124)	-0.155 (0.114)	-0.583* (0.331)
High	-0.451** (0.223)	-0.281* (0.157)	-0.382 (0.293)
Nominee score	0.540*** (0.056)	0.503*** (0.049)	0.650*** (0.116)
Tie	0.842*** (0.037)	0.930*** (0.039)	0.959*** (0.104)
Score x Tie	0.043* (0.022)	0.057*** (0.021)	0.148** (0.066)
Observations	110142	127088	19767
Ind.	301	366	67
Chi-test	804.58	766.33	144.77

Who makes better referrals?

OLS Model:

$$\text{Premium}_{ij} = \beta_0 + \beta_1 \text{SES}_i + \beta_2 \text{Score}_i + \beta_3 \Delta \text{OBIf}_i + \beta_4 \Delta \text{NBIf}_i + \mathbf{X}'_i \boldsymbol{\gamma} + \epsilon_i$$

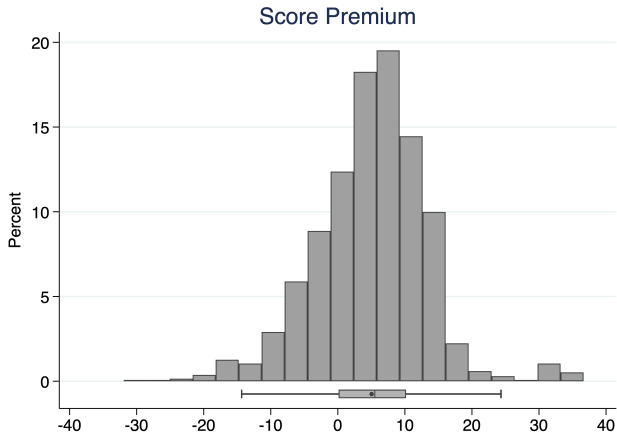
- Premium_{ij} : Nominee j 's test z-score minus mean score of i 's network
- SES_i : Referrer i 's socioeconomic status (Low, Middle, High)
- ΔOBIf_i , ΔNBIf_i : i 's beliefs on own and nominee test scores minus actual scores (standardized)
- Score_i : Referrer i 's own test z-score

Controls:

- Referrer i 's treatment (Baseline vs. Bonus)
- Test area indicator (Math vs. Reading)
- Number of classes taken together for i and nominee j

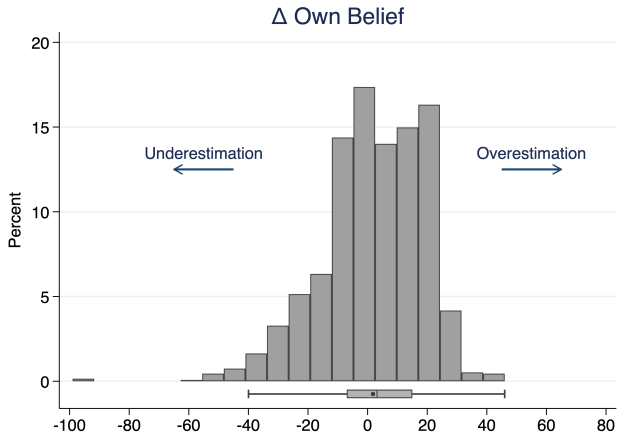
Referrals are better than network average

- Defined as nominee j 's score minus network average for each referrer i across Math and Reading
- No difference between SES groups [See](#)



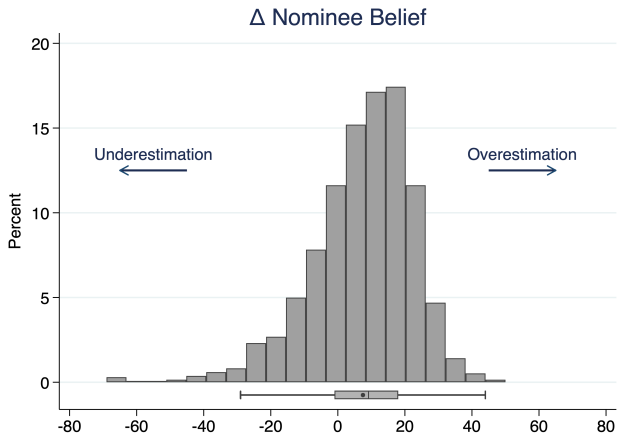
Beliefs about own scores are accurate

- Defined as referrer i 's own beliefs minus their score across Math and Reading
- No difference between SES groups [See](#)



Beliefs about nominees reveal a positive bias

- Defined as referrer i 's beliefs about nominee j minus j 's score across Math and Reading
- No difference between SES groups [See](#)
- Did not collect beliefs about SES group performance in general



Referrer score and beliefs predict better referrals

- Referrer i 's score predicts premium
- Accuracy on own scores increases premium [See](#)
- Accuracy on nominee beliefs increases premium [See](#)
- No effect of SES
- How about the interaction between SES, scores and beliefs?

	(1)	(2)	(3)
Low	0.068 (0.066)	0.031 (0.061)	0.026 (0.061)
High	0.219** (0.099)	0.158 (0.100)	0.155 (0.100)
Own score		0.269*** (0.031)	0.264*** (0.032)
Δ own belief		0.237*** (0.038)	0.241*** (0.038)
Δ nominee belief		-0.383*** (0.045)	-0.378*** (0.044)
Controls	No	No	Yes
Observations	1,342	1,342	1,342
Ind.	734	734	734

No heterogeneity in beliefs and performance

- **Marginally** stronger effect of own score for Low-SES (joint F-test $p < 0.1$)
- Effect of own belief driven by outliers

	(1)
Own score x Low	0.128* (0.065)
Own score x High	-0.043 (0.101)
Δ own belief x Low	0.009 (0.082)
Δ own belief x High	-0.248** (0.118)
Δ nominee belief x Low	0.002 (0.094)
Δ nominee belief x High	0.039 (0.159)
Observations	1,342
Individuals	734

Conclusion

- Networks are separated by SES
- Referrers pick close ties and better performers from respective networks
- Low and High-SES exhibit bias against one another and worsen the bias
- Referrers uniformly nominate better as their own scores get higher, have more accurate beliefs about own and nominee scores
- Referrals refer the same way, but **prefer** nominating similar others

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)
Low-SES	0.143* (0.086)	-0.007 (0.101)	-0.007 (0.102)
High-SES	-0.293** (0.128)	-0.271* (0.139)	-0.275** (0.139)
Nominee 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	128847	128847	128847
Ind.	673	673	673
Chi-test	10.81	1117.46	1145.58

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)
Low-SES	0.161* (0.086)	-0.013 (0.099)	-0.015 (0.100)
High-SES	-0.309** (0.131)	-0.343** (0.142)	-0.361** (0.144)
Nominee 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	128150	128150	128150
Ind.	669	669	669
Chi-test	12.38	1122.75	1154.40

Reading (Low-SES vs others)

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

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	(1)	(2)	(3)
Low-SES	0.199** (0.083)	0.041 (0.100)	0.042 (0.100)
Nominee 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
Ind.	673	673	673
Chi-test	5.73	1100.40	1127.92

Math (Low-SES vs others)

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

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	(1)	(2)	(3)
Low-SES	0.220*** (0.083)	0.049 (0.097)	0.050 (0.098)
Nominee 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
Ind.	669	669	669
Chi-test	7.02	1124.24	1156.08

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)
Low-SES	0.266* (0.155)	-0.202 (0.149)	-0.275 (0.369)
High-SES	-0.307 (0.268)	-0.254 (0.186)	-0.511 (0.377)
Nominee 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	54611	64596	9640
Ind.	275	340	58
Chi-test	531.49	553.06	97.57

Reading across SES (Low-SES vs others)

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

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	Low-SES (1)	Other-SES (2)
Low-SES	0.312** (0.153)	-0.160 (0.137)
Nominee score	0.545*** (0.076)	0.486*** (0.062)
Tie	0.876*** (0.046)	0.996*** (0.044)
Score x Tie	0.019 (0.027)	0.036 (0.025)
Observations	54611	74236
Ind.	275	398
Chi-test	517.41	627.40

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)
Low-SES	0.208 (0.150)	-0.101 (0.145)	-0.986** (0.469)
High-SES	-0.619** (0.283)	-0.313 (0.195)	-0.269 (0.381)
Nominee 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	55531	62492	10127
Ind.	283	327	59
Chi-test	525.71	561.64	110.76

Math across SES (Low-SES vs others)

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

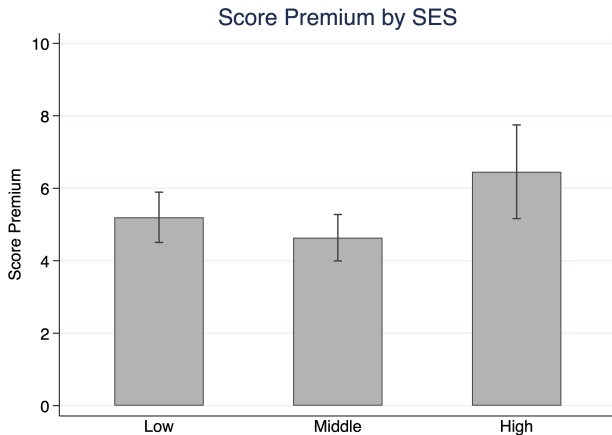
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	Low-SES (1)	Other-SES (2)
Low-SES	0.296** (0.147)	-0.138 (0.136)
Nominee score	0.533*** (0.063)	0.541*** (0.055)
Tie	0.820*** (0.042)	0.882*** (0.042)
Score x Tie	0.064** (0.028)	0.106*** (0.027)
Observations	55531	72619
Ind.	283	386
Chi-test	523.84	647.99

No differences for Score Premium by SES

- Middle-SES refer slightly worst (joint F-test, $p < 0.1$)

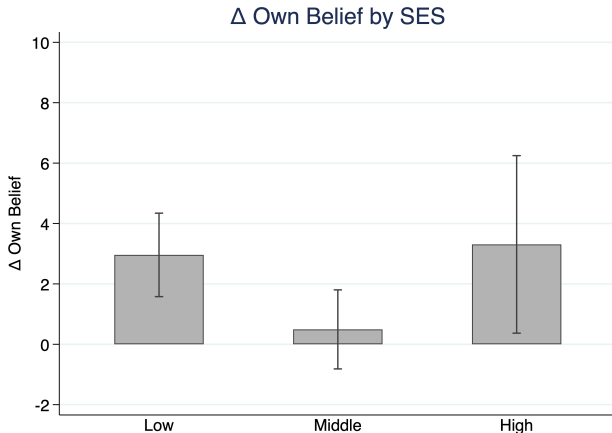
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No differences for own score beliefs by SES

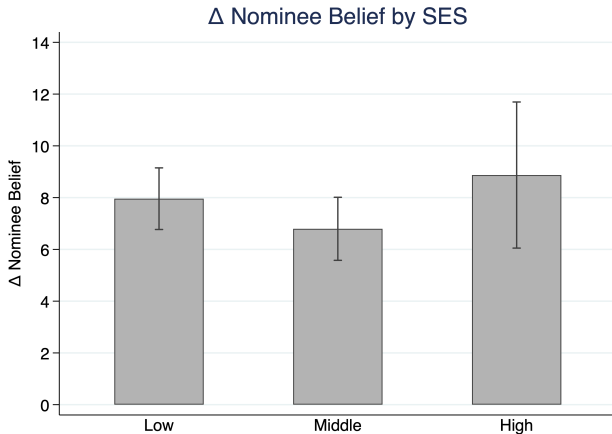
- Middle-SES are slightly more accurate (joint F-test, $p < 0.1$)

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No differences for nominee score beliefs by SES

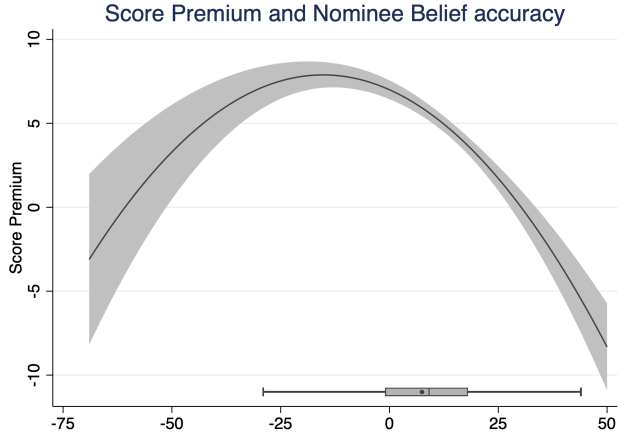
- No difference (joint F-test, $p = 0.41$) [Return](#)



Nominee Beliefs are rewarded for accuracy

- Negative coefficient is explained by quadratic shape

Return



Own score beliefs are rewarded for accuracy

- Positive coefficient is explained by quadratic shape and extreme outliers

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