

# Class differences in social networks: Evidence from a referral experiment

1-hour presentation

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16 May 2025

# Motivation

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- Understand persistent class differences in labor the market, like the underrepresentation of Low-SES researchers in elite academic institutions (Stansbury and Rodriguez, 2024)
- Focus on the role of class biases in **social networks** and in **referrals**

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- Hiring via connections benefit firms and workers alike
  - 40-50% of all jobs found through social connections (Granovetter, 1995; Topa, 2019)
  - Higher hiring probability, lower turnover, and wage premiums for referred workers (Brown et al., 2016; Dustmann et al., 2016; Friebe et al., 2023)
- Network connections are not formed at random
  - Networks exhibit homophily in social class, as people connect more often with similar others (McPherson et al., 2001)
  - Initial differences in average network employment status or education level can propagate inequality in labor market outcomes (Calvó-Armengol and Jackson, 2004; Calvó-Armengol et al., 2009)
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# Referrals amplify network effects

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- Differential treatment within existing networks, e.g., referral of strong ties such as family and/or close friends (Beaman and Magruder, 2012; Hederos et al., 2025; Kramarz and Skans, 2014)
- As well as biases against groups, e.g., race and gender (Beaman et al., 2018; DiTomaso, 2013; Smith, 2005)
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# Contribution

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- Unique setup where we observe both an entire network and referral behaviors within that network, isolating the processes driving Low-SES inequality

# Research Questions

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- *Could the class differences in labor market be driven by biases in referrals or by network structure?*
- *Do network structures differ by social class?*
- *Are there social class biases in referrals beyond the network structure?*

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# Setting

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- Universidad Autónoma de Bucaramanga (UNAB)
- Approx. 6000 students across all social classes
- Administrative data including **SES**, age, program, GPA, **courses attended**, year of entry, and the **entry exam scores**



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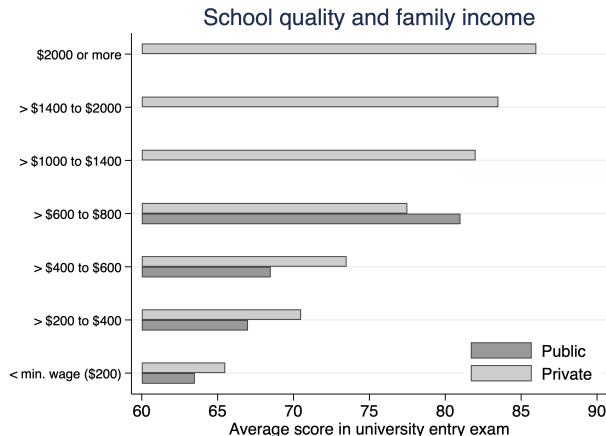
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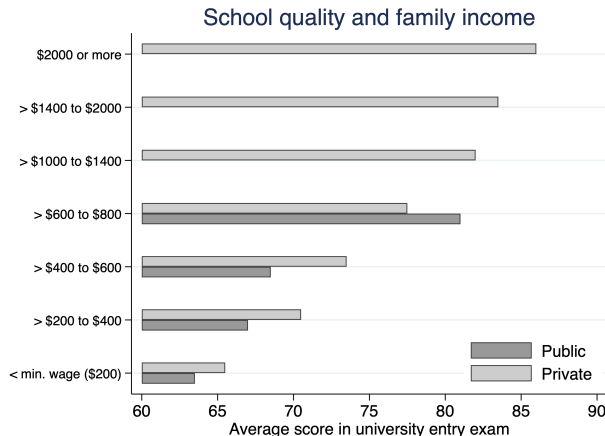
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- Families spend considerable amounts to provide kids with private higher education
- Non-elite private universities like UNAB cater to all social classes



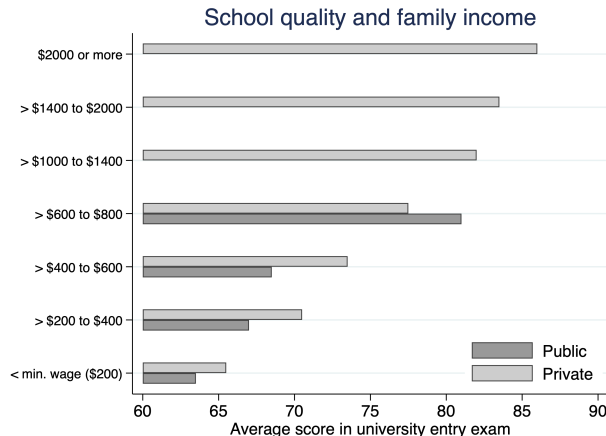
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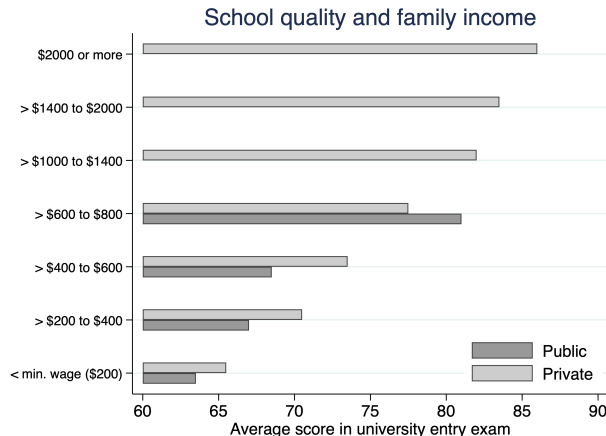
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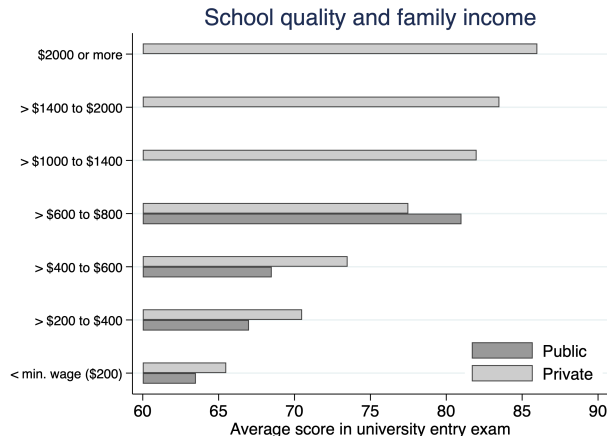
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# Design I: Referrals and Network

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- Ask students to refer someone they have taken at least one course with
- Observe the entire co-enrollment network at UNAB
- Avoid biases in recall for network construction (+)
- A proxy/subset of actual friendship network (−)

## Your recommendation

We are interested in your recommendation of the person you consider best to solve similar problems to those in the **Math test**.

\* Only someone with whom you have taken at least one class...

\* We will not contact your recommendation...

Please write the name of your recommendation:

John
John Lennon (Music - 2018)
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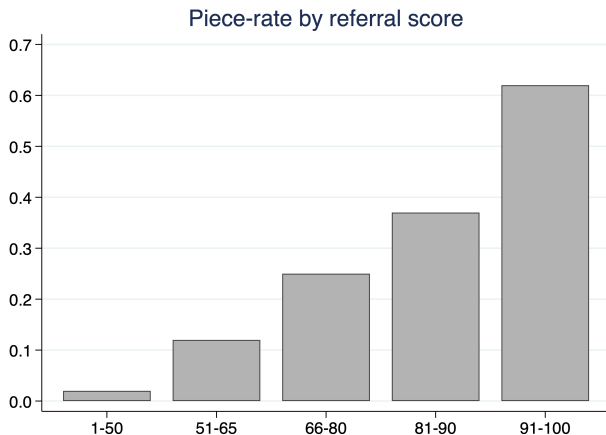
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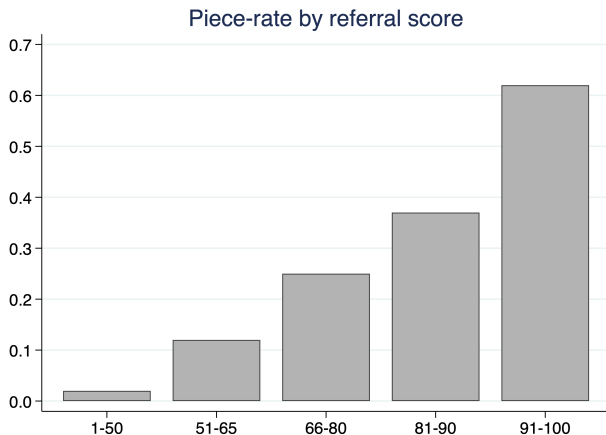
## Design II: Incentives

- Pay according to the student's math and verbal scores in the national entry exam
- Incentivize better referrals by increasing monetary reward as referral score goes higher
- Objective and widely accepted performance measure (+)
- Not a real job opportunity (—)



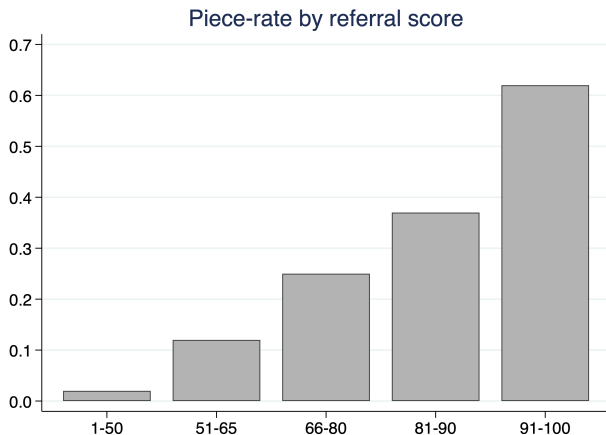
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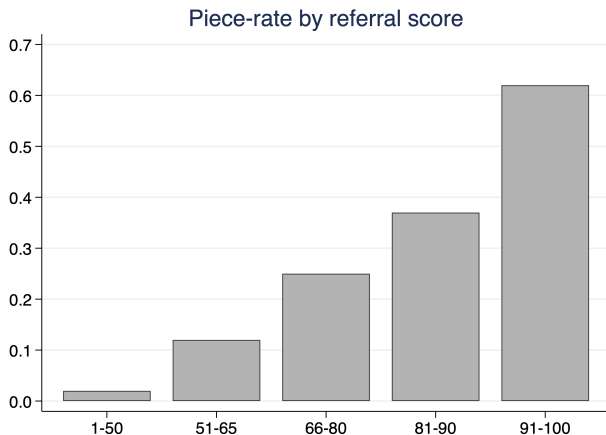
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- **Baseline:** Pay by referral score (Merit)
- **Bonus:** Pay by referral score and a fixed sum for the referred network member (Social concern)



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# Procedures

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- Recruited participants by emailing 4500 students ( $>1$ st year)
- 30 minute online experiment in Qualtrics
- Average payment of 8 USD
- 840 complete responses
- Final sample 734 participants who referred someone they took a course with

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# Balance between treatments

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- 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
Courses taken	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 descriptives

# Network size and courses taken together

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



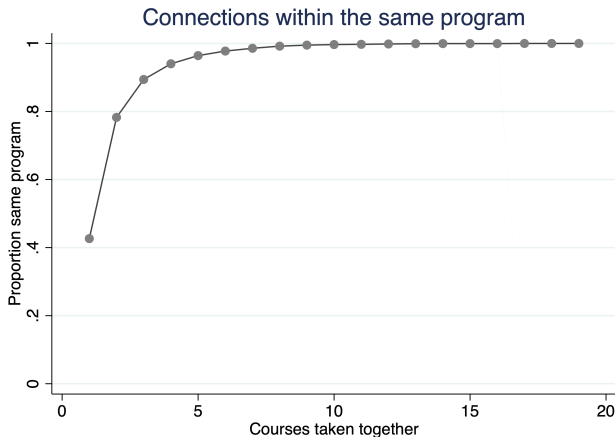
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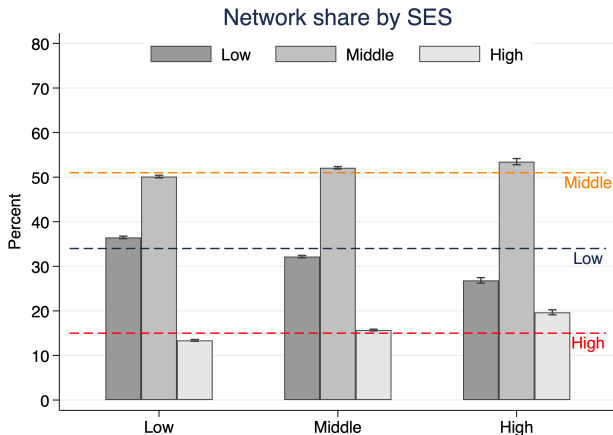
# Courses taken together

- Taking more than 5 courses together implies studying in the same program



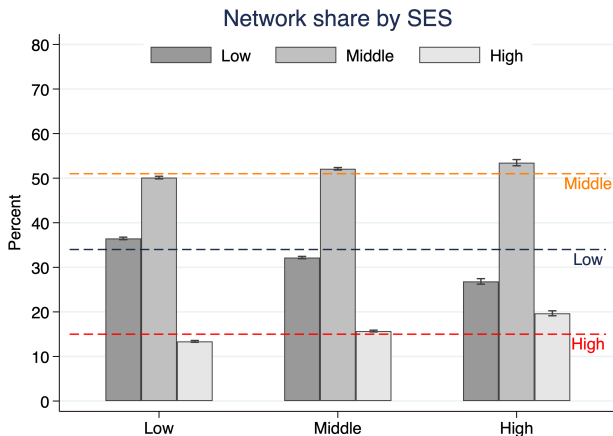
# Network-level SES shares

- 51 % of UNAB is **Middle-SES**, 34 % **Low-SES**, and 15 % **High-SES**
- Network shares are very different from the UNAB population
- Why?



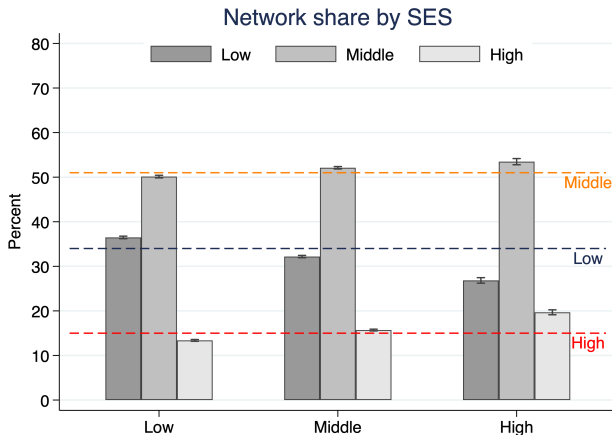
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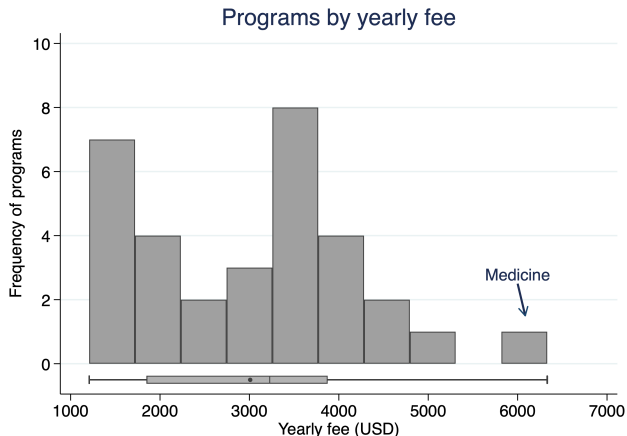
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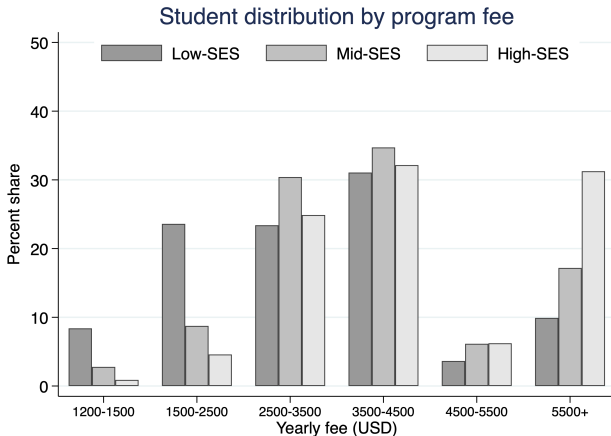
# Selection into programs

- UNAB prices each program differently based on its cost
- Medicine is the largest and the most expensive program at UNAB
- A much larger share of High-SES study in medicine
- Minimum legal monthly wage at \$200 and average monthly net wage at \$350



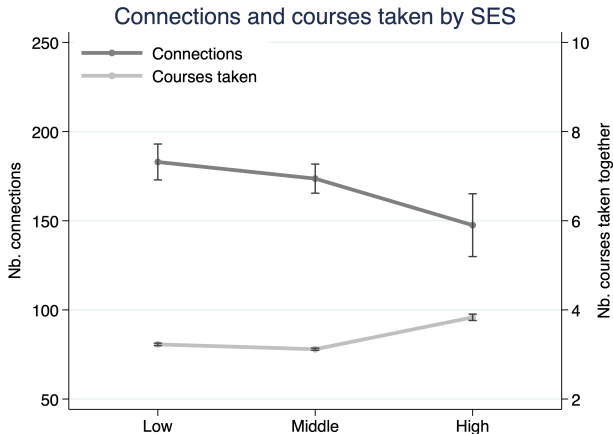
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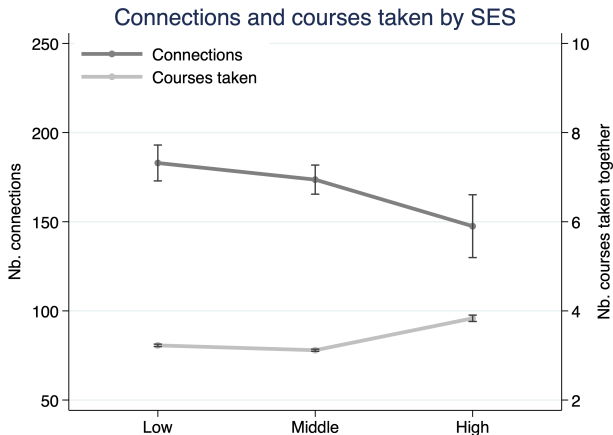
# Program selection and network characteristics

- Connections decrease with SES
- Courses taken with peers increases with SES
- High-SES take more courses with their own [See](#)



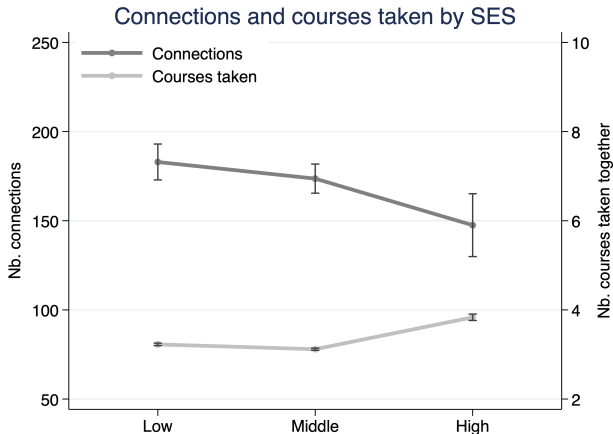
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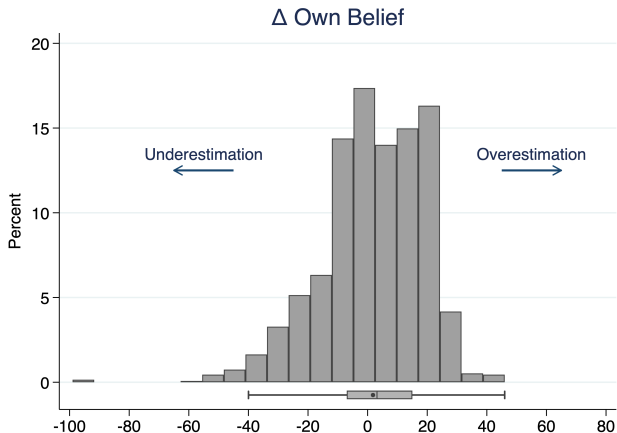
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# Results: Referrals versus Networks

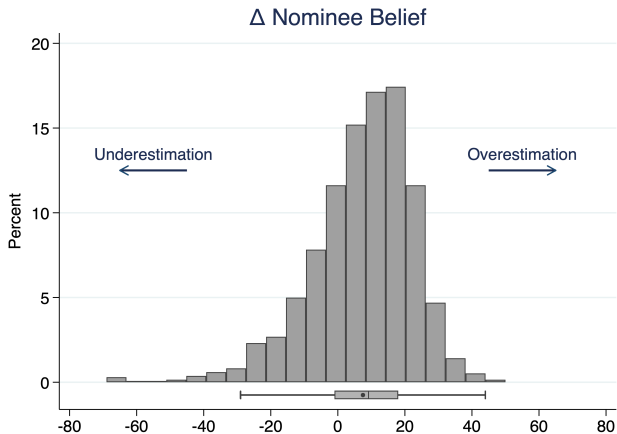
# Participants know their own exam ranking

- Defined as referrer  $i$ 's own ranking belief minus their actual rank across Math and Reading
- No difference between SES groups [See](#)



# Participants know their nominees' exam ranking

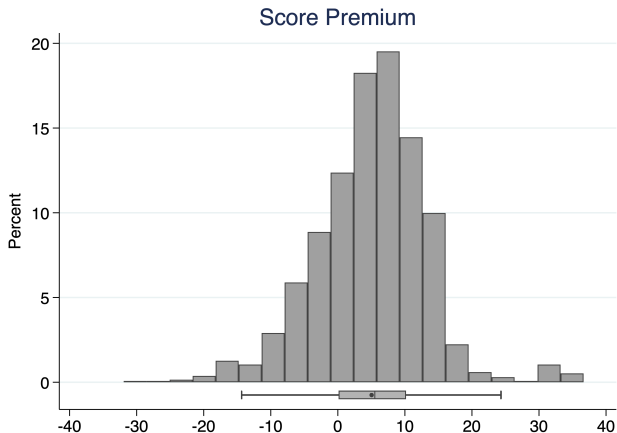
- Defined as referrer  $i$ 's belief about nominee  $j$ 's ranking minus  $j$ 's actual rank across Math and Reading
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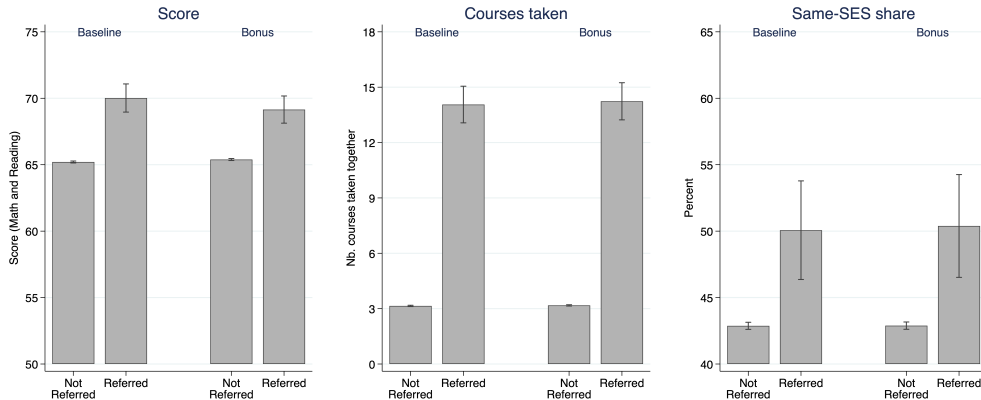


# Referrals are better than network average

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



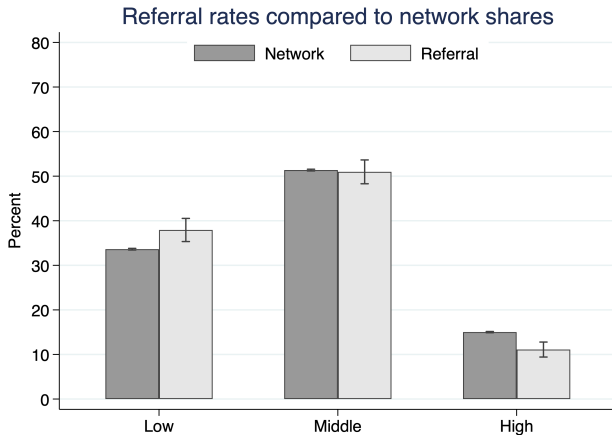
# Who gets the referral?



- Higher scores, more courses together, and more often same-SES
- Marginal treatment effect on the referred scores ( $t$ -test,  $p = 0.08$ )

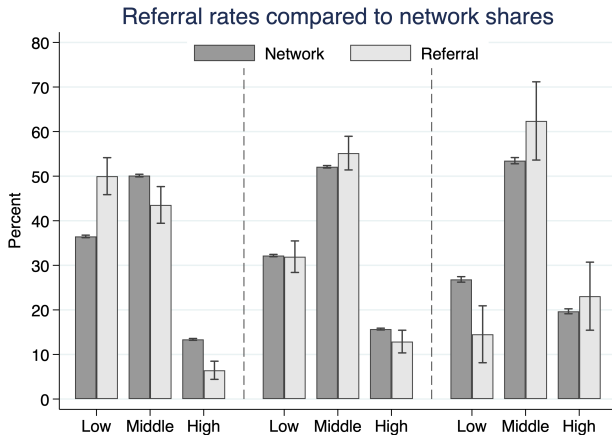
# No overall bias against low-SES in referrals

- More referrals for Low-SES and less for High-SES



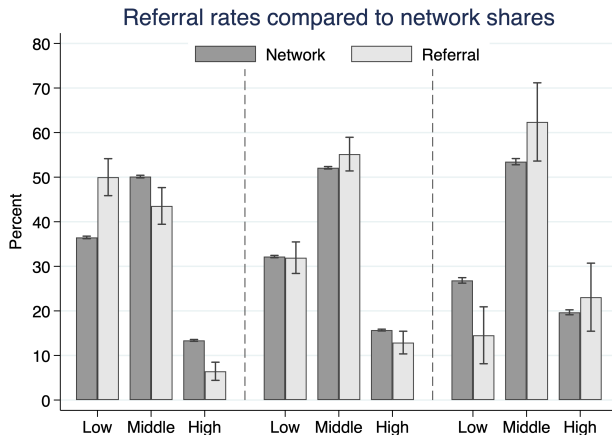
# Referral SES composition

- Stark differences in referral rates by SES
- Is program selection driving differences in referrals?



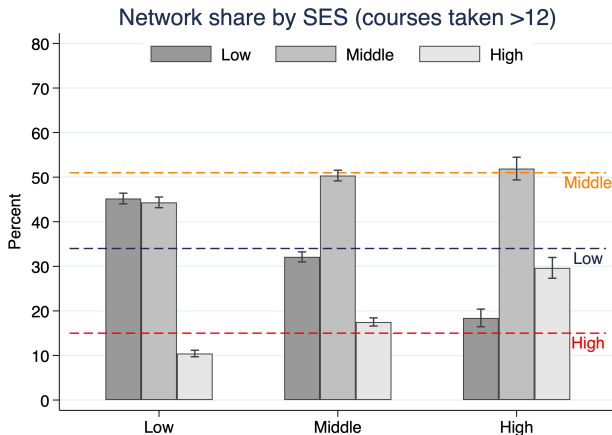
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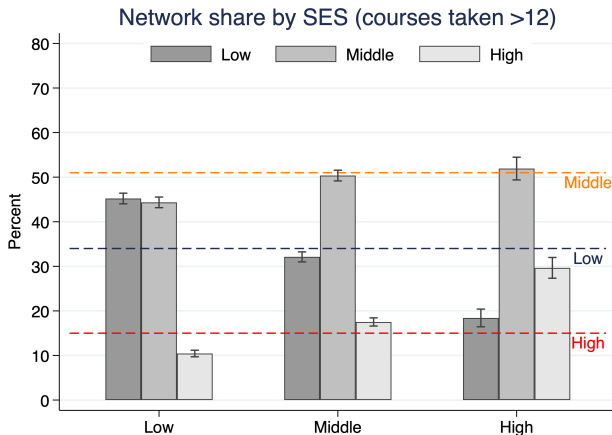
# Referrer networks may drive differences

- By restricting the network to courses taken above 12, we observe even larger differences in SES shares
- Own SES shares are even higher than network averages except for Middle-SES
- Do differences persist after controlling for classes taken?



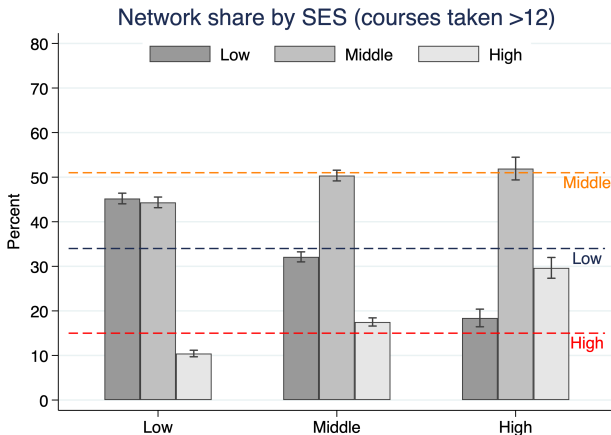
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# Is there a SES bias in referrals?

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## Conditional FE Logit:

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

- $\text{Refer}_{ij}$ : Binary outcome indicating whether individual  $i$  refers individual  $j$
- $\text{SES}_j$ : Referral  $j$  is Low, Middle, or High SES
- $\text{Courses}_{ij}$ : Standardized number of courses taken together for  $i$  and  $j$
- $\text{Score}_j$ : Standardized Math or Reading score of referral  $j$
- $\alpha_i$ : Individual fixed effect for referrer  $i$
- Pool for each SES group

# Low-SES referrers are biased

- Marginal bias for favoring own SES
- Strong bias against High-SES nominees

	(1)	(2)	(3)
Low	0.453*** (0.109)	0.242** (0.123)	0.237* (0.124)
High	-0.584*** (0.211)	-0.445** (0.222)	-0.451** (0.223)
Courses taken		0.859*** (0.036)	0.842*** (0.037)
Nominee score		0.607*** (0.052)	0.540*** (0.056)
Score x Courses taken			0.043* (0.022)
Observations	110142	110142	110142
Ind.	301	301	301
Chi-test	33.47	789.87	804.58

# Middle-SES referrers are not biased

- Marginal bias against High-SES nominees

	(1)	(2)	(3)
Low	-0.019 (0.098)	-0.159 (0.114)	-0.155 (0.114)
High	-0.255* (0.145)	-0.274* (0.157)	-0.281* (0.157)
Nominee score		0.587*** (0.047)	0.503*** (0.049)
Courses taken		0.948*** (0.038)	0.930*** (0.039)
Score x Courses taken			0.057*** (0.021)
Observations	127088	127088	127088
Ind.	366	366	366
Chi-test	3.18	756.06	766.33

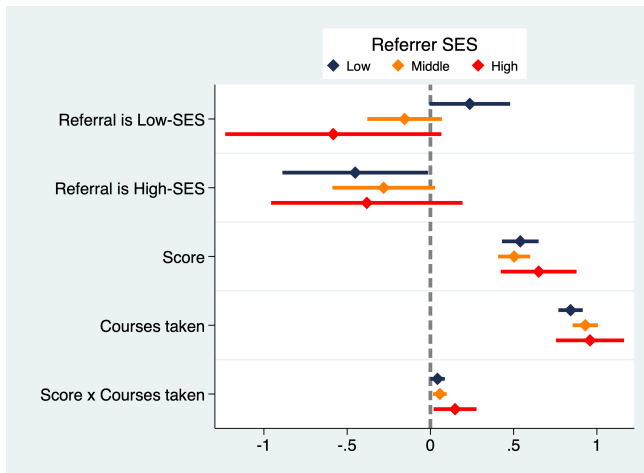
# High-SES referrers are not biased

- Marginal bias against Low-SES nominees
- No positive bias for own SES

	(1)	(2)	(3)
Low	-0.710** (0.333)	-0.600* (0.327)	-0.583* (0.331)
High	0.001 (0.261)	-0.345 (0.287)	-0.382 (0.293)
Nominee score		0.883*** (0.111)	0.650*** (0.116)
Courses taken		1.043*** (0.118)	0.959*** (0.104)
Score x Courses taken			0.148** (0.066)
Observations	19767	19767	19767
Ind.	67	67	67
Chi-test	4.94	120.54	144.77

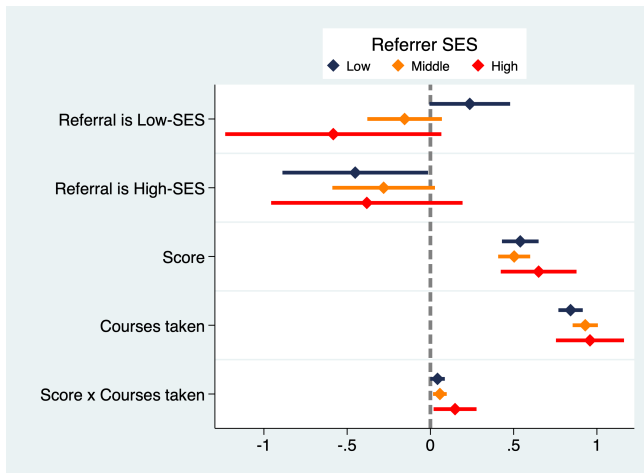
# No bias against Low-SES in referrals

- Low-SES referrers are biased against High-SES and favor their own
- Middle-SES referrers are not biased and do not favor their own
- High-SES referrers are not biased against and do not favor their own



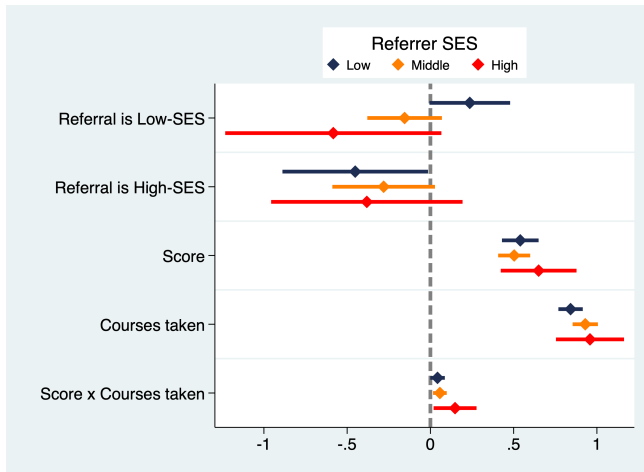
# No bias against Low-SES in referrals

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# Summary

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- Networks are separated by SES
- Referrers refer equally well across SES, and pick close ties with higher scores
- Little to no bias in referrals in contrast to stark differences in network structures



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# Implications

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- Individuals across SES refer equally well with proper incentives and without bias
- Differences in network structures lie at the heart of the problem for solving inequality

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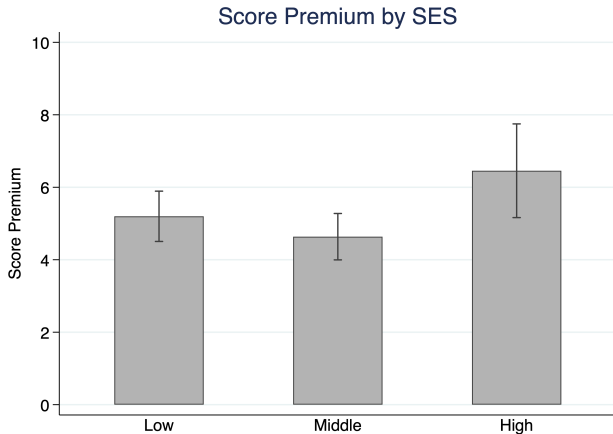


# No differences for Score Premium by SES

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

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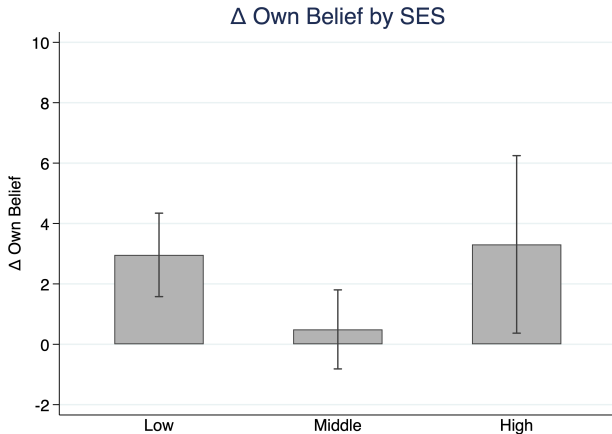


# No differences for own ranking beliefs by SES

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

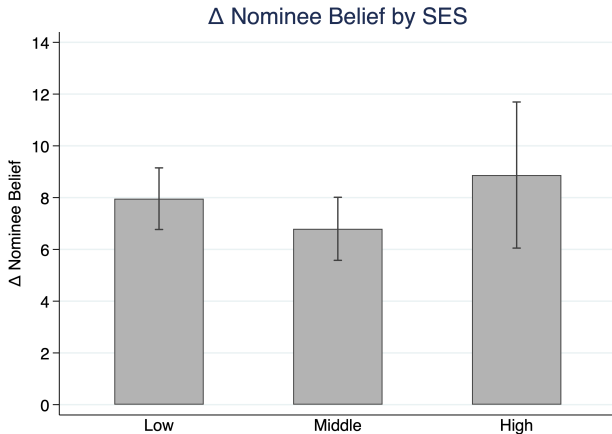
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# No differences for nominee score beliefs by SES

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

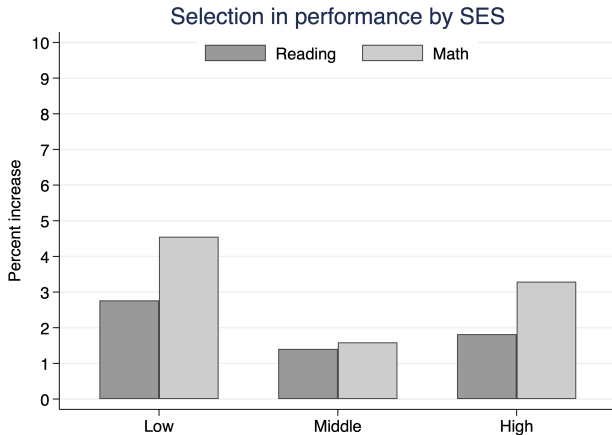


# Strong selection by Low-SES

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- Significant Low-SES selection ( $t$ -tests,  $p < 0.01$ )
- Other SES groups do select less ( $t$ -tests,  $p > 0.05$ )

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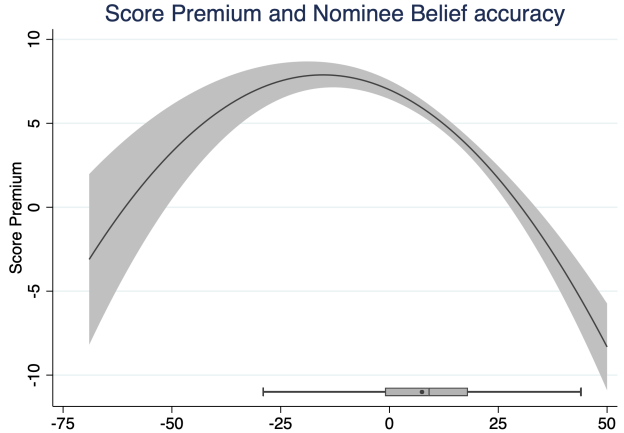


# Nominee Beliefs are rewarded for accuracy

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- Negative coefficient is explained by quadratic shape

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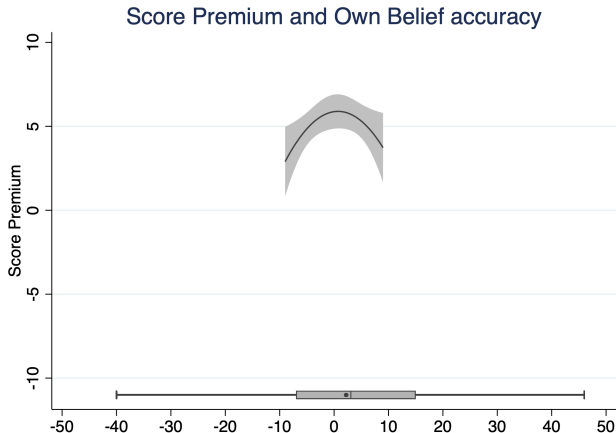


# Own score beliefs are rewarded for accuracy

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- Positive coefficient is explained by quadratic shape and extreme outliers

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# Courses taken by SES

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- High-SES take almost twice more courses with their own

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