First Generation Elite: The Role of School Social Networks

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Intergenerational persistence in education

Strong intergenerational persistence in education across contexts, even in high mobility contexts [Bjorklund and Salvanes, 2011; Heckman and Landerso 2017, 2021]

Lack of educational mobility particularly high at top end of education distribution

- 3% (70%) of Harvard students come from the lowest (top) income quintile [Chetty et al., 2019]
- 7% (47%) of Norwegian elite graduates comes from the lowest (top) quintile [Butikofer et al., 2021]

High returns to elite education [Zimmerman, 2019; Anelli , 2020; Dahl, Rooth, Anders, 2020; Britton et al., 2021]

Explanations for strong persistence in elite education

Many traditional explanations proposed in the literature do not apply to Norway

- Financial constraints $\rightarrow$ no tuition fee and generous maintenance grants
- Legacy admission systems $\rightarrow$ centralised university admission system based on high school GPA

Growing interest in the role of **social capital** in driving mobility

- Social connectedness in friendship networks [Chetty et al 2022]

$\Rightarrow$ **This paper provides causal evidence on the role of school social networks play in driving intergenerational mobility and the mechanisms through which they do**

This paper: objective and some definitions

We aim to understand *whether* and *why* exposure to **elite peers** during high school shapes elite education decisions and socio-economic inequalities therein

Elite peers

- Fraction of elite educated parents in the student's high school cohort
- High school admission system creates high levels of segregation in elite peers across schools

Elite education

- Masters in Business & Engineering, Law or Medicine at a few elite institutions
- 3-4% of students enrol into elite education
- By 30-32 those with elite degrees 3.5x more likely in top percentile of earnings (within cohort)

▸ Earnings premium

Mechanisms through which elite peers change enrolment

1. High school grades (↑ or ↓)
   - Learning / effort: Positive or negative spillovers from high-achieving students [Bifulco, Fletcher, Ross, 2011; Cools, Fernandez, Patacchini, 2019]
   - Teacher assessment: partially drives High school GPA: presence of elite peers may change rank of other students and hence their grade
   - Teacher bias favouring low or high SES [Murphy and Wyness, 2020; Burgess and Greaves 2013]
2. Applications to elite degree programmes (↑)
   - Role model channel
   - Over and above GPA, may affect application behaviour
   - Information or inspiration 'role model' [Lundberg 2020; Porter and Serra 2020; Many and Riley 2019]

⇒ **Overall effect ambiguous and likely different for low and high SES students**

Roadmap

1. What the effect of elite peers on elite degree enrollment? Is it different by SES?
2. What mechanisms are behind these (differential) effects?
3. What is the relative importance of these mechanisms? (Mediation analysis)
4. What implications does this have for intergenerational persistence in income?

Research design

Institutional details

High school system

- At the end of middle school (age 16) students go on to either **academic** or vocational high school
- Admission to high school based either on distance to school or on middle school GPA
- High school GPA based on exams done in all 3 years (combination of teacher assessments, written exams and oral exams)

Higher education

- 3 year bachelor and 5 year combined bachelor-graduate degrees
- Elite degrees: 5 year degrees in STEM, Law or Medicine in a few elite institutions *
- Students apply to a course-institution combination
- Centralized admission system based on high school GPA and student's rank of course-institution

*Norwegian School of Economics; Engineering at the Norwegian University of Science and Technology; Engineering School in Trondheim or NTNU; and Economics, Law or Medicine from the U of Oslo, Bergen, Trondheim and Tromsø.

Research design: Data

Norwegian register and administrative data, linked by Statistics Norway

- Links students' educational records to parents' education and labour market outcomes for all youth in the same school

Sample: Students finishing middle school and entering academic high school b/w 2002 and 2012

- 178,000 students; 557 schools

Focus on differential effects of networks for low and high SES students

- Low SES: students w/ at least one parent compulsory level and no parent with an elite degree
- High SES: students w/ at least one parent with elite degree and no parent with compulsory level

Key variables: definition and summary statistics

- Outcome Y_{isc}: Indicator for whether youth *i* of high school *s* and cohort *c* enrolled in elite degree within 6 yrs of middle school completion

	Total	Low SES	High SES
Proportion enrolled in elite degree	0.102	0.053	0.260
	(0.303)	(0.224)	(0.439)
N	177,219	58,610	20,018

Key variables: definition and summary statistics

- Outcome Y_{isc}: Indicator for whether youth *i* of high school *s* and cohort *c* enrolled in elite degree within 6 yrs of middle school completion
- Treatment P_{-isc}: Proportion of elite educated parents in the youth's school cohort *sc* excluding the focal student *i*'s own parents

	Total	Low SES	High SES
Proportion enrolled in elite degree	0.102	0.053	0.260
	(0.303)	(0.224)	(0.439)
% Parents w/ elite degree	0.061	0.047	0.100
	(0.056)	(0.047)	(0.068)
N	177,219	58,610	20,018

→ SES gap in average exposure to networks could be a reason behind lack of social mobility, but this depends on the differential impact of networks on low and high SES students' outcomes

▸ Additional Stats

Research design: Identification of elite peer effect

Identification strategy exploits within school, between cohort variation in peer characteristics [Hoxby, 2000; Burke and Sass, 2008; Lavy and Schlosser, 2011; etc.]

Benchmark model: Let *i* index the individual student, *s* the school and *c* the cohort

$$Y_{isc} = \beta_1 P_{-isc} + X'_{isc}\beta_2 + \alpha_s + \rho_c + \epsilon_{isc}$$

- Y_{isc}: student *i* enrols in elite degree (Masters in STEM, Law or Medicine)
- P_{-isc}: % of cohort-school peers' parents with an elite degree (mean(0) sd(1))
- X'_{isc}: student *i*'s gender, middle school GPA, mother and father's years of schooling and elite education, income, Norwegian born
- α_s: school fixed effect
- ρ_c: cohort fixed effect
- ϵ_{isc}: error term

$\rightarrow$ β_1 = effect of one SD increase in % of elite parents in the youth's cohort on the likelihood to enroll in an elite degree

Validity of empirical strategy

1. Variation in P_{ics} is large enough

- Raw data: Mean = 0.061 / SD = 0.056
- Conditional on school and cohort effects: SD = 0.027
- Illustrative variation for randomly picked schools (one from each decile by cohort size) Graph

2. Identifying assumption: Any variation in the characteristics of peers' parents from one cohort to another, within the same school is random (conditional on the X's we control for)

- Placebo test: within-school variation in P_{-ics} is not related to variation in student birth outcomes
- Robustness checks including school-specific linear cohort trends
- Pool low and high SES; then include interacted school-cohort indicators
- 'Drop if more than random': For schools exhibiting time trends in the proportion of elite educated parents, drop if this variation is higher than the variation from mis-assigning the years randomly
- Include measure of school quality: mean teacher traits (% female, % from a professional or low skilled background and average age).

Benchmark results

Exposure to elite school peers exacerbates intergenerational education persistence

Dependent variable: Indicator for enrolling in an elite degree

	(1) Full sample	(2) Low SES	(3) High SES
Benchmark			
Proportion of parents with elite degree (std)	0.026***	0.013***	0.040***
	(0.003)	(0.003)	(0.008)
Number of pupils	177,219	58,328	20,018
Number of schools	556	524	459

▸ SES by income

Robustness checks

1. Specification checks

- Non-linearities in the effect of elite peers ▸ Results
- Definitions of ‘elite’ ▸ Results

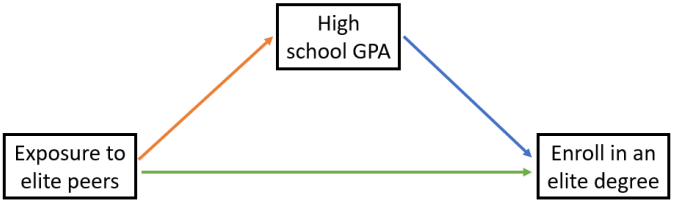
2. Checks on the validity of the empirical strategy

- Placebo analysis with birth outcomes ▸ Placebo
- Robust to including school linear trends; school-cohort dummies; drop if more than random; include teacher traits ▸ Validity
- Robust to excluding Oslo; first born only; drop small schools; ▸ Sensitivity
- Robust to excluding areas with competitive high school admission system

Mechanisms

Mechanisms: overview

To explore mechanisms, we look at the two margins on which elite peers can have an effect



- Direct effect conditional on GPA : *application behaviour channel*
- Indirect effect through GPA: *effort, learning* and *teacher assessment* channels

$\rightarrow$ We exploit that GPA is based on both blindly and non-blindly assessed exams

$$\text{GPA} = \underbrace{\text{External written exams}}_{\text{Blind assessments}} + \underbrace{\text{Teacher assessment + Semi-external oral exams}}_{\text{Non-blind assessments}}$$

Exposure to elite peers decreases overall GPA

We-estimate the benchmark model with overall high school GPA as dependent variable

$$GPA_{isc} = \beta_1 P_{-isc} + X'_{isc}\beta_2 + \alpha_s + \rho_c + \epsilon_{isc}$$

	(1) Full sample	(2) Low SES	(3) High SES
Dependent variable:			
Overall GPA	-0.118***	-0.170***	-0.046***
	(0.013)	(0.016)	(0.012)
Number of observations	177,219	58,328	20,018

Exposure to elite peers increases blindly marked scores...

	(1) Full sample	(2) Low SES	(3) High SES
Dependent variable:			
Overall GPA	-0.118***	-0.170***	-0.046***
	(0.013)	(0.016)	(0.012)
External written exams	0.025***	0.030**	0.030*
	(0.009)	(0.012)	(0.016)
Number of observations	177,219	58,328	20,018

- Elite peers exposure ↑ written scores: positive learning / effort channel

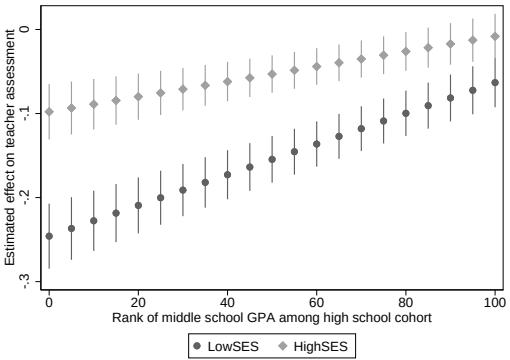
...but reduces teacher assessed exam scores

	(1) Full sample	(2) Low SES	(3) High SES
Dependent variable:			
Overall GPA	-0.118***	-0.170***	-0.046***
	(0.013)	(0.016)	(0.012)
External written exams	0.025***	0.030**	0.030*
	(0.009)	(0.012)	(0.016)
Teacher assessments	-0.110***	-0.162***	-0.040***
	(0.013)	(0.016)	(0.012)
Semi-external oral exams	-0.036***	-0.064***	-0.013
	(0.008)	(0.011)	(0.014)
Number of observations	177,219	58,328	20,018

- Elite peers exposure ↑ written scores: positive learning / effort channel
- But ↓ teacher assessment: mark on a curve (rank effect)? teacher bias?

Rank effect?

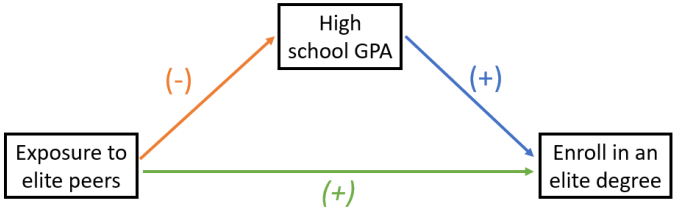
$$GPA_{isc} = \beta_{11} P_{-isc} + \beta_{12} P_{-isc} * Rank_i + X'_{isc}\beta_2 + \alpha_s + \rho_c + \epsilon_{isc}$$



- The 'mechanical' rank effect of elite (high-achieving) students explains some of the negative effect, but not all of it → Suggestive of a teacher bias against low SES strengthened by the presence of elite peers

Mediation analysis

Mediation analysis



The results so far:

- Overall positive effect of elite peers on elite degree enrollment (smaller for low SES)
- Negative elite peer effect on GPA (especially for low SES)
- This implies that elite peers must have a direct positive influence on elite degree application, conditional on GPA

→ We perform a (causal) mediation analysis to quantify these channels

Mediation analysis

We aim to quantify the elite peer effect conditional on high school GPA:

$$Y_{isc} = \lambda_1 P_{-ics} + \lambda_2 GPA_{ics} + X'_{ics}\lambda_3 + \alpha_s + \rho_c + \epsilon_{ics}$$

GPA_{ics} is endogenous so we instrument it by exploiting a unique institutional feature in Norway generating random variation in GPA

- Subject of written exams in 2nd and 3rd years are randomly allocated across students, within schools

IV for High School GPA

Background on Norwegian high school assessments:

- All high school subjects are assessed by a teacher
- In year 3, subject of written exam is randomised within schools
- Being randomly allocated to taking a written maths exam low SES students may improve their GPA
  - Repeating our regressions with teacher assessment on maths; Norwegian; English, the downgrade is largest for maths
  - Teacher bias against low SES is present in mathematics assessments (Copur-Gencturk et al 2020)
  - Evidence from Denmark that a similar randomization of (semi-external) maths test reduced gender gap in graduation from STEM degrees (Burgess et al 2022)

Proposed IV: Being randomly allocated to taking external written exam in math (as opposed to another subject) in year 3 of high school

- Relevance: It is strongly positive correlated with GPA especially for low SES students
- Rank: Plausible it only affects the probability to enrol in elite education through its effect on GPA

▸ Balance

Estimates of the elite peer effect on elite degree enrollment, conditional on GPA

	(1)	(2)	(3)	(4)
	Low SES		High SES	
	OLS	IV	OLS	IV
1st stage - Dependent variable: high school GPA				
Assigned to math written exam (IV)		0.031***		0.029**
		(0.008)		(0.013)
F stat		*16.23*		*5.00*
Number of pupils	58,586		19,968	

Estimates of the elite peer effect on elite degree enrollment, conditional on GPA

	(1)	(2)	(3)	(4)
	Low SES		High SES	
	OLS	IV	OLS	IV
1st stage - Dependent variable: high school GPA				
Student took written math exam (IV)		0.031***		0.029**
		(0.008)		(0.013)
F stat		*16.23*		*5.00*
2nd stage - Dependent variable: enrollment to elite degree				
Proportion of parents with elite degree (std)	0.010***	0.038***	0.032***	0.054***
	(0.004)	(0.008)	(0.006)	(0.024)
Overall high school GPA		0.690***		2.273**
		(0.172)		(0.970)
Number of pupils		58,586		19,968

Estimates of the elite peer effect on elite degree enrollment, conditional on GPA

	(1)	(2)	(3)	(4)
	Low SES		High SES	
	OLS	IV	OLS	IV
A - Dependent variable: high school GPA				
Student took written math exam (IV)		0.031***		0.029**
		(0.008)		(0.013)
F stat		*16.23*		*5.00*
B - Dependent variable: enrollment to elite degree				
Proportion of parents with elite degree (std)	0.010***	0.038***	0.032***	0.054***
	(0.004)	(0.008)	(0.006)	(0.024)
Overall high school GPA		0.690***		2.273**
		(0.172)		(0.970)
C - Decomposition				
Direct effect		0.038		0.054
Indirect effect		-0.027		-0.020
Total effect		0.011		0.034
Number of pupils		58,586		19,968

Long run implications for earnings and intergenerational mobility

Impacts of elite peers on earnings and mobility

If elite degrees have positive returns for both low and high SES students, exposure to elite peers would increase earnings, and segregation of elite across schools would *exacerbate* the intergenerational persistence of earnings in Norway

We examine this by using earnings data for 5 oldest cohorts in our sample

- Document elite degree premium for low and high SES students
- Estimate effect of elite peers on earnings for low and high SES students

Long-term implications for earnings

Dependent variable: Earnings percentile

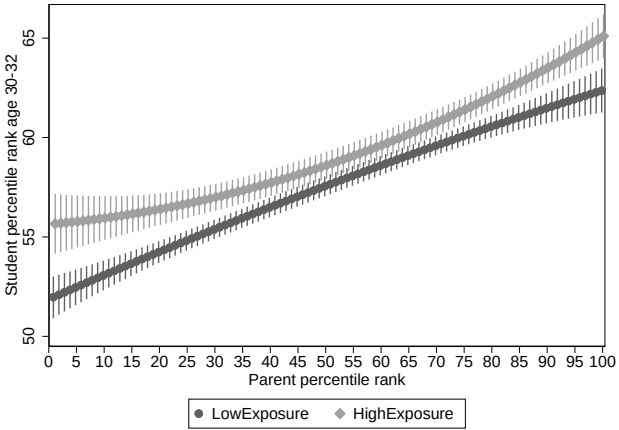
	(1) Low SES	(2) High SES	(3) Low SES	(4) High SES
Student ever enrolled in degree	10.185***	14.369***		
	(0.455)	(1.574)		
Student ever enrolled in elite degree	26.701***	30.521***		
	(0.828)	(1.639)		
Proportion of parents with elite degree			0.816***	2.462***
			(0.344)	(0.615)
Number of pupils	*20,454*	*6,765*	*20,454*	*6,765*
Number of schools			*457*	*372*

▸ Mincer by types of elite degree

Impact of elite peers on intergenerational earnings persistence

$$EarnChild_{isc} = f(EarnParent_{isc}, P_{-ics}) + X'_{isc}\beta + \alpha_s + \rho_c + \epsilon_{ics}$$

Figure 1: Intergenerational rank-rank correlation, across exposure to elite peers

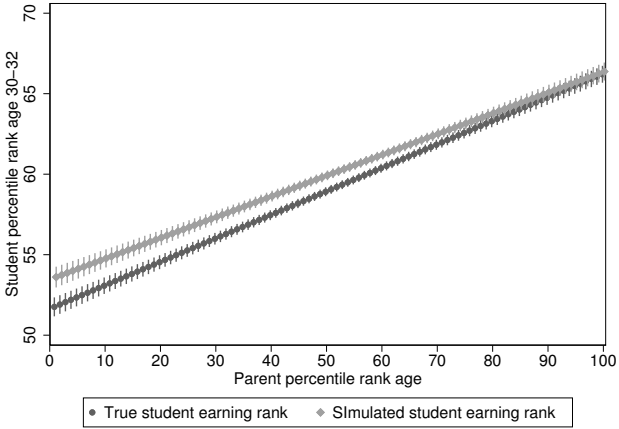


Notes: This graph plots the fitted values from an intergenerational mobility rank-rank regression allowing for the interaction between exposure to elite peers and the parent percentile rank to be quadratic. High exposure is defined as above mean proportion of elite peers in the high school cohort.

Implications of reducing elite segregation in schools for earnings mobility

- We simulate a reassignment of low SES students in low elite exposure schools, into schools with high exposure
- whilst simultaneously reassigning a high SES student from the high exposure school into the low exposure school
- This generates a new mean exposure for all students in affected school; and a new school FEF for the reassigned pupil
- We take our estimates of the causal effect of elite peers on earnings percentile rank to predict a new percentile rank; then estimate a rank-rank regression
- The net effect is to raise mobility Details

Figure 2: Intergenerational rank-rank correlation in raw data and after reassignment



Notes: This graph plots the fitted values from an intergenerational mobility rank-rank regression. The bold symbols represent the relationship using the student's true earnings rank whilst the lighter symbols represent the relationship using the student's simulated earnings rank.

Conclusion

Conclusion

This paper examines whether increasing low SES students' exposure to elite peers at school can help them become first generation elite and increase intergenerational mobility

We show that:

- Exposure to elite peers can help low SES students become first generation elite
- But it also partially explains persistence at the top of socioeconomic distribution
- Segregation of elite-educated families at high school level is a barrier to mobility

Policy implications

- Higher reliance on blind assessments could mitigate detrimental effects of teacher bias
- Role model/mentoring programs could be beneficial

Descriptive Statistics

	Low SES		Elite SES		Total	
	Mean	St Dev	Mean	St Dev	Mean	St Dev
University enrolment	0.861	0.346	0.956	0.206	0.904	0.295
Parent % w/elite degree	0.047	0.047	0.100	0.068	0.061	0.056
HS Year	2005.524	2.285	2005.568	2.303	2005.622	2.287
Norwegian born	0.832	0.373	0.852	0.355	0.873	0.333
Female	0.650	0.477	0.527	0.499	0.601	0.490
Mother: Compulsory edu	0.931	0.253	0.161	0.367	0.516	0.500
Mother: HS edu	0.069	0.253	0.144	0.351	0.126	0.332
Mother: Degree+	0.000	0.000	0.695	0.460	0.358	0.479
Father: Copmulsory edu	0.916	0.277	0.073	0.261	0.578	0.494
Father: HS edu	0.084	0.277	0.042	0.200	0.139	0.346
Father: Degress+	0.000	0.000	0.885	0.319	0.282	0.450
Middle School GPA	0.497	0.639	0.921	0.591	0.676	0.634
Pear mean MS GPA	0.300	0.541	0.613	0.399	0.427	0.496
HS GPA total	4.005	0.611	4.484	0.643	4.175	0.642
HS Teacher assessment	4.099	0.628	4.574	0.647	4.268	0.653
HS Exam	3.293	0.729	3.848	0.804	3.487	0.778
HS Oral	4.227	1.065	4.803	1.004	4.441	1.066
Observations	58,610		20,018		177,219	

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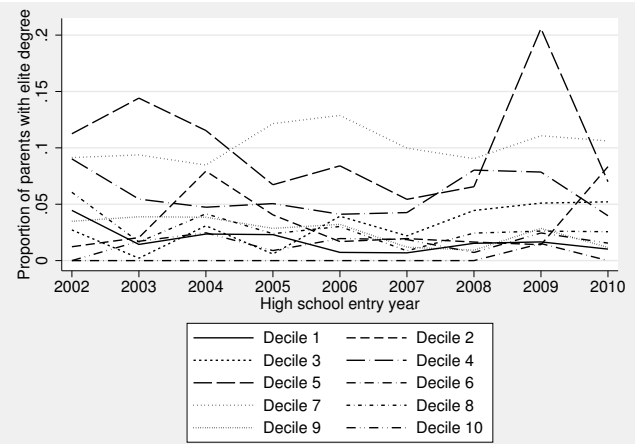
Figure 3: Distribution of exposure to elite peers



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Controlling for income and occupation of peers' parents

	Total	Low SES	High SES	Total	Low SES	High SES
% parent w/elite degree	0.023***	0.010***	0.038***	0.028***	0.014***	0.044***
	(0.003)	(0.003)	(0.009)	(0.004)	(0.003)	(0.008)
% parents in top income decile	0.065***	0.074***	0.030			
	(0.022)	(0.018)	(0.080)			
% parents in elite occupations				-0.256	-0.073	-0.516
				(0.159)	(0.183)	(0.468)
Observations	177,219	58,328	20,018	177,219	58,328	20,018

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Sensitivity

	Total	Low SES	High SES
a) first born only			
% parent w/elite degree	0.026***	0.014***	0.042***
	(0.003)	(0.003)	(0.008)
b) drop OSLO			
% parent w/elite degree	0.025***	0.013***	0.040***
	(0.004)	(0.003)	(0.009)
c) drop small schools			
% parent w/elite degree	0.026***	0.013***	0.040***
	(0.003)	(0.003)	(0.008)

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Checks on the validity of the strategy

	(1) Birth weight	(2) Low birth weight	(3) Gestation	(4) Height	(5) Head cir.	(6) Congenital malf.	(7) Severe deformity
% parents w/elite degree (std)	-3.177	-0.000	-0.011	-0.010	0.004	-0.000	-0.001
	(3.483)	(0.001)	(0.012)	(0.015)	(0.009)	(0.001)	(0.001)
Observations	170,563	177,965	158,302	164,747	168,644	170,832	170,832
Number of high schools	555	557	553	552	554	555	555

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Checks on the validity of the strategy

	(1) Benchmark	(2) School-specific linear trends	(3) School-cohort fixed effects interacted	(4) 'Drop if more than random'	(5) Including teacher traits	(6) Quadratic
A - Low SES students						
% elite parents (std)	0.013***	0.013***		0.010**	0.015***	0.014***
	(0.003)	(0.003)		(0.004)	(0.004)	(0.003)
% elite parents squared						-0.001
Number of pupils	*58,610*	*58,610*		*28,181*	*37,270*	*58,610*
B - High SES students						
% elite parents (std)	0.040***	0.047***		0.038***	0.053***	0.058***
	(0.008)	(0.008)		(0.013)	(0.009)	(0.010)
% elite parents squared						-0.008**
Number of pupils	*20,018*	*20,018*		*8,420*	*12,737*	*20,018*
C - Low and High SES						
% elite parents (std)			0.050***			
			(0.004)			
Low SES			0.041***			
			(0.014)			
% elite parents * low			-0.031***			
			(0.003)			
Number of pupils			*78,540*			

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Balance checks on the IV

	(1)	(2)
	Low SES	High SES
Proportion of parents with elite degree (std)	-0.016*	-0.008
	(0.008)	(0.008)
Student is female	0.003	-0.003
	(0.005)	(0.007)
Student is born in Norway	0.001	0.014
	(0.007)	(0.010)
Mother years of schooling	-0.001	0.001
	(0.001)	(0.001)
Father years of schooling	-0.001	-0.001
	(0.001)	(0.001)
Middle school teacher assessment	0.068	0.036
	(0.076)	(0.125)
Middle school written exams	0.002	0.003
	(0.007)	(0.012)
Middle school oral exams	0.009	-0.000
	(0.006)	(0.010)
Middle school overall GPA	-0.132	-0.082
	(0.086)	(0.146)
Proportion of student's own parent with an elite degree	-0.032	0.007
	(0.047)	(0.016)
Student's parents are in top income decile	-0.002	-0.020**
	(0.008)	(0.008)
Number of pupils	58,586	19,968

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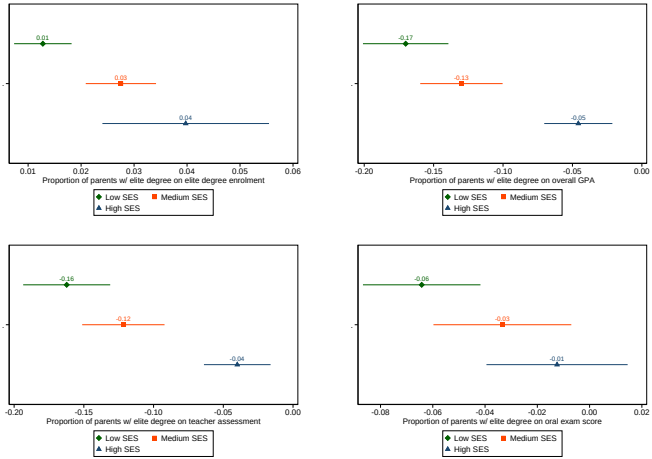
Figure 4: Effect of exposure to elite peers on student outcomes by socioeconomic background



Notes: This graph plots the marginal effect of an increase in P_{-ics} on student outcomes: the probability of enrolling in an elite degree; overall high school GPA; high school teacher assessment and high school written exams.

Defining low and high SES by parents' income

Dependent variable: Indicator for enrolling in an elite degree

	(1) Full sample	(2) Bottom 20% income	(3) Top 20% income
Benchmark			
Proportion of parents with elite degree (std)	0.026*** (0.003)	0.018*** (0.003)	0.030*** (0.005)
Number of pupils	177,219	35,447	35,439
Number of schools	556	520	480

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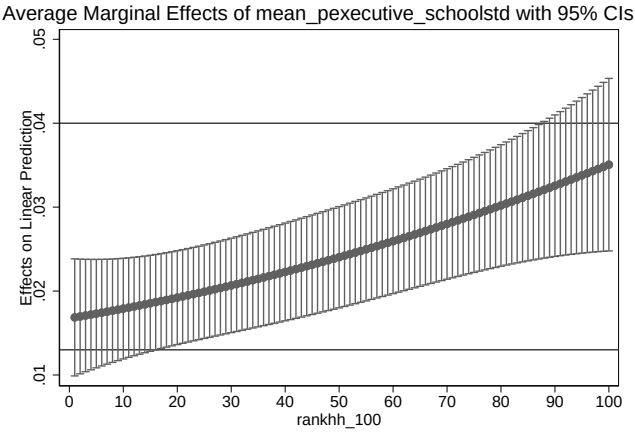
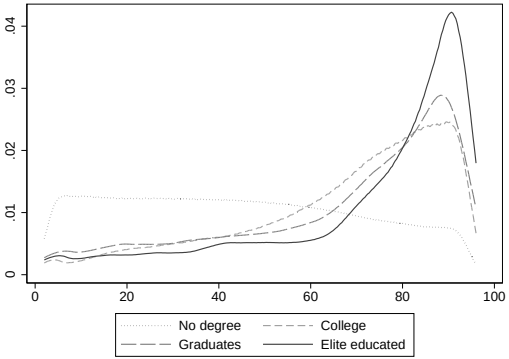
Defining low and high SES by parents' income II

Figure 5: Plotting the effect of exposure to elite peers across household income percentile rank



Notes: This graph plots the marginal effect of exposure to elite peers on elite degree enrolment, in a specification which interacts

Figure 6: Density of earnings percentiles by education level



Notes: This graph plots the density of earnings percentiles across educational groups. Sample is the population of Norway aged 28-40 between 1993-2001. The percentile rank of earnings is calculated within each birth cohort.

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We do see different probabilities of reaching the top percentile by low and high SES for law and medicine degrees

	(1) Low SES	(2) High SES	(3) Low SES	(4) High SES	(5) Low SES	(6) High SES
	Earnings percentile		Richest decile		Top percentile	
Student ever enrolled in degree	10.032***	9.120***	0.027***	0.048**	0.008***	0.034***
	(0.454)	(1.428)	(0.005)	(0.021)	(0.002)	(0.011)
Student enrolled in elite degree:						
STEM	25.699***	22.596***	0.243***	0.203***	0.040***	0.040***
	(1.009)	(1.541)	(0.012)	(0.023)	(0.005)	(0.012)
Law	24.143***	23.765***	0.146***	0.162***	0.030***	0.076***
	(1.382)	(1.892)	(0.016)	(0.028)	(0.008)	(0.015)
Medicine	39.014***	33.982***	0.642***	0.548***	0.218***	0.167***
	(2.485)	(2.029)	(0.029)	(0.030)	(0.014)	(0.016)
Observations	20,454	6,765	20,454	6,765	20,454	6,765

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Long-term implications for earnings

	(1) Low SES	(2) High SES	(3) Low SES	(4) High SES
A - Dependent variable: Earnings percentile				
Student ever enrolled in degree	10.185***	14.369***		
	(0.455)	(1.574)		
Student ever enrolled in elite degree	26.701***	30.521***		
	(0.828)	(1.639)		
Proportion of parents with elite degree			0.816***	2.462***
			(0.344)	(0.615)
B - Dependent variable: Richest decile				
Student ever enrolled in degree	0.028***	0.082***		
	(0.005)	(0.024)		
Student ever enrolled in elite degree	0.250***	0.284***		
	(0.010)	(0.025)		
Proportion of parents with elite degree			0.004	0.022***
			(0.004)	(0.009)
Number of pupils	*20,454*	*6,765*	*20,454*	*6,765*

Elite

- Elite degrees: 5 year degrees in STEM, Law or Medicine in a few elite institutions (Norwegian School of Economics; Engineering at the Norwegian University of Science and Technology; Engineering School in Trondheim or NTNU; and Economics, Law or Medicine from the U of Oslo, Bergen, Trondheim and Tromsø.) ▸ Earnings premium

- Elite occupations: working in a STEM occupation (Denning and Norway 2019); as a lawyer or a doctor

- Elite earners: in the top 5% of the income distribution (calculated within high school cohort using earnings of parents in the year before high school)

- 3-4% of the population enrol into elite degrees; 1.7% in elite occupations; 3% of population have parents in top income 5% of high school cohort

Details on the simulated reassignment of low and high SES students

- Within each cohort, schools ranked by their exposure to parents with an elite degree
- N low SES students were randomly chosen from all low SES students in the school with the lowest exposure and moved to the school with the highest exposure - and N high SES students (randomly chosen from all high SES students in the highest exposure school) moved in the opposite direction
- We repeated for the school with the second lowest/highest exposure; then the third lowest/highest exposure until
  1. All schools in the top and bottom decile (of elite peer exposure)
  2. All schools in all of Norway

  had taken part in the reassignment
- Using our estimates of the effect of elite peer exposure on earnings percentile, a new earnings percentile was calculated using new peer mean and new school identifier

Rank-rank regression results for different simulations

Table 1: Simulating a reassignment of low (high) SES students into schools with a high (low) level of elite peers

	(1) Benchmark	(2) Simulation 1	(3) Simulation 2	(4) Simulation 3	(5) Simulation 4
No. schools		Top and bottom decile		All schools	
No. children moved per school		1	5	1	5
Parent percentile rank	0.143***	0.139***	0.136***	0.139***	0.129***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Constant	53.090***	52.829***	53.032***	52.874***	53.474***
	(0.332)	(0.332)	(0.332)	(0.332)	(0.334)
Observations	30,849	30,849	30,849	30,849	30,849
R-squared	0.023	0.021	0.020	0.021	0.018

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Different Elite Categories

Dependent variable: Indicator for enrolling in an elite degree

	(1)	(2)	(3)	(4)
Low SES				
Proportion of parents with elite degree (std)	0.013***			0.011***
	(0.003)			(0.003)
Proportion of parents with elite occ (std)		0.004**		-0.002
		(0.002)		(0.003)
Proportion of parents with elite income (std)			0.011***	0.008***
			(0.002)	(0.002)
Number of pupils	58,328	58,328	58,328	58,328
High SES				
Proportion of parents with elite degree (std)	0.040***			0.042***
	(0.008)			(0.009)
Proportion of parents with elite occ (std)		0.011*		-0.008
		(0.007)		(0.007)
Proportion of parents with elite income (std)			0.024***	0.005
			(0.008)	(0.009)
Number of pupils	20,018	20,018	20,018	20,018

Non-linearity does not explain the SES gradient in elite network effect

We re-estimate the benchmark model with a quadratic in elite peers:

$$Y_{isc} = \beta_{11} P_{-isc} + \beta_{12} P^2_{-isc} + X'_{isc}\beta_2 + \alpha_s + \rho_c + \epsilon_{isc}$$

Figure 7: Predicted marginal effect exposure to elite social networks