

How Socioeconomic and Parental Background Shape Peer Networks and Educational Spillovers

Ragnar Hjellset Alne¹ Eyo I. Herstad² Andreas Myhre³

¹NIFU & Western Norway Univ. of Applied Sciences

²Erasmus University Rotterdam and Tinbergen Institute

³Statistics Norway

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Introduction

- Friends may transmit attitudes, knowledge, and study habits, and this may have significant *peer effects* on academic achievement
- While peer effects in school are well documented, a challenge in the literature has been to separate the influence of peers' own ability from that of their background and parents
- **This paper:** Combines detailed Norwegian survey *and* registry data to examine the formation of friendships, the importance of parental background and the spillovers of peers' GPA

This Paper

Research questions:

- 1 What factors determine friendship formation among students?
 - e.g. shared traits like gender, parental background, socioeconomic status?
- 2 How do friends' academic outcomes affect another student's outcome beyond the effects of friends parents?
- 3 What are the implications for classroom assignment and education policy?

What we do:

- 1 Estimate a network-formation model to investigate how friendships are formed
- 2 Estimate a peer-effects model including a rich set of student and parental characteristics
- 3 Simulate different class compositions to investigate effects of alternative policies

Key Results and Contributions:

- 1 *Network Formation Estimates:*
 - Class and gender dominate friendship formation
 - Student and parental background also play a small role
- 2 *Peer-effect Estimates:* + 1 SD rise friends' avg. GPA increases own GPA ≈ 0.33 SD
 - Robust to adding rich contextual variables for student and parental background
- 3 *Counterfactual exercises (preliminary):* Sorting students by ability increases GPA of high achievers and decreases GPA of low achievers. No effect on average GPA.

Data and Setting

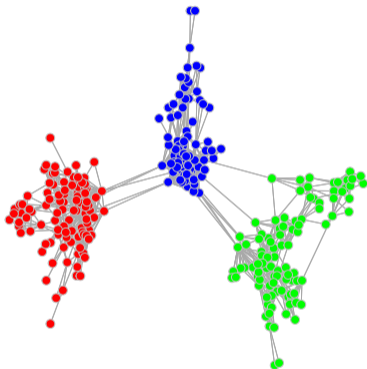
- **Data:**

- Complete friendship networks from a student survey
- From two typical Norwegian lower secondary schools (grades 8–10)
 - Students are grouped into 4 classes within each grade
 - Approx. 600 students in 24 classes in total
- High participation rate ($\sim 94\%$)
- Combined with Norwegian administrative data on students and their parents (income, wealth, education, foreign-born etc.)

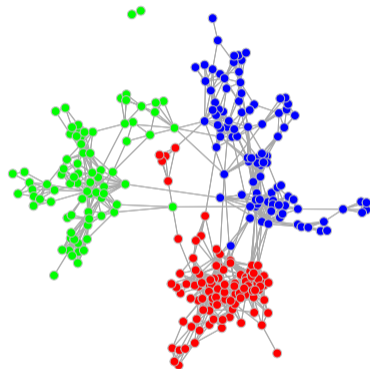
- **How do we observe friendships?:**

- Students identified their own friends, and we observe mutual friendships
- No restriction on the number of friends

The Two Schools



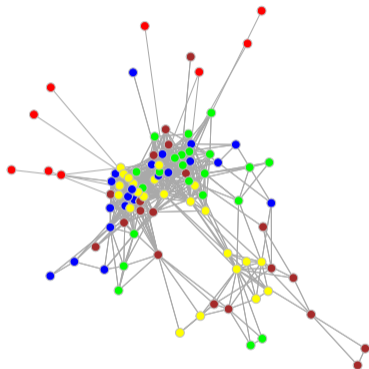
School 1



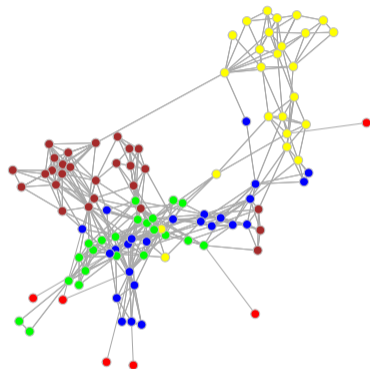
School 2

- Most friendships are formed *within the same grade level*. Cross-grade friendships are rare.

School 1: 9th and 10th grade



9th grade



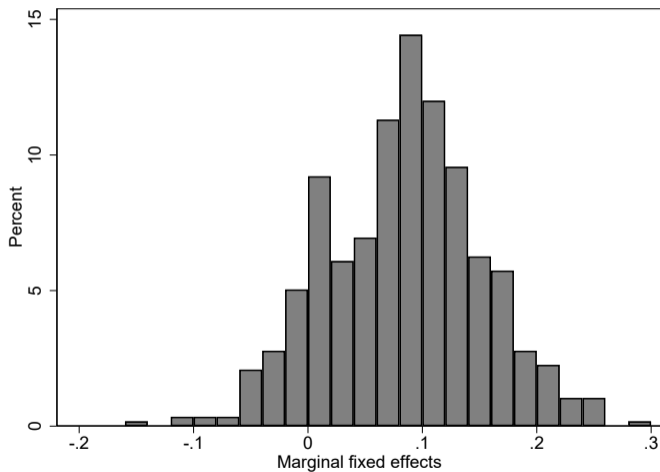
10th grade

- There are a lot of friendships *across classes within the same grade level.*

Modeling Friendship Formation

- Using a logit regression and network formation model with homophily, individual popularity and pair level shocks à la Graham (2017)
- **Dependent variable:** Both students nominated each other as friends
- **Explanatory factors:** Shared characteristics (homophily) and differences:
 - Same class, gender
 - Prior familiarity (e.g. attended the same elementary school)
 - Academic performance similarity (e.g. differences in prior test scores)
 - Parental background: age, foreign-born, education, income, wealth etc.
- Include **individual fixed effects** to account for each student's overall tendency to form friendships
- The baseline probability that two students are friends is $\sim 11\%$

Variation in Popularity



Logit model: Key Determinants

Key Determinants

Column:	(1)	(2)
Same class	13.54*** (0.33)	13.78*** (0.32)
Same gender	16.40*** (0.44)	16.26*** (0.38)
Same elective subject	1.97*** (0.36)	3.00*** (0.39)
Same elementary school	1.69*** (0.39)	2.91*** (0.41)
Difference in National test GPA	-1.07*** (0.21)	-0.87*** (0.27)
Same parent immigrant category	2.41*** (0.47)	2.98*** (0.59)
Difference in log HH income	-0.26 (0.32)	-1.22*** (0.44)
Same parent social-security status	2.08*** (0.43)	2.56*** (0.62)
Constant (de-meanded)	10.97*** (0.17)	10.97*** (0.15)
Individual fixed effects	No	Yes
Pseudo R^2	0.184	0.363
Observations	27 233	27 233

Key Determinants of Friendship Logit

- ****Same class:**** +14 percentage points higher chance of friendship
- ****Same gender:**** +16 pp higher friendship likelihood compared to mixed-gender pairs
- ****Prior ties:**** +3 pp Same elementary school background
- ****Academic similarity:**** Similar academic achievement more likely to be friends
- ****Parental background:**** Some, but not all factors have an effect
 - Students from similar socioeconomic background (parents on welfare benefits, similar income levels, or similar immigrant background) are more likely to be friends
 - No significant effect of parental education or wealth
- **Key takeaway:** Student and parental background matter for friendship formation, but class assignment and gender are by far the strongest determinants. Policymakers can strongly influence who becomes friends through classroom composition.

Identifying Peer Effects

- **Question:** Does having higher-achieving friends improve a student's own performance?
- **Challenge:** Friends influence each other simultaneously (*reflection problem*) and may self-select: High achievers tend to befriend each other (Manski, 1993).

Identifying Peer Effects: IV model

- **Solution:** Use measure of ability as IV for current GPA
 - 2SLS regression of student i 's GPA on avg. GPA of student i 's friends, using friends' lagged test scores as IV (following Bramoullé, Djebbari, & Fortin, 2009).
 - IV: avg. *national standardized test score from 5th grade* of student i 's friends
 - 3-5 years prior to current grades
- **Instrument Validity:**
 - **Relevance** – National test score gives a good measure of unobserved ability
 - **Exogeneity** – Mismeasurements in friends avg. National test score is not correlated with mismeasurements in students current GPA
 - **Exclusion** – Friends past National test scores do not drive a students GPA except through friends GPA

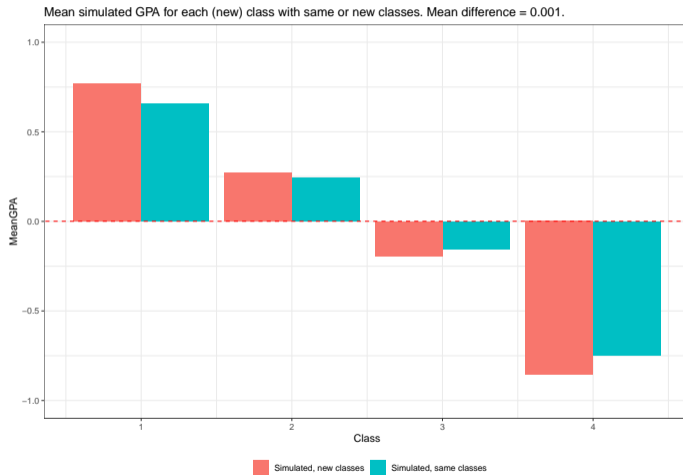
Peer effects: Main estimates

<i>Column:</i>	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: First stage						
Friends avg. NT Score	0.616*** (0.057)	0.584*** (0.058)	0.581*** (0.060)	0.630*** (0.042)	0.513*** (0.062)	0.594*** (0.043)
F-stat	116.2	100.5	93.1	227.1	68.5	193.4
Panel B: Second stage						
Friends avg. GPA	0.388*** (0.107)	0.372*** (0.115)	0.337*** (0.116)	0.410*** (0.096)	0.221* (0.131)	0.331*** (0.104)
Student controls	No	No	No	Yes	No	Yes
Parent controls	No	No	No	No	Yes	Yes
Class FE	No	Yes	Yes	Yes	Yes	Yes
Elementary school FE	No	No	Yes	Yes	Yes	Yes
Observations	546	546	546	546	546	546

Further results

- **Heterogeneity:** The peer effect is
 - Larger among female students
 - Similar across skill levels, but slightly larger for lower skilled males vs high skill males
- **Counterfactual simulations** (work in progress)
 - Class composition has a large effect on network formation, so how would different class compositions affect student's GPA through the network?
 - For each class composition: We draw network formation shocks, and compute outcomes given that network. We repeat this 200 000 times per school.
 - We compare classes with *tracking* (skill-based classes) with the status quo classes

Simulations



Thank you!

Questions & Discussion