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Peer effects and social networks: where we are now?

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10 years of Institutional Analysis

Motivation

- Initial interest to the role of USE test scores in student achievement
 - USE scores explained 36 to 43% of first-year GPA variation (HSE students, 3 programs, 2009 year of admission)
 - Olympiad winners have significantly higher GPA
- What other individual characteristics matter?
- What is the role of peer-related factors in academic achievement of Russian students (HSE case)?



Peer effects

Educational *peer effects* (PE) are any externalities in which an outcome of a student is affected by

- peers' backgrounds (*exogenous* or *contextual* PE)
- peers' outcome (*endogenous* PE)



Why data on Russian higher education system?

- Specific features of higher education system in Russia enable us to study PE in institutional context which is not often observed in the US and EU countries
 - Admission to university is based on national standardized test (USE)
 - Groups of about 20-40 students are formed administratively
 - Majority of courses are compulsory in first three years



Starting point: PE in exogenously formed groups

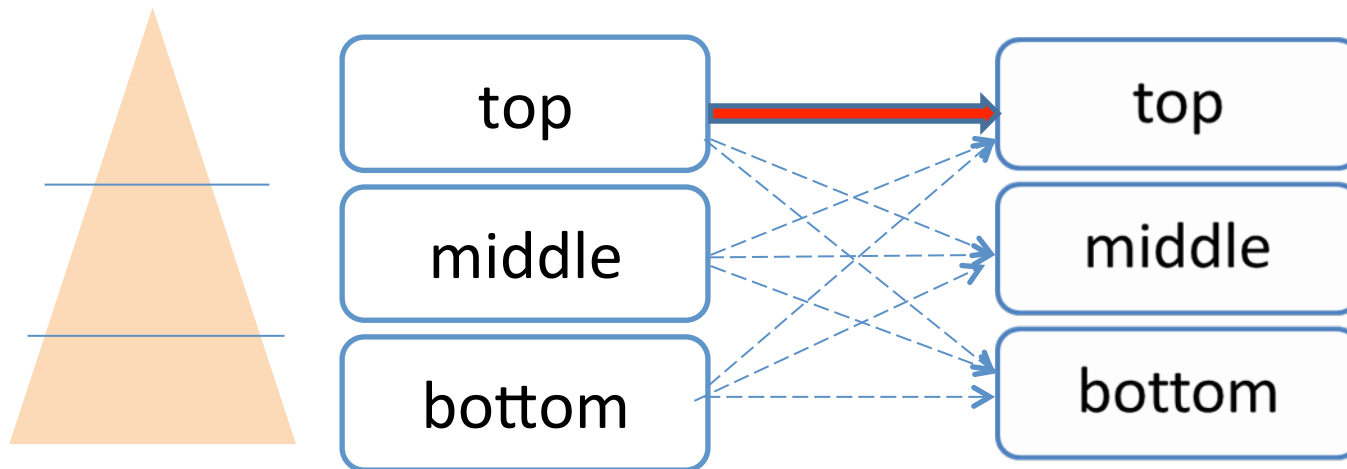
- 250 students in the HSE Econ department admitted in 2009
- 11 study groups (formed at the beginning of the academic year)

- We consider group fellows as the peer group of an individual
- Individual abilities are measured by previous achievement
 - USE scores in Russian language and mathematics
 - Olympiad wins



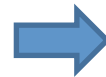
Findings

- Individual's grades in particular disciplines and first year GPA improve with the growth of classmates' abilities
- Peer effects are nonlinear:
 - High-able students benefit from the greater share of high-able students in the group
 - Increase in the percentage of less able students does not influence the classmates' achievement



Possible explanation

- Peers connected by social ties (friends) have greater influence than other peers
- Students of similar ability form social ties



Positive spillovers from high-able peers mostly benefit their friends who are also high-achievers

To move further...

- What we want to know more about peer effects
 - How peer effects are transmitted
 - How to separate effects of peers' current achievement (endogenous PE) from ones related to peer characteristics (exogenous PE)
- What peers are the most important?



Peer group identification problem

Who is are relevant peers?

- Students from the same year cohort?
- Group mates?
- Friends?
- Study helpers?



Social connections

In our surveys we ask the students to

- *Write up to the 5 names of your fellow students with whom you communicate most*
- *Write up to the 5 names of five of your fellow students, to which you are applying for help in study matters*

Each student has his/her own specific social ties



PE in social networks

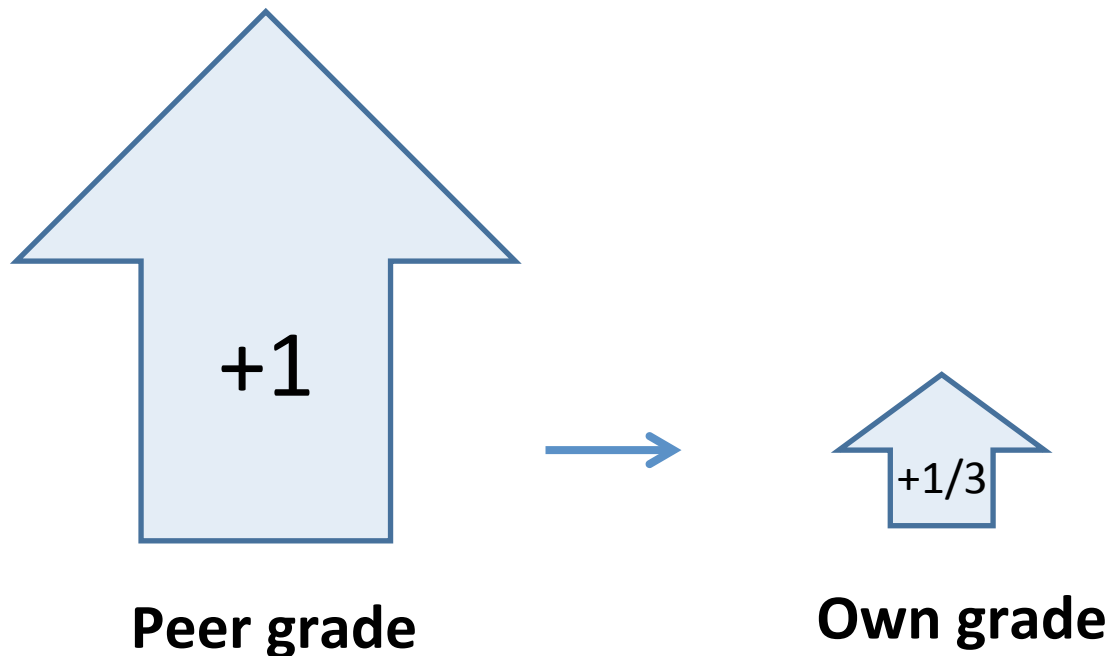
What is a role of social ties in creating peer effects?

- We use network regression (aka *spatial regression model*) approach
 - Each student has her own peer group
 - Now we are able to estimate both endogenous and exogenous PE
- Ties are voluntary → bias may arise
 - Omitted variable bias emerges if there are *unobserved* characteristics which are common among connected students.
 - We have tested the presence of omitted variables: no evidence of them



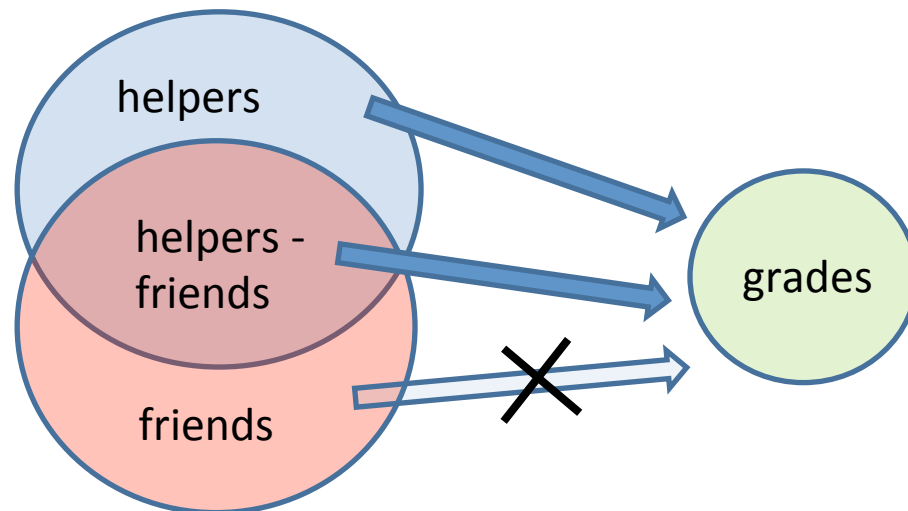
PE in social networks: findings

- We find significant positive peer effects from the academic achievements of friends and helpers
 - Increase of peers' grade by 1 is associated with own grade increase by $\frac{1}{4}$ to $\frac{1}{3}$



PE in social networks: findings

- Different combinations of friendship and study partner relationships have different effects on student performance
- Students' grades increase with the abilities of
 - Friends + Helpers
 - Study partners + Nonfriends
- whereas no such effect is found for
 - Friends + Nonhelpers



Interpretation:
knowledge-sharing
channel of peer influence
has a greater impact than
the role model channel

Social ties and choice of specialization

- The choice of major or specialization is an important decision for a student
- Peers affect the individual choice of students
 - The strongest effect is produced by those friends who are study partners and those with the similar academic achievements
 - Reciprocal friendship ties have a more profound impact on choices than nonreciprocal ties
 - Students also take into account the choice of classmates with similar academic achievements even if they are not friends or helpers



Predicting social ties and PE study

- Usually, we do not observe personal ties
- But we can predict them. **Are there PE in predicted network?**

- We use data on about 1000 HSE students and 500 students of one Brazilian university
- We find positive effects from peer group predicted by sharing the same
 - Study group and gender for **Russian** students
 - Region of origin and gender for **Brazilian** students (there is no administratively formed groups in this university)



Dynamics

Why to study peer effects and networks in dynamics

- Allow us to understand how social ties emerge
- Allow us to move from observing correlations to explaining causation
- Allow us to study coevolution of dynamic variables (e.g. individual achievements and networks)



Longitudinal surveys in Nizhny Novgorod Campus

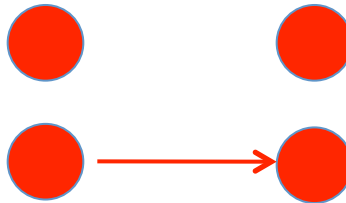
- Questionnaire surveys on friendship and advice networks
- Started in 2013 with first year students
- Patiently wait till students graduate



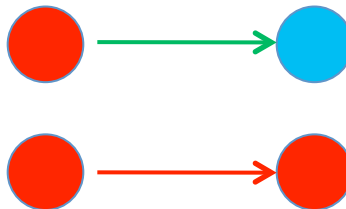
Social selection and social influence

Two different processes:

1) **Social selection:** Students select peers with similar academic achievements



2) **Social influence:** Students affect their peers, e.g. their achievements tend to become similar over time.



Social selection or social influence (2)

Research Questions:

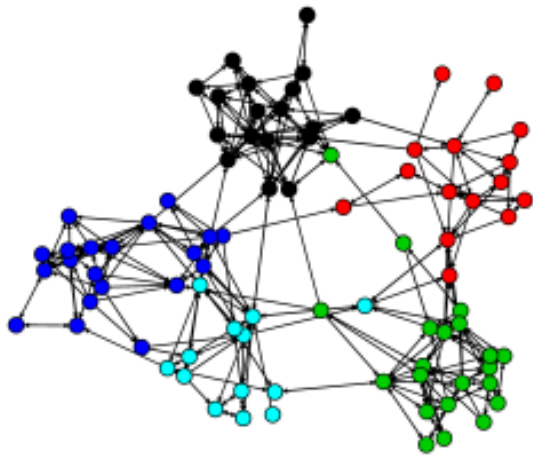
- How students select peers based on their performance?
- How peers influence performance of each other?

Method

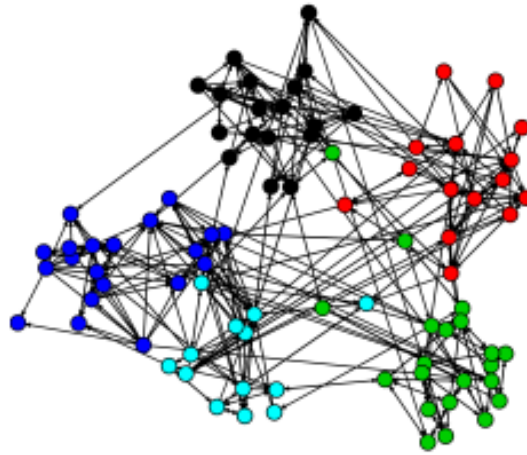
- Stochastic actor-oriented models
 - Each actor within the network improves its position
 - Network evolution is a continuous process and macro-changes within the network are the results of several micro-changes



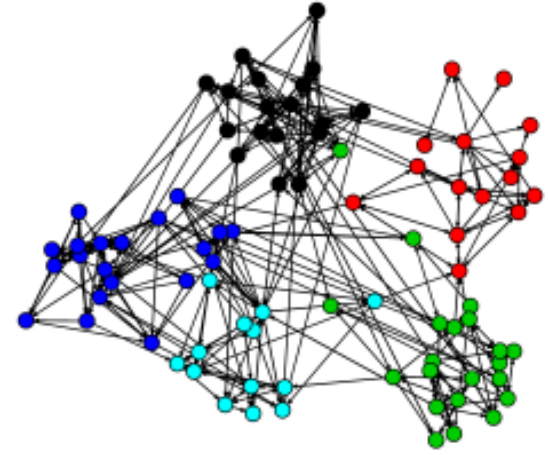
Network Visualizations



Wave 1

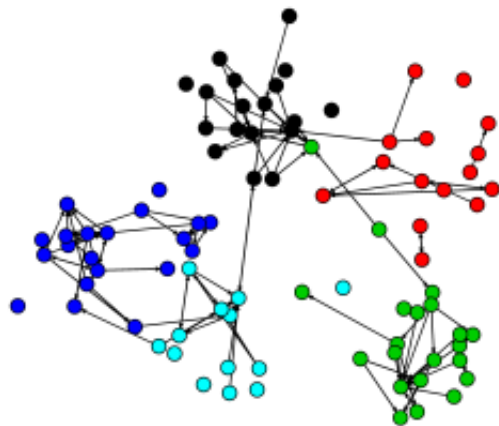


Wave 2

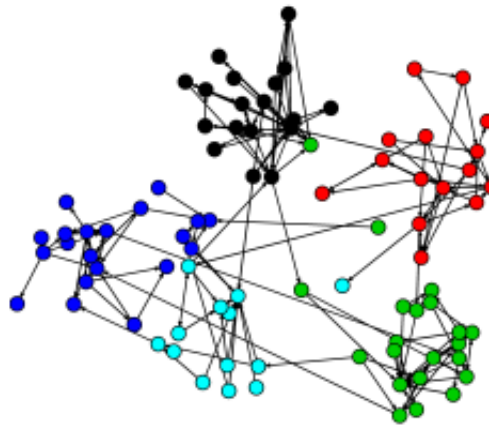


Wave 3

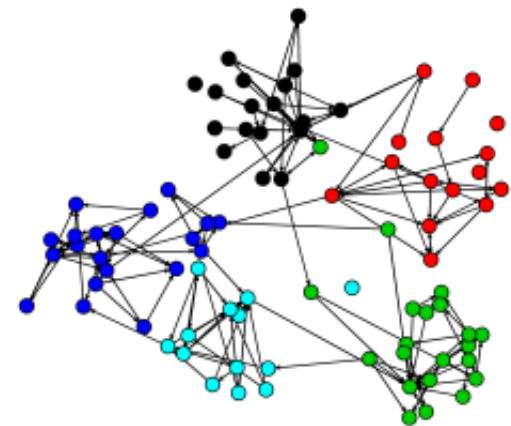
Friendship network (node color indicates study group affiliation)



Wave 1



Wave 2



Wave 3

Advice network (node color indicates study group affiliation)

Future directions

- Retakes and drop-outs
- Online and offline networks
- Long-lasting peer effects



TO BE CONTINUED

Another example how the study of HSE allow us to understand HE system in Russia better

- Peer effects in our research: some topics affect emergence of others
- USE – peer effects – PGE and networks – networks and dropouts etc

End

What shapes social ties

- We have analyzed factors that lead to the personal communication (friendship) and help networks formation
- The observed factors are among key determinants
 - Sharing the same study group is a dominant factor
 - Ties occur more often between students of the same gender
 - Similar academic achievement (current grades or admission tests) also matter
 - Peer's achievement matter in help network
 - Easily observed factors (study group, gender, USE, dormitory) predict friendship with 40% probability



Results

- Social influence in friendship networks:
 - Students with high and medium performance tend to positively influence on academic achievements of each other over time
 - Students with low and lower than medium achievements tend to receive lower grades over time even if their friends are high achievers
- Social selection in advice networks:
 - Strong for students from top 40%
 - All students tend to choose high-achievers as advisors
 - Students with poor grades do not tend to ask for help
- Social segregation based on performance (“rich-club phenomena”):
 - high-achievers form network core, low-achievers stay on network periphery and tend not to create social connections with their peers.



Results (2)

- How do friendship and advice student social networks coevolve?
 - Students, who are active (**have many ties?**) in help network, tend not to be active in friendship network and vice versa
 - Students, who are popular in friendship network tend not to be popular in advice network
 - Friends tend to create a link in advice network
 - Advisers tend to create a link in friendship network
 - Friends tend to create a reciprocal link in advice network
 - Friends of the same person tend not to create a link in advice network
 - Advisers of the same person tend to create a link in friendship network
 - Friends tend to ask the same person for advice



Impact of Academic Failure on Student Relationships

- Research Question:
How academic failure of students is connected with their network change?
- Method
 - Separable Temporal Exponential Random Graph Model (STERGM)
 - Different social forces that might participate in network formation and dissolution



Results

- Students with reexams tend to form ties with other students with reexams
- Students without reexams tend to form ties within their performance group
- Students with reexams over time become more active but less popular
- Friendship between high-achievers and students with reexams, if exists, tends to cease over time
- Ties within each performance group do not tend to dissolve
- Friendship between high-achievers and students with reexams, if exists, tends to cease over time.



Results (альтернативный вариант)

- There is a segregation based on student performance in the network
- Ties within each performance group do not tend to dissolve
- High-achievers over time tend not to choose students with reexams as friends
- Friendship between high-achievers and students with reexams, if exists, tends to cease over time
- Students that have reexams tend to become more active but less popular in the course of time

