SOCIAL policy gone bad EDUCATIONALLY: Unintended peer effects from transferred students

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Christos GENAKOS

Cambridge Judge Business School, CEP & CEPR

Eleni KYRKOPOULOU

AUEB, Econ

Transferring students as Social Policy

- Education, as leverage for social mobility and positive externalities, is a key social policy instrument.
- Mixing students from socioeconomic backgrounds, allowing school choice, affirmative action, desegregation are predicated upon positive peer effects.
- Lots of research on peer effects in primary and secondary education, but less evidence on tertiary education, somewhat modest if non-significant (none from Greece).
- How the tertiary education "production" function works (class size, methods, composition, financial/ psychological support etc)?
- This paper: How a social policy designed to help financially constrained families (allowing students to be transferred close to home) has gone bad educationally.

Transferring students as Social Policy

- University entrance exams in Greece (panhellenic exams).
- **After the exams** transfer system as part of social policy to assist financially constrained families.
- Highly inefficient system that harms the educational process (both of leaving and receiving departments, e.g., in academic year 2009-2010:
  - Early Childhood Education in Aristotle University of Thessaloniki : 110 receiving students, 104 transferred students
  - Business Administration in Athens University of Economics and Business : 250 receiving students, 218 transferred students.
  - Accounting in Technological Educational Institute of Piraeus : 150 receiving students, 257 transferred students
  - Law School in Democritus University of Thrace: 600 students entered; 132 students departed.
  - Department of Mathematics of the University of the Aegean : 210 students entered; 118 students departed
  - Department of Primary Education of the University of the Aegean: 250 students entered; 116 students departed
- Student heterogeneity and inefficient allocation.
- Despite importance and controversial impact, no systematic study of its effect on either transferred or receiving students.

This paper

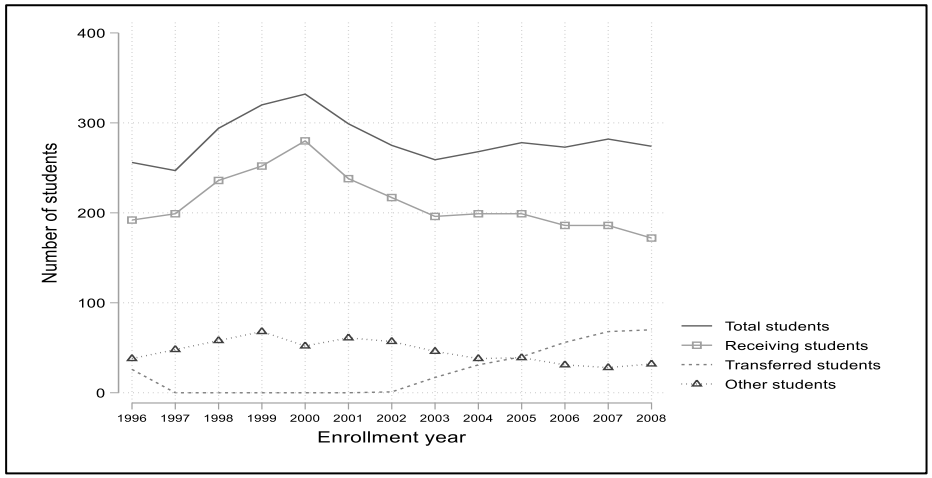
- We construct a novel dataset from a top undergraduate economics department in Greece, by linking **students' personal characteristics** and **exam results upon entry** (school grades, panhellenic exams grades, order of preference, order of entry, demographics etc.) with their **university academic performance** history (courses, grades).
- Large (quasi-random) variation in number of transferred students over time.
- We examine the impact of transferred students on the receiving students who have entered through national exams (panhellenics).
- Estimate peer effects at the university level.
- Our results contribute to evidence-based policy reform.

Data

- New dataset from a top undergrad economics department in Athens, Greece
- We link students' personal and background academic performance characteristics BEFORE university entry with their entire university academic performance history for all graduates who enrolled between 1996 and 2008.
- Individual level characteristics include:
  - Gender
  - School type (private/ public)
  - Studying away from home (parents not living in Athens)
  - Background in maths (majoring in classics at school)
  - Ranking order based on entry exams (Panhellenic exams)
  - Preference order (of the Department)
  - School grade/ Entry points

Transferred students change the composition of the student population

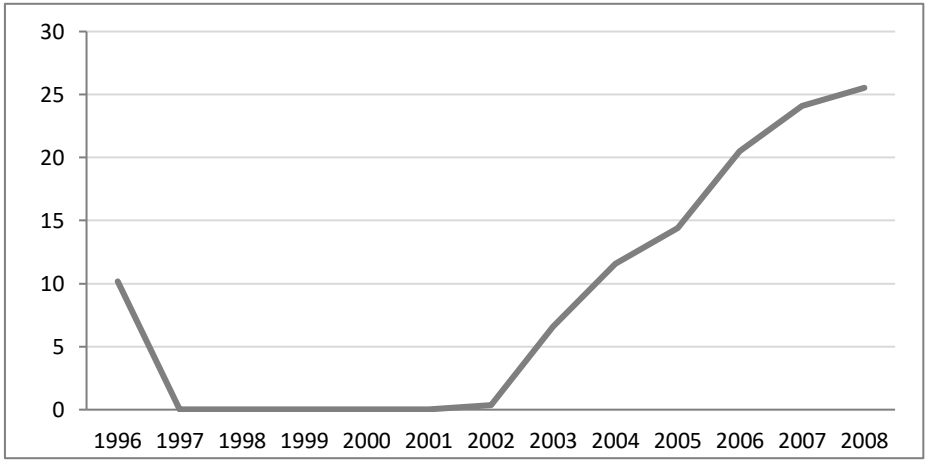
Number of students by enrollment type



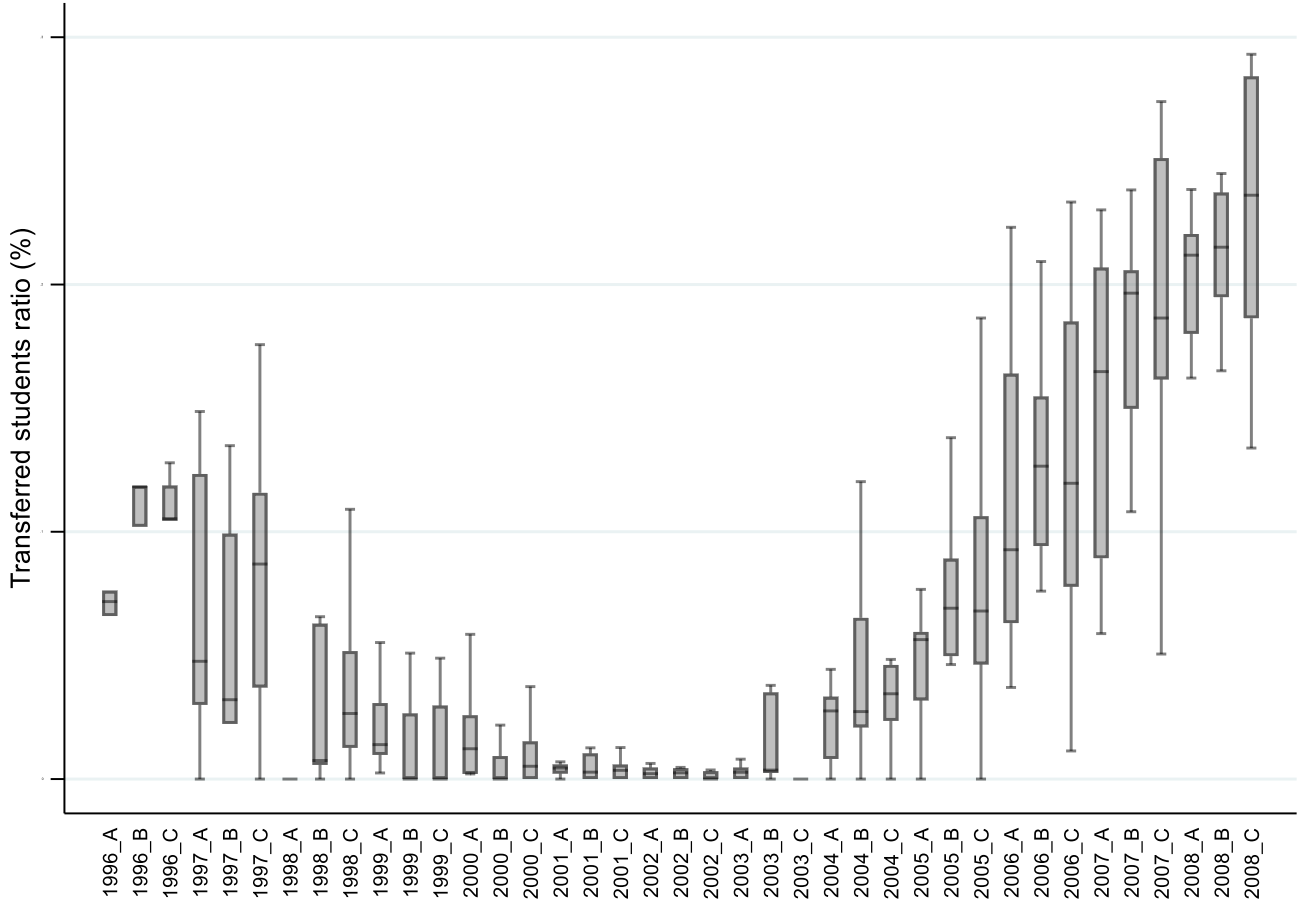
Average number of transferred students grows from 4 (before 2003) to 62

Given the total number of students pretty stable (281), percentage of transferred students grows from 0% to 26% by 2008

Transferred students' ratio by enrollment year (%)



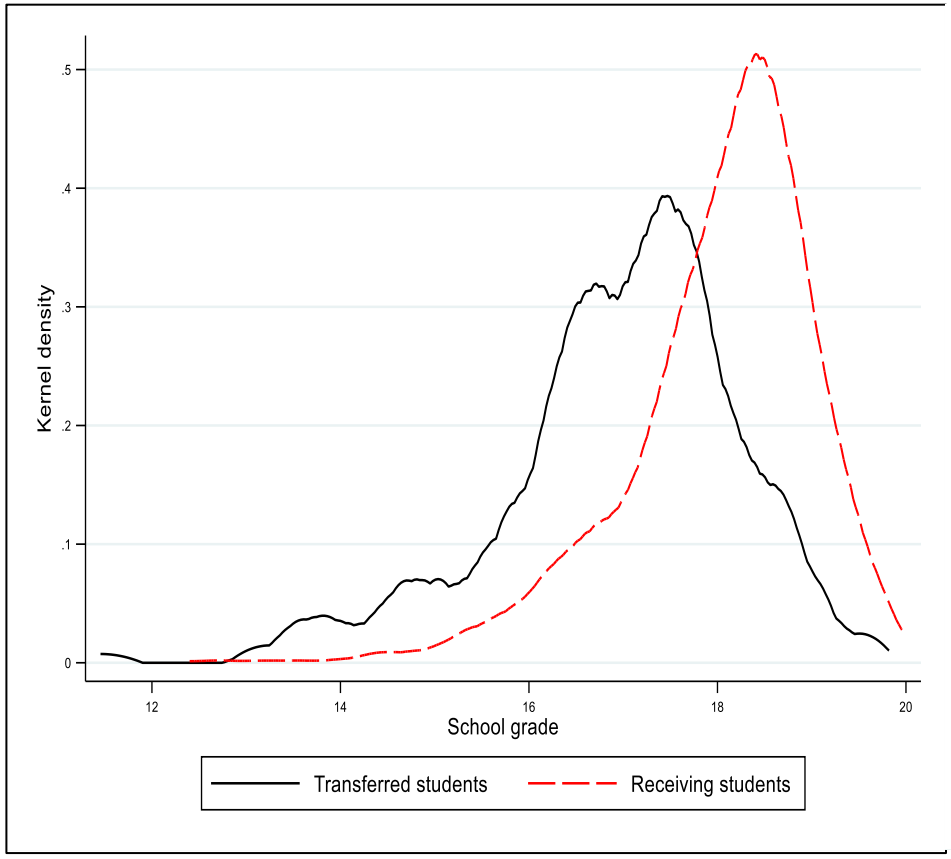
Frequent changes in regulations lead to quasi-random changes in % transferred students

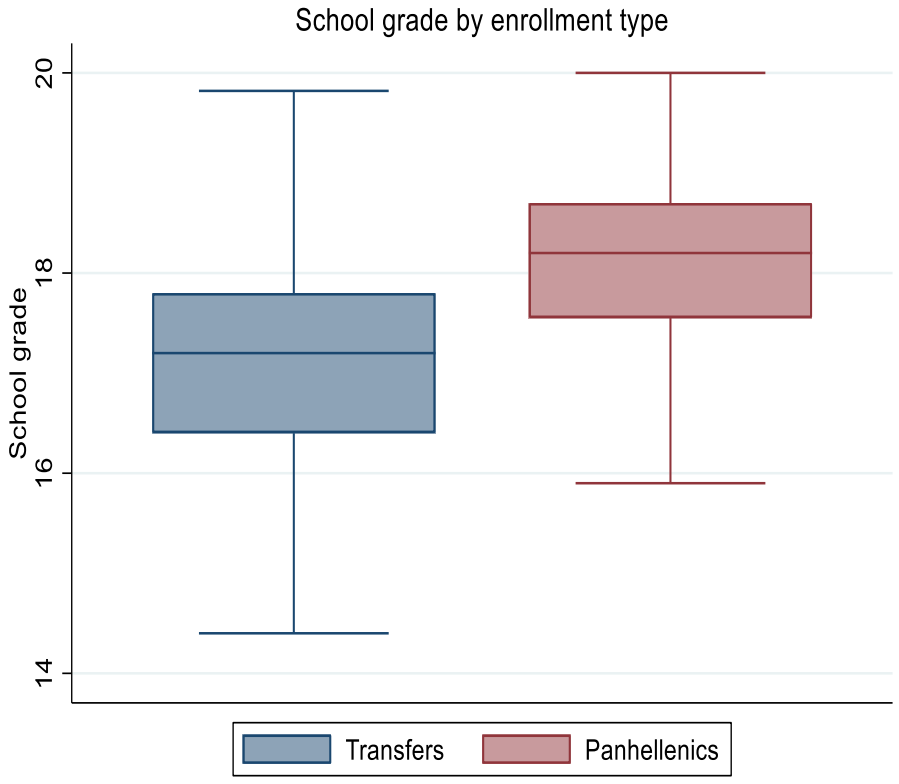


- Until 2004 social AND financial criteria.
- From 2004 onwards, financial criteria category alone was added.
- Several rule changes, including:
  - ✓ Entry semester
  - ✓ Passed courses in previous institution
  - ✓ Income threshold
  - ✓ Max percentage accepted
- Transferred students take different number of courses because they come at different point in time

Transferred students have lower school grades than receiving students

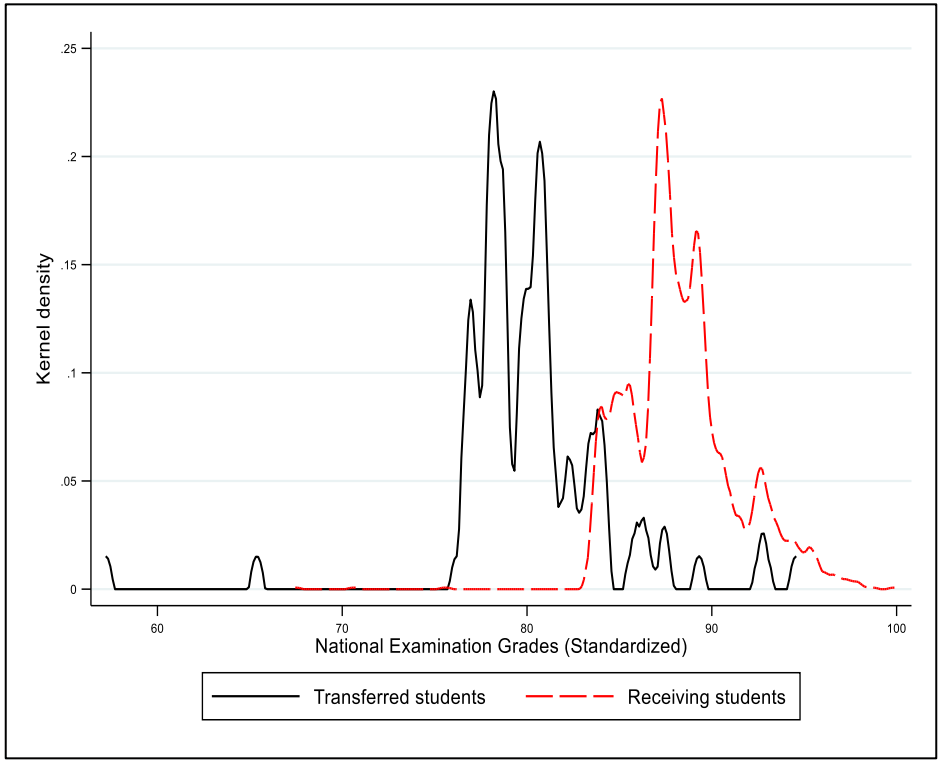
School grades by enrollment type

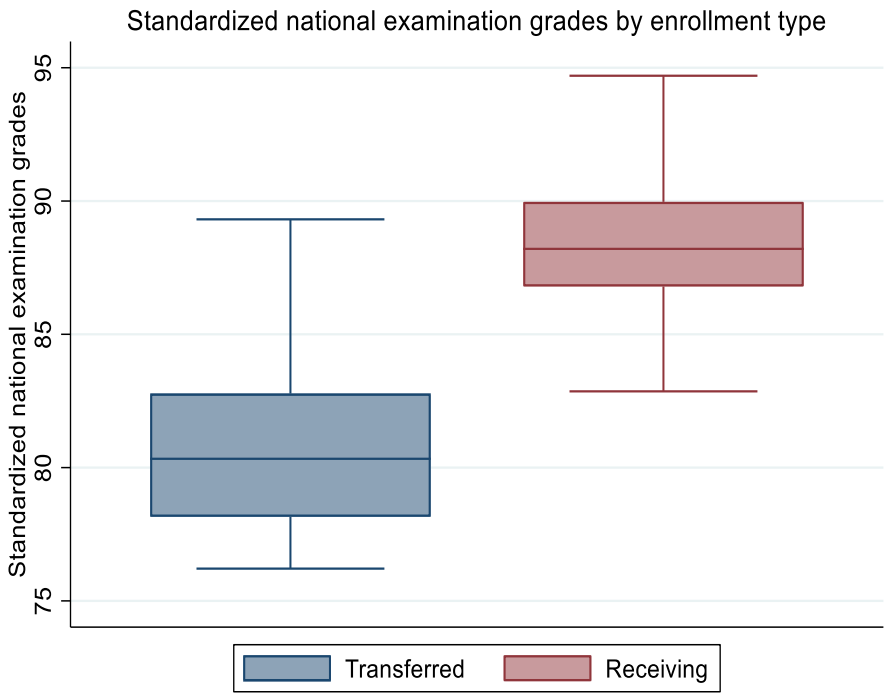




Transferred students have lower entry exam scores than receiving students

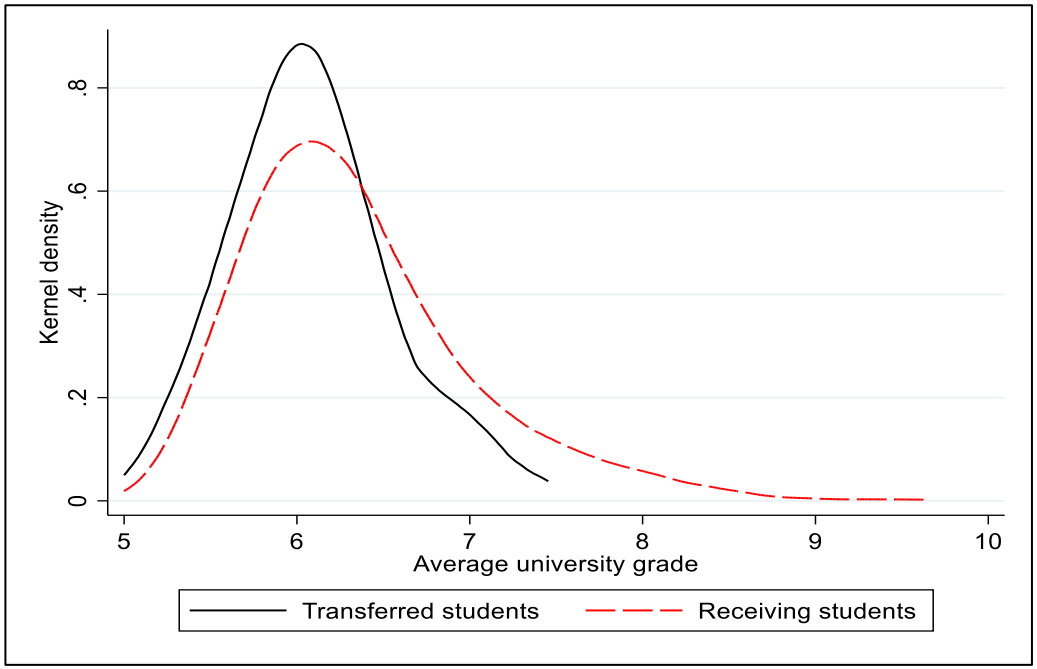
Standardized national examination grade by enrollment type





Transferred students graduate with lower grades than receiving students

Average university graduation grade by enrollment type



	Transferred	Receiving
Mean	6.08	6.34
Median	6.06	6.22
90th percentile	6.77	7.24

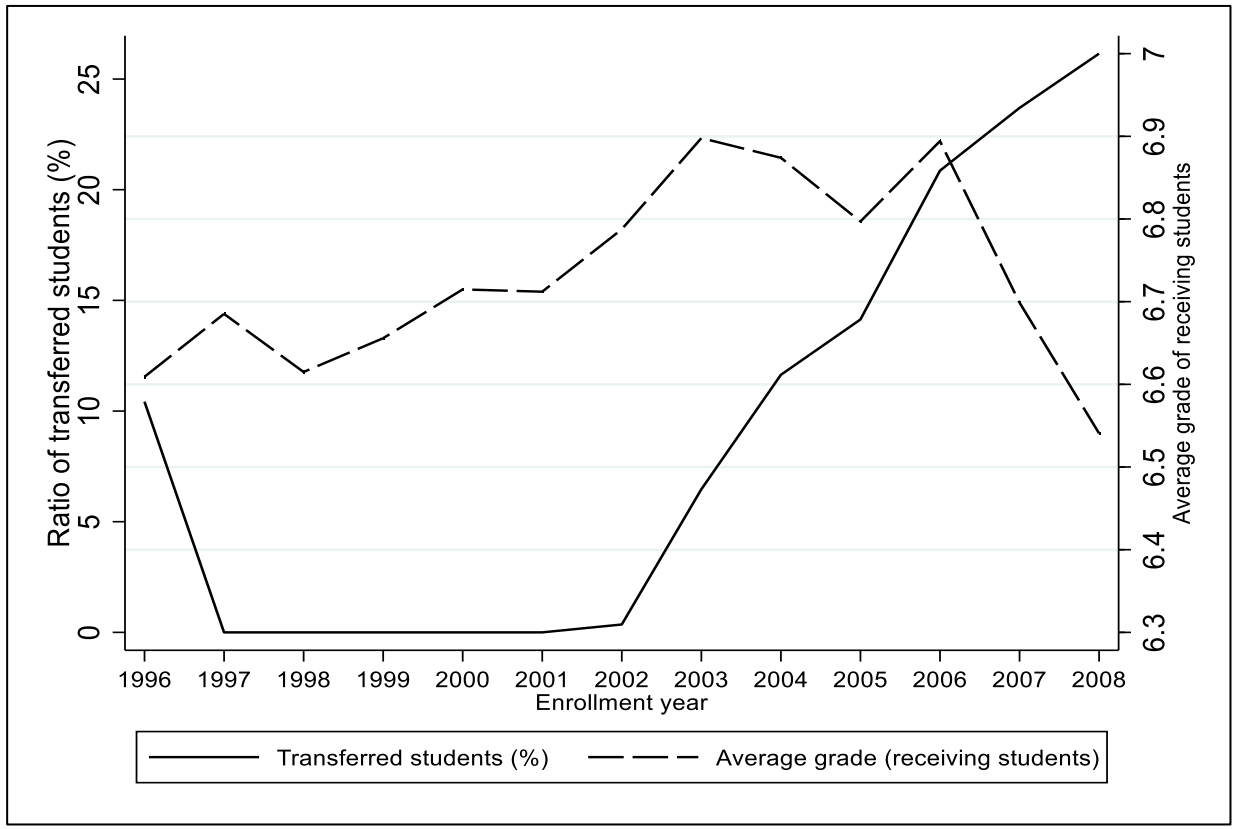
Transferred students take longer to graduate

TABLE 1 - GRADUATION RATE BY ENROLLMENT TYPE

	(1)	(2)	(3)
Enrollment type	Students' composition at entry (%)	Graduated in four years (%)	Not graduated in four years (%)
Receiving	77	85	63
Transferred	**8**	6	**23**
Others	15	9	14

Transferred students seem to exert a negative externality on receiving students

Percentage of transferred students
and average grade of receiving students



Methodology: **Value-added** specification

$$y_{ict} = \alpha + \beta Transfer\_Fraction_{ct} + \delta Uni\_grade_{i(t-1)} + \Omega X_{it} + \Gamma Exam\_Period_t + \Delta Enrollment\_Year_t + \Pi Course_c + \varepsilon_{ct}$$

y_{ict}: academic outcome (grade or pass) of receiving student i in course c at examination period t

$Transfer\_Fraction_{ct}$: number of transfer students over the total number of students taking course c at examination period t

$Uni\_grade_{i(t-1)}$: student i's average grade in the university up to the previous examination period.

Significant negative impact of fraction of transferred students on **grade**

TABLE 2 - TRANSFERRED STUDENTS IMPACT ON RECEIVING STUDENTS (**VALUE ADDED**)

Dependent variable	(1) $Grade_{ict}$	(2) $Grade_{ict}$	(3) $Grade_{ict}$	(4) $Grade_{ict}$	(5) $Grade_{ict}$	(6) $Grade_{ict}$	(7) $Grade_{ict}$	(8) $Grade_{ict}$
Sample	Benchmark	Characteristics	Female	Male	Bottom quartile of receiving students	2nd quartile of 3rd quartile of receiving students	3rd quartile of receiving students	Top quartile of receiving students
$Transfer\_fraction_{ct}$	-0.087**	-0.078**	-0.070*	-0.089**	-0.096**	-0.086**	-0.074*	-0.053
	(0.041)	(0.037)	(0.039)	(0.038)	(0.039)	(0.041)	(0.043)	(0.042)
$GPA_{i(t-1)}$ university average up to that exam period	0.432***	0.368***	0.371***	0.364***	0.343***	0.381***	0.369***	0.369***
	(0.007)	(0.007)	(0.008)	(0.008)	(0.010)	(0.010)	(0.010)	(0.009)
Observations	71,614	71,614	38,421	33,193	18,675	18,143	17,991	16,697
$Exam\_Period_t$	yes	yes	yes	yes	yes	yes	yes	yes
$Course_c$	yes	yes	yes	yes	yes	yes	yes	yes
$Enrollment\_Year_t$	yes	yes	yes	yes	yes	yes	yes	yes
Additional controls: gender, private school, classics major, family town, preference order, school grade, ranking order, experience.		yes	yes	yes	yes	yes	yes	yes

Significant negative impact of fraction of transferred students on **pass**

TABLE 3 - TRANSFERRED STUDENTS IMPACT ON RECEIVING STUDENTS (**VALUE ADDED**)

Dependent variable	(1) $Pass_{ict}$	(2) $Pass_{ict}$	(3) $Pass_{ict}$	(4) $Pass_{ict}$	(5) $Pass_{ict}$	(6) $Pass_{ict}$	(7) $Pass_{ict}$	(8) $Pass_{ict}$
Sample	benchmark	characteristics	Female	Male	Bottom quartile of receiving students	2nd quartile of receiving students	3rd quartile of receiving students	Top quartile of receiving students
$Transfer\_fraction_{ct}$	-0.050***	-0.044*	-0.045***	-0.044***	-0.053***	-0.054***	-0.044**	-0.025
	(0.018)	(0.022)	(0.016)	(0.016)	(0.018)	(0.018)	(0.019)	(0.018)
$GPA_{i(t-1)}$ university average up to that exam period	0.166***	0.130***	0.133***	0.127***	0.125***	0.139***	0.136***	0.116***
	(0.003)	(0.007)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Observations	71,614	71,614	38,421	33,193	18,675	18,143	17,991	16,697
$Exam\_Period_t$	yes	yes	yes	yes	yes	yes	yes	yes
$Course_c$	yes	yes	yes	yes	yes	yes	yes	yes
$Enrollment\_Year_t$	yes	yes	yes	yes	yes	yes	yes	yes
Additional controls: gender, private school, classics major, family town, preference order, school grade, ranking order, experience.		yes	yes	yes	yes	yes	yes	yes

Methodology: **Peer effects**

$$y_{ict} = \alpha + \rho\bar{y}_{-ict} + \delta Uni\_grade_{i(t-1)} + \Omega X_{it} + \Gamma Exam\_Period_t + \Pi Course_c + \Delta Enrollment\_Year_t + \varepsilon_{ict}$$

y_{ict}: academic outcome (grade or pass) of receiving student i in course c at examination period t

$\bar{y}_{-ict}$: average peer grade obtained by receiving students (who have entered through panhellenic exams) in course c at examination period t excluding student i.

- Peer effect ρ: self-selection (core courses) and reflection problem (IV: Transfer fraction)

Significant negative peer effect from transferred students

TABLE 4 - **PEER EFFECTS** IN ACHIEVEMENT FOR RECEIVING STUDENTS

	(1)	(2)	(3)	(4)
Estimation method	2SLS	2SLS	2SLS	2SLS
Dependent variable	$Grade_{ict}$	$Grade_{ict}$	$Pass_{ict}$	$Pass_{ict}$
Sample	benchmark	with characteristics	benchmark	with characteristics
$\overline{y}_{-ict}$	0.272***	0.239***	0.107***	0.091***
average peer score	(0.049)	(0.059)	(0.016)	(0.017)
$GPA_{i(t-1)}$	0.431***	0.372***	0.166***	0.131***
university average up to that exam period	(0.007)	(0.007)	(0.003)	(0.003)
First Stage				
$Transfer\_fraction_{ct}$	-0.328***	-0.282**	-0.462***	-0.399***
	(0.108)	(0.109)	(0.109)	(0.108)
F-test of excluded instruments	9.21	6.72	17.98	13.59
p-value	[0.003]	[0.010]	[0.000]	[0.000]
Observations	71,606	71,606	71,606	71,606
$Exam\_Period_t$	yes	yes	yes	yes
$Course_c$	yes	yes	yes	yes
$Enrollment\_Year_t$	yes	yes	yes	yes
Additional controls: gender, private school, classics major, family town, preference order, school grade, ranking order, experience.		yes		yes

The main channel of negative externality is courses with strong math component

TABLE 5 - PEER EFFECT HETEROGENEITY ACROSS COURSE TYPE

	(1)	(2)	(3)	(4)
Estimation method	2SLS	2SLS	2SLS	2SLS
Dependent variable	$Grade_{ict}$	$Grade_{ict}$	$Pass_{ict}$	$Pass_{ict}$
Sample	econ	math	econ	math
$\bar{y}_{-ict}$	0.129	0.306***	0.066*	0.130***
average peer score	(0.233)	(0.040)	(0.037)	(0.017)
$GPA_{i(t-1)}$	0.439***	0.408***	0.167***	0.162***
university average up to that exam period	(0.008)	(0.013)	(0.003)	(0.005)
First Stage				
$Transfer\_fraction_{ct}$	-0.127	-0.548***	-0.320***	-0.564***
	(0.116)	(0.165)	(0.118)	(0.175)
F-test of excluded instruments	1.20	11.05	7.33	10.36
p-value	[0.275]	[0.001]	[0.007]	[0.002]
Observations	52,551	19,055	52,551	19,055
$Exam\_Period_t$	yes	yes	yes	yes
$Course_c$	yes	yes	yes	yes
$Enrollment\_Year_t$	yes	yes	yes	yes

Other results

- Peer effects do **not** differ by academic quality level of receiving students

- We do not detect nonlinearities, when we classify both receiving and transferred students by their pre-university achievement quartiles

  Exception: the weakest receiving students are the ones mostly affected (by the weakest transferred students) compared to the rest of receiving students

- We do not find that the negative externality due to transferred students is stronger for students in their first year as opposed to more mature students.

Conclusions

- ✓First systematic examination of how transferred university students impact receiving students, using detailed micro data.
- ✓Transferred students are of significant lower quality before moving and graduate with lower grades.
- ✓Transferred students exert a significant negative externality across the quality spectrum of incumbent students.
- ✓The main channel of negative externality is in courses with strong math component
- ✓A social policy that is meant to help financially constraint families and correct inequalities has the unintended consequence of lowering the academic achievements of incumbent students.
- ✓More research is needed (other depts, other fields).
- ✓Policy needs to change!

Thank you for your attention!

For comments & suggestions please reach me at:

ekyrkopoulou@hbs.edu

kyrkopel@aueb.gr

www.linkedin.com/in/elenikyrkopoulou

@EKyrkopoulou

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TABLE A1 - TRANSFERRED STUDENTS IMPACT ON RECEIVING STUDENTS (VALUE ADDED)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation method	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Dependent variable	$Grade_{ict}$	$Grade_{ict}$	$Grade_{ict}$	$Grade_{ict}$	$Grade_{ict}$	$Grade_{ict}$	$Grade_{ict}$	$Grade_{ict}$
Sample	Benchmark	Characteristics	Female	Male	Bottom quartile	2nd quartile	3rd quartile	Top quartile
$Transfer\_fraction_{ct}$	-0.087**	-0.078**	-0.070*	-0.089**	-0.096**	-0.086**	-0.074*	-0.053
	(0.041)	(0.037)	(0.039)	(0.038)	(0.039)	(0.041)	(0.043)	(0.042)
$GPA_{i(t-1)}$ university average up to that exam period	0.432***	0.368***	0.371***	0.364***	0.343***	0.381***	0.369***	0.369***
	(0.007)	(0.007)	(0.008)	(0.008)	(0.010)	(0.010)	(0.010)	(0.009)
Female		0.020***			0.025*	0.003	0.049***	0.018
		(0.007)			(0.014)	(0.014)	(0.014)	(0.015)
Private school		0.024**	0.033**	0.016	0.042**	0.012	-0.004	0.015
		(0.010)	(0.014)	(0.014)	(0.021)	(0.018)	(0.020)	(0.019)
Parents' residence in the same city		-0.013*	-0.015	-0.007	-0.025*	0.002	-0.015	0.003
		(0.007)	(0.010)	(0.011)	(0.013)	(0.013)	(0.014)	(0.016)
High school specialization without maths		-0.037**	-0.054***	-0.016	-0.041	-0.075***	0.010	-0.058**
		(0.015)	(0.016)	(0.028)	(0.026)	(0.024)	(0.024)	(0.027)
Dept first in preference		0.017*	0.046***	-0.012	0.020	-0.010	-0.001	0.036**
		(0.010)	(0.013)	(0.014)	(0.024)	(0.019)	(0.018)	(0.015)
School grade		0.005	0.015**	0.001	-0.001	0.021***	0.001	-0.007
		(0.004)	(0.006)	(0.005)	(0.007)	(0.008)	(0.008)	(0.009)
Top 10 panhellenic student		0.106***	0.084***	0.128***	0.004	0.154**		-0.092
		(0.023)	(0.029)	(0.032)	(0.055)	(0.069)		(0.182)
Top10-50 panhellenic student		0.024	-0.001	0.052**	0.036	-0.070*	0.053	-0.169
		(0.016)	(0.021)	(0.025)	(0.051)	(0.038)	(0.174)	(0.180)
Top50-100 panhellenic student		0.013	0.021	0.004	0.050	-0.058	0.223	-0.176
		(0.015)	(0.020)	(0.023)	(0.065)	(0.038)	(0.164)	(0.181)
Top100-200 panhellenic student		0.003	0.013	-0.003	-0.034		0.235	
		(0.014)	(0.019)	(0.023)	(0.022)		(0.164)	
First time taking this course		0.502***	0.484***	0.520***	0.489***	0.482***	0.485***	0.551***
		(0.015)	(0.016)	(0.016)	(0.019)	(0.018)	(0.018)	(0.020)
Observations	71,614	71,614	38,421	33,193	18,675	18,143	17,991	16,697
Exam_Period FE	yes	yes	yes	yes	yes	yes	yes	yes
Enrollment Year FE	yes	yes	yes	yes	yes	yes	yes	yes
Course FE	yes	yes	yes	yes	yes	yes	yes	yes

TABLE A.2.1 - TRANSFERRED STUDENTS IMPACT ON RECEIVING STUDENTS (VALUE ADDED)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation method	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Dependent variable	$Pass_{ict}$	$Pass_{ict}$	$Pass_{ict}$	$Pass_{ict}$	$Pass_{ict}$	$Pass_{ict}$	$Pass_{ict}$	$Pass_{ict}$
Sample	benchmark	characteristics	Female	Male	Bottom quartile	2nd quartile	3rd quartile	Top quartile
$Transfer\_fraction_{ct}$	-0.050***	-0.044*	-0.045***	-0.044***	-0.053***	-0.054***	-0.044**	-0.025
	(0.018)	(0.022)	(0.016)	(0.016)	(0.018)	(0.018)	(0.019)	(0.018)
$GPA_{i(t-1)}$	0.166***	0.130***	0.133***	0.127***	0.125***	0.139***	0.136***	0.116***
	(0.003)	(0.007)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Gender		0.003			0.007	-0.007	0.012	0.003
		(0.005)			(0.007)	(0.007)	(0.007)	(0.007)
Private school		0.011*	0.016**	0.006	0.022**	-0.002	0.001	0.014
		(0.006)	(0.007)	(0.007)	(0.011)	(0.010)	(0.010)	(0.010)
Parents' residence in the same city		-0.008*	-0.013***	-0.001	-0.013*	0.000	-0.011	0.001
		(0.004)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)	(0.008)
High school specialization without maths		-0.012	-0.015*	-0.015	0.001	-0.042***	0.000	-0.009
		(0.012)	(0.008)	(0.014)	(0.013)	(0.013)	(0.012)	(0.012)
Dept first in preference		0.004	0.009	0.000	-0.000	-0.012	-0.006	0.019**
		(0.004)	(0.006)	(0.007)	(0.012)	(0.010)	(0.010)	(0.008)
School grade		0.003	0.008**	0.001	-0.000	0.010**	0.001	0.001
standardized school grade		(0.003)	(0.003)	(0.002)	(0.004)	(0.004)	(0.004)	(0.005)
Top 10 panhellenic student		0.014	0.011	0.013	-0.002	0.064		-0.119
		(0.008)	(0.015)	(0.017)	(0.026)	(0.039)		(0.086)
Top10-50 panhellenic student		0.007	0.000	0.013	0.013	-0.068***	-0.004	-0.119
		(0.005)	(0.011)	(0.013)	(0.024)	(0.020)	(0.101)	(0.085)
Top50-100 panhellenic student		0.008	0.015	0.000	0.030	-0.035*	0.050	-0.129
		(0.005)	(0.011)	(0.013)	(0.032)	(0.020)	(0.097)	(0.085)
Top100-200 panhellenic student		0.004	0.009	-0.001	-0.012		0.047	
		(0.006)	(0.011)	(0.012)	(0.012)		(0.097)	
First time taking this course		0.313***	0.306***	0.319***	0.307***	0.305***	0.303***	0.334***
		(0.013)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)
Observations	71,614	71,614	38,421	33,193	18,675	18,143	17,991	16,697
Exam_Period FE	yes	yes	yes	yes	yes	yes	yes	yes
Enrollment Year FE	yes	yes	yes	yes	yes	yes	yes	yes
Course FE	yes	yes	yes	yes	yes	yes	yes	yes

TABLE A2.2 - TRANSFERRED STUDENTS IMPACT ON RECEIVING STUDENTS (VALUE ADDED)

LOGIT

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation method	Logit	Logit	Logit	Logit	Logit	Logit	Logit	Logit
Dependent variable	$Pass_{ict}$	$Pass_{ict}$	$Pass_{ict}$	$Pass_{ict}$	$Pass_{ict}$	$Pass_{ict}$	$Pass_{ict}$	$Pass_{ict}$
Sample	benchmark	characteristics	Female	Male	Bottom quartile	2nd quartile	3rd quartile	Top quartile
$Transfer\_fraction_{ct}$	0.245***	-0.244**	-0.246***	0.242***	0.275***	0.287***	-0.242**	-0.156
	(0.084)	(0.117)	(0.085)	(0.084)	(0.091)	(0.094)	(0.098)	(0.098)
$GPA_{i(t-1)}$ university average up to that exam period	0.797***	0.693***	0.713***	0.675***	0.642***	0.739***	0.720***	0.673***
	(0.015)	(0.033)	(0.019)	(0.019)	(0.024)	(0.025)	(0.025)	(0.024)
Observations	71,614	71,614	38,421	33,193	18,675	18,143	17,991	16,697
Exam_Period FE	yes	yes	yes	yes	yes	yes	yes	yes
Enrollment Year FE	yes	yes	yes	yes	yes	yes	yes	yes
Course FE	yes	yes	yes	yes	yes	yes	yes	yes
Additional controls: gender, private school, classics major, family town, preference order, school grade, ranking order, experience.		yes	yes	yes	yes	yes	yes	yes

TABLE A3 - PEER EFFECTS IN ACHIEVEMENT FOR RECEIVING STUDENTS

Dependent variable	(1) Grade	(2) Grade	(3) Pass	(4) Pass
Sample	benchmark	with characteristics	benchmark	with characteristics
$\bar{y}_{-ict}$	0.272***	0.239***	0.107***	0.091***
average peer grade	(0.049)	(0.059)	(0.016)	(0.017)
$GPA_{i(t-1)}$	0.431***	0.372***	0.166***	0.131***
university average up to that exam period	(0.007)	(0.007)	(0.003)	(0.003)
Total number of students		0.013		0.009
		(0.017)		(0.007)
Female		0.020***		0.003
		(0.007)		(0.004)
Private school		0.025**		0.011**
		(0.010)		(0.005)
Parents' residence in the same city		-0.013*		-0.007**
		(0.007)		(0.004)
High school specialization without maths		-0.040***		-0.014*
		(0.015)		(0.007)
Dept first in preference		0.019*		0.004
		(0.010)		(0.005)
School grade		0.006		0.004*
standardized school grade		(0.004)		(0.002)
Top 10 panhellenic student		0.102***		0.012
		(0.022)		(0.011)
Top10-50 panhellenic student		0.022		0.007
		(0.015)		(0.008)
Top50-100 panhellenic student		0.014		0.008
		(0.014)		(0.008)
Top100-200 panhellenic student		0.002		0.004
		(0.014)		(0.008)
First time taking this course		0.464***		0.298***
		(0.017)		(0.008)
Observations	71,606	71,606	71,606	71,606
Exam_Period FE	yes	yes	yes	yes
Enrollment Year FE	yes	yes	yes	yes
Course FE	yes	yes	yes	yes

Theory and Literature

Large literatures on

- Various elements of the educational production function. *(e.g. Koedel et al., 2015)*
- Peer effects in education. (*e.g., Angrist and Lang, 2004)*
- Unintended consequences of (social) policies. *(e.g., Imberman et al., 2012)*

Theory predictions:

- ✓ **Ambiguous impact** of transferred to incumbent students *a priori* (important for policy).
- ✓ What are the **channels** through which transferred students impact incumbent students?

Summary statistics

Variable	Receiving	Transferred	Difference test
Demographics			
Female	0.547	0.626	-0.078**
	(0.498)	(0.485)	(0.023)
Parents' residence in the same city	0.644	0.617	0.033
	(0.479)	(0.487)	(0.414)
Private school	0.147	0.066	0.081***
	(0.354)	(0.249)	(0.001)
Before university entry			
School grade	18.025	16.961	1.063***
	(1.007)	(1.289)	(0.000)
Panhellenic exam score	88.299	80.254	8.046***
	(2.934)	(4.329)	(0.000)
Ranking order	102.592	-	
	(62.692)		
Preference order	3.929	-	
	(4.003)		
Classics major	0.092	0.062	0.031
	(0.290)	(0.241)	(0.121)
University academic performance			
Number of years	4.533	4.313	0.221**
	(1.489)	(1.169)	(0.030)
Average grade (core modules)	6.340	6.079	0.261***
	(0.653)	(0.453)	(0.000)
Observations	2,379	227	

Random Assignment

RANDOM ASSIGNMENT

Dependent variable	(1) National exam grade	(2) Female	(3) Private school	(4) Family same city	(5) Ranking order	(6) School grade	(7) Classics major
$Transfer\_indicator_{ct}$	-124.808	-0.007	-0.009*	0.004	-0.534	-0.031*	0.001
D=1 if no transferred students in class	(76.820)	(0.008)	(0.005)	(0.008)	(1.065)	(0.016)	(0.004)
Observations	41,617	41,617	41,617	41,617	41,583	27,300	41,617
Within R-squared	0.856	0.0136	0.0295	0.0114	0.0434	0.536	0.0600
Enrollment $Year_t$	yes	yes	yes	yes	yes	yes	yes
$Exam\_Period_t$	yes	yes	yes	yes	yes	yes	yes
$Course_c$	yes	yes	yes	yes	yes	yes	yes

Methodology
Step 1: aggregate level

Three step methodology:

- Step 1: impact of transferred on receiving students (aggregate level)

$$\bar{y}_{ct} = \alpha + \beta Transfer\_Fraction_{ct} + \Gamma Exam\_Period_t + \Delta Enrollment\_Year_t + \Pi Course_c + \varepsilon_{ct}$$

where:

$\bar{y}_{ct}$ is the average grade obtained by receiving students (who have entered through panhellenic exams) in course c at examination period t,

$Transfer\_Fraction_{ct}$ is the number of transfer students divided by the total number of students taking course c at examination period t

$Exam\_Period_t$ is period fixed effects

$Course_c$ is course fixed effects

$\Delta Enrollment\_Year_t$ is cohort fixed effects

s.e. clustered at the course level

Aggregate results: Significant negative impact of transferred students on average grade

TABLE A4 - TRANSFERRED STUDENTS IMPACT ON RECEIVING STUDENTS (AGGREGATE LEVEL)

Dependent variable	(1) $Grade_{ct}$	(2) $Grade_{ct}$	(3) $Grade_{ct}$	(4) $Grade_{ct}$	(5) $Pass_{ct}$	(6) $Pass_{ct}$	(7) $Pass_{ct}$	(8) $Pass_{ct}$
$Transfer\_Fraction_{ct}$	-0.447***		-0.448***		-0.103***		-0.103***	
	(0.112)		(0.110)		(0.024)		(0.024)	
First quartile $Transfer\_fraction_{ct}$		-0.370**		-0.322*		-0.068**		-0.064**
		(0.175)		(0.165)		(0.029)		(0.030)
Second quartile $Transfer\_fraction_{ct}$		-0.696***		-0.672***		-0.130***		-0.128***
		(0.219)		(0.206)		(0.037)		(0.037)
Third quartile $Transfer\_fraction_{ct}$		-1.015***		-0.994***		-0.205***		-0.203***
		(0.248)		(0.237)		(0.042)		(0.041)
Fourth quartile $Transfer\_fraction_{ct}$		-1.065***		-1.033***		-0.237***		-0.234***
		(0.287)		(0.289)		(0.056)		(0.056)
Total number of $students_{ct}$			-0.143	-0.114			-0.016	-0.010
			(0.087)	(0.082)			(0.013)	(0.012)
Observations	522	522	522	522	522	522	522	522
Within R-squared	0.402	0.421	0.408	0.425	0.393	0.409	0.395	0.410
Exam_Period FE	yes	yes	yes	yes	yes	yes	yes	yes
Course FE	yes	yes	yes	yes	yes	yes	yes	yes

Methodology
Step 3a: peer effect by quality of incumbent students

- Step 3a: peer effect by quality of incumbent students

$$y_{ict} = \alpha + \rho_1 \overline{y}_{-ict} \times \mathrm{D}_{Q1} + \rho_2 \overline{y}_{-ict} \times \mathrm{D}_{Q2} + \rho_3 \overline{y}_{-ict} \times \mathrm{D}_{Q3} + \rho_4 \overline{y}_{-ict} \times \mathrm{D}_{Q4} + \delta Uni\_grade_{i(t-1)} + \Omega X_{it} + \Gamma Exam\_Period_t + \Delta Enrollment\_Year_t + \Pi Course_c + \varepsilon_{ct}$$

where, D_{Qk} is an indicator of whether incumbent student i school grade or panhellenic exam entry score is in quartile $k = 1,2,3,4$ of the incumbent distribution for year t.

Peer effects no different across different quartiles of receiving students

TABLE A5 - NON-LINEAR PEER EFFECTS FOR RECEIVING STUDENTS

	(1)	(2)	(3)	(4)
Estimation method	2SLS	2SLS	2SLS	2SLS
Dependent variable	$Grade_{ict}$	$Grade_{ict}$	$Pass_{ict}$	$Pass_{ict}$
Sample	benchmark	with characteristics	benchmark	with characteristics
Average peer grade × quartile 1 of receiving student distribution	0.182	0.127	0.146**	0.113
	(0.136)	(0.156)	(0.067)	(0.073)
Average peer grade × quartile 2 of receiving student distribution	0.282***	0.288**	0.096*	0.090
	(0.106)	(0.121)	(0.058)	(0.058)
Average peer grade × quartile 3 of receiving student distribution	0.208*	0.170	0.035	0.018
	(0.118)	(0.126)	(0.079)	(0.085)
Average peer grade × quartile 4 of receiving student distribution	0.409***	0.371**	0.146**	0.141*
	(0.149)	(0.146)	(0.065)	(0.074)
$GPA_{i(t-1)}$ university average up to that exam period	0.430***	0.370***	0.166***	0.131***
	(0.007)	(0.007)	(0.003)	(0.003)
Observations	71,498	71,498	71,498	71,498
Exam_Period FE	yes	yes	yes	yes
Enrollment Year FE	yes	yes	yes	yes
Course FE	yes	yes	yes	yes
Additional controls: gender, private school, theoretical major, family town, preference order, school grade, ranking order, experience.		yes		yes

Methodology
Step 3b: nonlinear peer effect by quality of incumbent students

- Step 3b: nonlinear peer effect by quality of incumbent students

$$E(y_{ict}/Q_k) = \alpha + \beta_{q1} Transfer\_Fraction_{Q1ct} + \beta_{q2} Transfer\_Fraction_{Q2ct}$$
$$+\beta_{q3} Transfer\_Fraction_{Q3ct} + \beta_{q4} Transfer\_Fraction_{Q4ct}$$
$$+\Omega X_{it} + \Gamma Exam\_Period_t + \Delta Enrollment\_Year_t + \Pi Course_c + \varepsilon_{ct}$$

where, Q_k is the incumbent student's i school grade or panhellenic exam entry score quartile k. We classify incumbent and transferred students by pre-university achievement quartiles. Then we estimate separate regressions for incumbent students in each quartile of achievement on the transferred fraction of students who fall in each quartile.

Result 5a: No significantly detectable nonlinear peer effects (grade), **except for the bottom**

TABLE A6.1 - FULLY NON-LINEAR PEER EFFECTS FOR RECEIVING STUDENTS

Panel A					
Dependent variable	(1) $Grade_{ict}$	(2) $Grade_{ict}$	(3) $Grade_{ict}$	(4) $Grade_{ict}$	(5) $Grade_{ict}$
Period	ALL	Bottom quartile	2nd quartile	3rd quartile	Top quartile
$Transfer\_fraction_{ct}$ in quartile 1	-0.064	-0.092**	-0.071	-0.046	-0.033
	(0.040)	(0.042)	(0.043)	(0.044)	(0.049)
$Transfer\_fraction_{ct}$ in quartile 2	-0.005	0.017	-0.014	-0.022	-0.026
	(0.031)	(0.036)	(0.035)	(0.036)	(0.032)
$Transfer\_fraction_{ct}$ in quartile 3	-0.038	-0.027	-0.039	-0.023	-0.064
	(0.036)	(0.037)	(0.040)	(0.038)	(0.043)
$Transfer\_fraction_{ct}$ in quartile 4	-0.017	-0.016	-0.015	-0.023	-0.038
	(0.026)	(0.027)	(0.029)	(0.028)	(0.031)
Observations	79,923	21,878	20,785	19,381	17,879
$Exam\_Period_t$	yes	yes	yes	yes	yes
$Course_c$	yes	yes	yes	yes	yes
$Enrollment\_Year_t$	yes	yes	yes	yes	yes

Result 5b: No significantly detectable nonlinear peer effects (pass), except for the bottom

TABLE A6.2 - FULLY NON-LINEAR PEER EFFECTS FOR RECEIVING STUDENTS

Panel B					
Dependent variable	$Pass_{ict}$	$Pass_{ict}$	$Pass_{ict}$	$Pass_{ict}$	$Pass_{ict}$
Period	ALL	Bottom quartile	2nd quartile	3rd quartile	Top quartile
$Transfer\_fraction_{ct}$ in bottom quartile	-0.035**	-0.054***	-0.031	-0.034*	-0.013
	(0.018)	(0.019)	(0.020)	(0.021)	(0.021)
$Transfer\_fraction_{ct}$ in quartile 2	-0.017	-0.010	-0.022	-0.017	-0.028**
	(0.013)	(0.017)	(0.016)	(0.016)	(0.012)
$Transfer\_fraction_{ct}$ in quartile 3	-0.013	-0.003	-0.019	-0.007	-0.027
	(0.015)	(0.016)	(0.017)	(0.017)	(0.017)
$Transfer\_fraction_{ct}$ in top quartile	-0.005	-0.003	-0.008	-0.008	-0.009
	(0.011)	(0.013)	(0.013)	(0.012)	(0.013)
Observations	79,923	21,878	20,785	19,381	17,879
$Exam\_Period_t$	yes	yes	yes	yes	yes
$Course_c$	yes	yes	yes	yes	yes
$Enrollment\_Year_t$	yes	yes	yes	yes	yes