Habits and peer effects in cultural transmission*

Antonello E. Scorcu

Laura Vici

Lorenzo Zirulia

Department of Economics

and

Center for Advanced Studies on Tourism (CAST)

University of Bologna

Abstract

The individual accumulation of cultural capital has been often explained in terms of personal and family characteristics (age, gender, education, income,...), on the one side, and in terms of some cultural related variables of the group the individual belongs, on the other side. The mechanism of formation of peer groups helps to explain the transmission of cultural contents among persons given individual and peers' characteristics. In particular, individual cultural accumulation incorporates an important social dimension and peer groups are important drivers of cultural capital.

Using a unique dataset on university students, this paper empirically analyzes the process of peer group formation and the factors affecting the transmission of knowledge and culture through social interactions. Similarities in terms of individual characteristics favor peer formations. Important differences emerge across fields of study.

* Antonello Eugenio Scorcu: Department of Economics, Strada Maggiore 45, I-40126 Bologna, Italy. antonello.scorcu@unibo.it; Laura Vici: Department of Economics, Strada Maggiore 45, I-40125 Bologna, Italy. laura.vici@unibo.it; Lorenzo Zirulia: Department of Economics, Piazza Scaravilli 2, I-40126 Bologna, Italy lorenzo.zirulia@unibo.it.

Introduction

Universities, schools, parents and teachers have interests in assessing peer effects in education and in quantifying the externalities due to interactions among students. The literature suggests that peer effects can be statistically and economically significant in a variety of educational contexts (Sacerdote, 2001; Stinebrickner and Stinebrickner, 2000, Hoxby, 2001, Arcidiacono and Nicholson, 2005, among many others).

To investigate the influence of the peer group in education, many papers have examined the effects of roommates on individual performance, trying to control for the endogeneity bias and reflexion problem (De Giorgi et al., 2009; Lyle, 2007 Foster, 2006; Stinebrickner and Stinebrickner, 2006; Zimmerman, 2003; Winston and Zimmermann 2003; Angrist and Lang, 2002; Sacerdote, 2001).

Before assessing peer effects on students' performances in terms of average marks or predicted wage, it is crucial to understand when, how and why students join groups, with resultant implications on individual and group performances. Moreover, group formations, performances and efficiency vary across groups due to individual/group contingent situations and characteristics.

The aim of this paper is to investigate the factors affecting the formation of peer groups across different fields of study, using data of students enrolled in different faculties and fields of study of the University of Bologna (Italy).

The main idea is that students' production functions vary across individual characteristics (ability, preferences in terms of learning tools, habits, etc.), are affected by those peer groups more similar to the individual (De Giorgi, 2009) and vary with the fields of study (Brunello et al., 2010).

In this paper, we model individual preferences to study alone or in groups as a function of individual contexts and characteristics, based on the social and cultural capital of each student, and peers' characteristics (due to the contingent context). Even if the most important factors for an effective education are time and effort devoted to study (Costrel, 1994), besides individual ability, peers affect individual performances through social interactions. In other words, many factors directly and indirectly affect peer group formation.

In particular, we believe that the individual decision to attend a group of students depends upon two sets of factors. A first factor affecting social participation to study groups is individual ability. Studying in groups implies costs and benefits that vary across peers: the net benefits of smarter students (in terms of learning gained or time and effort saved) are, in general, lower than those gained by less-talented students. In other words, less-able students learn more from abler students than abler students from less-talented students (Sacerdote, 2001). The second factor refers to students' personal propensity to join groups for non-educational reasons (staying with friends, meeting new mates, etc.).

A significant novelty of this work is that we do not restrict our analysis to the behavior of roommates or doormates, as in most of the papers assessing peer effects, but we use a more general dataset of students enrolled in university courses, independently from their residence. The main reason is that, particularly in Italy, the number of students living in dormitories or university residences are a limited share of the population of enrolled students, which vary across universities and fields of study. Depending on the field of study, on the proximity to the university city, on personal budget and time constrains, students may decide to live in the university city (if already resident or by renting a room or a flat) or to daily commute.

We test the factors affecting the propensity to join peer groups and assess whether these factors vary across fields of study using data on students enrolled at the University of Bologna, one of the most popular and biggest Italian universities.[1] First, we show that the factors affecting students enrolled in hard sciences faculties are quite different from those influencing Humanities students or Social Science students (Brunello et al., 2010; Hoxby, 2001; Sacerdote, 2001; Carrell et al., 2008). Second, we show that the propensity to join study groups decreases when the ability of students increases (proxied by the high-school final mark). Moreover, the magnitude of this effect differs across fields of study besides other observable characteristics.

The paper is organized as follows. The next section introduces our model of peer group formation. Section 3 describes the empirical specification and the dataset, whereas the

[1] In Italy students are required to choose their field of study before enrolling at the University.

estimated results are reported and discussed in Section 4. After a brief discussion of policy implications, Section 5 concludes.

2. The model

Let us assume the existence of two population of students, the population of high ability students and the population of low ability students. To start with, both populations have mass 1. Ability is captured by the parameter θ, which can take two values, θ and $\underline{\theta}$, with $\theta > \underline{\theta}$. Students can learn in two ways, socially, i.e. interacting with their peers, or individually.

Let us assume that the utility of high ability agents learning socially is:

$$U_i^S = \alpha_H^H n^H + \alpha_H^L n^L + \beta^S(X_i) \quad (1)$$

n^H and n^L are the mass of students learning socially being respectively high and low ability, and α_H^H, α_H^L are positive parameters measuring the extent to which a high ability student can learn from high and low ability students; $\beta^S(X_i)$ measures the intrinsic benefit of social interaction (unrelated to learning activities), which is a function of the individual characteristics of individual *i*.

The utility of low ability agent learning socially is:

$$U_i^S = \alpha_L^H n^H + \alpha_L^L n^L + \beta^S(X_i) \quad (2)$$

Here, similarly as before, α_L^H, α_L^L are positive parameters measuring the extent to which a low ability student can learn from high and low ability students.

Finally, the utility of "learning alone" is:

$$U_i^{NS} = \beta^{NS} X_i + \gamma \theta \quad (3)$$

Let us consider the special case $\gamma \theta = 0$.

A high (low) ability student will learn socially iff:

$$\alpha_H^H n^H + \alpha_H^L n^L + \beta^S(X_i) \geq \beta^{NS} X_i$$

$$\alpha_L^H n^H + \alpha_L^L n^L + \beta^S(X_i) \geq \beta^{NS}\ X_i$$

i.e.

$$\begin{aligned} \alpha_H^H n^H + \alpha_H^L n^L + \beta^S\ X_i\ - \beta^{NS}\ X_i\ \geq 0 \\ \alpha_L^H n^H + \alpha_L^L n^L + \beta^S\ X_i\ - \beta^{NS}\ X_i\ \geq 0 \end{aligned} \tag{4}$$

We define $\beta_i \equiv \beta^S\ X_i\ - \beta^{NS}\ X_i$, and assume that β_i has a cumulative function $F(\cdot)$ (with density function f). Suppose that $F(\cdot)$ is common knowledge, and students have rational expectations.

Therefore, the mass of high (low) ability students learning socially in equilibrium are given by $n^{*,H} = 1 - F(\beta^H)$ and $n^{*,L} = 1 - F(\beta^L)$, where $\beta^H and\ \beta^L$ are the solutions of :

$$\begin{aligned} \alpha_H^H\ 1 - F\ \beta^H\ + \alpha_H^L\ 1 - F\ \beta^L\ + \beta^H = 0 \\ \alpha_L^H\ 1 - F\ \beta^H\ + \alpha_L^L\ 1 - F\ \beta^L\ + \beta^L = 0 \end{aligned} \tag{5}$$

2.1 A special case

We suppose that $F(\cdot)$ is a uniform distribution between -½ and ½. In this case the equilibrium conditions are:

$$\begin{aligned} \alpha_H^H\ 1/2 - \beta^H\ + \alpha_H^L\ 1 - \beta^L\ + \beta^H = 0 \\ \alpha_L^H\ 1/2 - \beta^H\ + \alpha_L^L\ 1 - \beta^L\ + \beta^L = 0 \end{aligned} \tag{6}$$

If we assume for simplicity that $\alpha_H^L = \alpha_L^L = 0$ (no one can learn from low-ability students) then we get:

$$\begin{aligned} \beta^H = -1/2\ \frac{\alpha_H^H}{(1 - \alpha_H^H)} \\ \beta^L = -1/2\ \alpha_L^H(1 + \frac{\alpha_H^H}{1 - \alpha_H^H}) \end{aligned} \tag{7}$$

The theory suggests that learning socially should depends on: i) individual characteristics, and ii) the distribution of characteristics in the population of students.

Moreover, the "social" thresholds, $\beta^H and\ \beta^L$, negatively depend on the impact that high-ability students have on low and high ability students (presuming that the "learning net benefits" of low ability students from high ability students are larger than the net benefits of high ability students from other high ability students, $\alpha_L^H > \alpha_H^H$). In the case of high-ability students, the threshold over which students are willing to study with peers, β^H, negatively depends on the extent to which a high ability student can learn from high ability students. In other words, the higher the net benefits produced by studying with peers, the higher the probability of joining the group. In the case of low-ability students, the threshold over which students will join the group, negatively depends on the extent to which a high and low ability student can learn from high ability students. Specifically, the higher the spillover effects high and low ability students receive from other high ability students (reducing the threshold level), the higher the probability that low ability students will join the group. The empirical counterpart of this specific case would be a regression with ability as single regressor.

Moreover, as suggested by Brunello et al. (2010), Arcidiacono (2004) and Grogger and Eide (1995), conditional on individual and peer ability and individual effort, individual outcomes and expected earnings depend on the major chosen. Analogously, peer formation depends on the major selected and this choice will affect indirectly the expected earnings even through peer group configuration processes with different impacts across groups.

3. Empirical model and dataset

Our empirical specification aims to test the individual and peer group characteristics affecting the probability that an individual join a group (and study with her peers).

In particular, we estimate:

$$peer_i = \gamma_0^f + \gamma_1^f mark_i + \gamma_2^f X_i + \gamma_3^f mark_{-i} + \gamma_4^f X_{-i} + \varepsilon_i \qquad (8)$$

The propensity of being social, $peer_i$, is a function of a vector of individual factors, X_i (which include gender, origin place, year of enrollment, lecture attendance, employment status, living status, housing and living position), the personal ability, proxied by the high-school final mark, $mark_i$, and peers' average characteristics and ability, $X\text{-}_i$ and $mark\text{-}_i$.

Peer, the individual propensity of being social, is an ordered variable measured on a five-level Likert scale. The covariate vector, X, includes the working status, a set of dummy variables that distinguish non-worker students from occasionally or permanent workers. Moreover, given that peer formation is highly affected by similarity in individual characteristics (Weinberg, 2007; Arcidiacono and Nicholson, 2005; Hoxby, 2001),[2] we includes gender, the number of exams passed as a proxy for tenure, and a dummy for supplementary year students. We also include a set of dummies that consider whether students live in the university city (as inhabitants or non-local residents that rent rooms, flats or other kinds of lodging) or daily commute, since daily traveling distances physically and geographically students and reduces the time they share for studying together.

Finally, the larger the percentage of lectures attended (*lecture attendance*) the higher the probability to meet new peers and to organize studying sessions in group.

We expect that the impact of the mentioned covariates changes with the field of study. We consider f fields of study: Humanities, Social Science and Sciences (that include Hard Sciences, Natural Sciences, Medicine, etc.).

This study is based on an online survey conducted at the University of Bologna (UNIBO), Italy. The University of Bologna is one of the largest Italian universities by enrollments (87,000 students enrolled in the A.A.2013/2014) and the oldest university in continuous operation in the World. UNIBO is the Italian top ranked university in the 2013/14 QS World University Rankings®.[3] The University of Bologna gives its name to the Bologna Process, a project with the aim of enhancing the compatibility among the European educational systems.

[2] In Hoxby (2001), Arcidiacono and Nicholson's (2005) view, demographically similar subgroups of students may be the best peer groups for a given student. Similar observable characteristics can facilitate peer group formation (Weinerg, 2007).

[3] For further details, http://www.topuniversities.com/qs-world-university-rankings.

An invitation to fill in an on-line questionnaire[4] was sent to all the students enrolled at the University of Bologna in the academic year 2009-2010.[5] The survey was conducted in the second quarter of 2010 and collected 13808 answers, which corresponds to an overall completion rate of 16.68% of the total population.

Such approach, although not completely satisfying in dealing with the risks of sample bias and non-randomness, has proved to be effective as the ex-post distribution of respondents' characteristics matched the available population data.

The survey covered a range of issues related to students' lifestyle, their approach to study, habits, cultural and social background. In particular, students were asked a number of questions on different aspects of their university experience, including: i) socio-demographic characteristics (gender, age, origin place, etc.); ii) education information (faculty attended, year of enrollment, number of passed exams, type of secondary education and final marks, etc.); iii) cultural and economic background (parents' education degrees and professional status, household library size, reading frequency for leisure reasons, etc.); iv) employment information (permanent or temporary/occasional workers or full-time students); v) learning practices (tools used to prepare exams, habits to study with classmates, classmates' learning tool-mix used and study practices, past study practices, and the percentage of lectures attended).

The 39.38% of the sample are males and only a small percentage are foreign students (4.38%).

Even if the University of Bologna constitutes a significant attractor for students from other Italian regions, usually, universities attract students living in surrounding areas: indeed, a large percentage of respondents comes from the North of Italy, and, in particular, from Emilia Romagna (55.12%), where the University of Bologna is located, (Table 1).

Table 1: descriptive statistics

Origin region	**Percent**	**Scientific field categories**	**Percent**

[4] A preliminary pilot test was submitted to a group of students. The results suggested only few minor modifications and clarifications of the survey content.

5 The questionnaire was anonymous and students could not fill in the questionnaire twice. Two recalls were sent to non-respondents at regular intervals of time to induce students to complete the questionnaire.

Northern Italy	63.95%
Centre Italy	7.76%
Southern Italy	18.67%
Islands	5.14%
Foreigners	4.38%
NA	0.10%

Students' job	**Percent**
Non-workers	50.69%
Temp./occas. workers	36.75%
Perm. Worker	12.56%

Social Sciences	36.49%
Sciences	40,47%
Humanities and Classical stud.	23.04%

Students' lifestyle	**Percent**
Non-local resident students	42.86%
Commuters	38.28%
Local resident students	18.86%

Given the large number of faculties, we grouped them in three scientific-cultural groups (as in Brunello et al, 2010, and Sacerdote, 2001). The groups with the largest number of respondents are Sciences (with 40.47% of respondents), that includes many faculties and Social Sciences (with the 36.49% of respondents).

Empirical evidence (Balducci and Vici, 2009) shows how students living in the same places, as local residents or non-local residents (coming from other cities/countries and renting rooms or flats), or commuting every day, adopt different behaviors and learning practices (given different time and budget constraints).[6] Therefore, we have asked respondents to state their student status: almost 40% of our sample are commuters against 19% of local residents. A high percentage of respondents is composed of non-local residents (42.86%), who rent a flat or a room in the university city. Most students do not work (50.69%), while almost 13% are full-time workers.[7]

[6] Similar behaviors are probably due to the fact that commuters interact mainly with other commuters sharing their daily journey than with students living in the campus. Students, who share the same flat or live in close flats, are more likely friends, often study in groups. Moreover, different family income and lifestyle affect studetns' budget constraints.

[7] Technical studies and hard science faculties are characterized by the highest percentages of non-worker students. In Humanities and Social science faculties, the share of seasonal worker students is relatively high. Students enrolled in bachelor degrees, in two-year masters, in general, do not work. Unsurprisingly, the share of students who work increases with age.

4. Empirical results

According to the specification discussed in Section 3, we analyze the factors affecting the probability of joining the peer group in educational activities, conditional on the field of study.

We estimate an orderd logit, where the dependent variable, measured on a five-level Likert scale, is the individual propensity of being social (and joining the group), *peer*.

Following the empirical specification (8), the dependent variable is regressed on a constant term, on the individual ability, proxied by the high-school final mark, on the average ability of peers, on a set of individual and group covariates, X, and an individual idiosyncratic effect (u_{ij}). A priori the impact of individual determinants (mark, gender, foreigner, housing condition and employment status) may be strengthened or balanced by the peers' average characteristics.

Table 5 shows the results of four ordered logit regressions estimated using the full sample or conditionally on the field of study. The idea is that the propensity of been social is mainly affected by the major chosen, since even the knowledge and cultural transmission is affected by the field of study.

Table 2: Peer formation. Dependent var.: Habit to study with peers - Orderd logit regression

VARIABLES	(1) full sample	(2) Social Science	(3) Humanities	(4) Sciences
Mark	-0.0142***	-0.0155***	-0.00904***	-0.0158***
	(0.00148)	(0.00251)	(0.00307)	(0.00231)
foreigner student	-0.0579	-0.0441	-0.0595	-0.223
	(0.103)	(0.159)	(0.258)	(0.162)
Male	-0.145***	-0.267***	-0.147*	-0.0800
	(0.0384)	(0.0671)	(0.0823)	(0.0580)
Suppl. year student	0.235***	0.160	0.0603	0.362***
	(0.0578)	(0.0999)	(0.124)	(0.0882)
no. exams	0.0151	0.0402	-0.00489	9.76e-05
	(0.0163)	(0.0284)	(0.0361)	(0.0248)
Non-local-resident	0.0277	-0.0907	-0.0497	0.140*
	(0.0494)	(0.0854)	(0.111)	(0.0746)
commuter	-0.208***	-0.304***	-0.330***	-0.0748
	(0.0503)	(0.0847)	(0.115)	(0.0758)
lecture attendance	0.180***	0.172***	0.212***	0.0361
	(0.0189)	(0.0309)	(0.0371)	(0.0335)
occasional worker	0.175***	0.258***	0.234***	0.0510

	(0.0392)	(0.0675)	(0.0799)	(0.0613)
permanent worker	0.0575	0.194*	0.00990	-0.155
	(0.0698)	(0.111)	(0.141)	(0.121)
average mark	0.0310***	-0.525***	0.164**	0.112***
	(0.0110)	(0.0965)	(0.0804)	(0.0310)
% commuters	1.418***	-1.545***	0.823	-0.204
	(0.245)	(0.544)	(0.928)	(0.535)
% supp.year stud.	1.809***	-32.36***	5.710	1.206
	(0.640)	(5.360)	(5.797)	(1.016)
% perman. workers	-2.811***	27.14***		-1.092
	(0.664)	(4.347)		(1.643)
% occas. workers	-1.703***	5.485***		3.231***
	(0.399)	(1.130)		(1.215)
% of males	0.926***	13.49***		-0.0525
	(0.164)	(1.942)		(0.315)
Cut 1- Constant	0.541	-39.96***	13.47*	7.209**
	(1.000)	(7.368)	(7.821)	(2.806)
Cut 2- Constant	1.764*	-38.76***	14.79*	8.451***
	(1.000)	(7.366)	(7.823)	(2.807)
Cut 3- Constant	2.964***	-37.63***	16.02**	9.741***
	(1.000)	(7.365)	(7.823)	(2.808)
Cut 4- Constant	4.316***	-36.28***	17.51**	11.08***
	(1.001)	(7.363)	(7.824)	(2.808)
Observations	10,524	3,639	2,447	4,371
Model chi-square	685.4	186.2	133.5	151.4
Df	16	16	13	16
Prob > chi2	0	0	0	0
Log likelihood	-16191	-5613	-3641	-6696
Pseudo R2	0.0207	0.0163	0.0180	0.0112

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As expected, the abler is the student, the lower the probability of joining the group, since the net benefits decreases with ability. However, this effect markedly changes when differences in majors are considered. In particular, cleverer students enrolled in Humanity faculties are less affected than those enrolled in Hard Sciences, since the latter are more used to work in groups (in laboratories, projects, etc.). The effect (in sign and size) of ability is similar in Sciences and Social Science. However, in general, and in particular for the Humanity and Science subsamples, this negative effect is in part offset when peers' average mark is high (enhancing and strengthening the transmission of knowledge from smarter students). On the contrary, in Social Science (column 2) a

higher average ability of the peer group strengthens the competition among brilliant students and reduces their participation to study groups.

As the similarity along observable characteristics, such as origin place, may affect the decision of joining the same group, neither being foreigner nor being older students (measured by the number of passed exams and by the status of supplementary year students) significantly modify the probability of being social. However, the larger the number of supplementary year students in the group (more informed individuals), the higher the probability of being social in the full sample, whereas the probability decreases in Social Science (due to a likely repentant student effect).

With the exception of Sciences, where the share of females is lower, being male decreases the probability of studying in group. However, when the percentage of males enrolled in the faculty increases, it positively affects the likelihood of joining the group, since group composition is more homogeneous (Weinberg, 2007).

Students who more regularly attend classes are more likely to study in groups, partly because they have more opportunities to meet new and other peers and to organize study sessions.

Previous studies suggest that students' life style significantly affects learning habits and processes (Balducci and Vici, 2010). In particular, living in the city where the university is located (being inhabitants or non-local residents but renting flats or rooms in the university town) does facilitates the probability to study in group (except for Science students). On the contrary, commuters spend more time in traveling from/to their residence city and have, in general, less compatible schedules with other students. However, in the full sample, if the percentage of commuters within the same faculty increases, the probability to study in group rises, being more likely to live and study in the same non-university city. The opposite applies for Social Science.

Finally, a priori it is expected that time constraints reduce the opportunities to study with other students. Surprisingly, while permanent workers do not behave differently from non-workers, the probability to study in group rises when students work occasionally. In the latter case, time constraints are less binding than for permanent workers, and students optimize the learning time available. However, whereas in the full

sample, as the percentage of occasional or permanent workers increases the likelihood of studying with peers decreases, for Social and Hard Science students the probability increases because students with similar work schedules can organize their remaining time.

5. Conclusions

The literature on peer effects mainly focuses on the impact of peers on students' performances, both at school and university levels, and on the expected individual earnings (Sacerdote, 2001; Angrist and Lang, 2002; Zimmerman, 2003).

However, before analyzing peer externalities on outcomes, it is important to understand when, how and why students decide to study in groups, indirectly influencing their individual and group performance and cultural consumption.

Understanding the nature, the formation processes and the importance of peer groups is crucial for education institutions and for policy makers who aim at identifying the inefficiencies in the educational processes (De Giorgi, 2009), who want to enhance the outcomes from knowledge and cultural transmission processes through public education institutions, who look at educational perspectives and effectiveness.

This paper aims at analyzing the mechanisms of peer formations and understanding the factors affecting the decision of studying in group, besides the choice of the specific group.

The "gravitational attraction" of peer groups changes with the individual skill and the average group ability, among other factors (Brunello, 2010; Hoxby, 2001; Sacerdote, 2001). However, in peer group formation processes even "social" factors and cultural characteristics play an important role.

Peer group formation will affect the cultural transmission and will impact the consumption of cultural goods. Understanding the process of formation will help to promote and drive cultural consumption.

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