Peer effects on non-cognitive skills

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Abstract

The aim of this paper is to investigate peer effects on students' non-cognitive skills. The empirical analysis is based on a unique and rich secondary school student dataset referred to a sample of around 4,500 9th to 13th grade students attending upper secondary school in the Valle d'Aosta region. In addition to standard information on socio-demographic characteristics, school performance and extra-curricular activities, the data-set provides self-reported information to get validated measures of the Big Five personality traits (openness to experience, conscientiousness, extroversion, agreeableness and neuroticism). School fixed-effects estimates show a statistically significant effect of peers' ability on students' non-cognitive skills, particularly in the case of openness to experience. Furthermore, results by gender reveals that conscientiousness and agreeableness are negatively influenced by the concentration of peers in the lower part of the ability distribution in the case of females, in the upper part of the same distribution in the case of males. Finally, while males seem to benefit from being in a classroom with similar peers in terms of ability, the opposite result emerges for females.

Keywords: Big Five, non-cognitive skills, cognitive skills, peer effects.

Jel Classification: I1; I2; J24.

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1. Introduction

A number of studies have shown relations between non-cognitive skills and educational outcomes. Individuals' soft skills such as patience, self-control, motivation and self-discipline are good predictor of academic outcomes (Eckstein and Wolpin, 1999; Oreoupulos, 2007; Duckwworth and Seligman, 2005; Lindahl et al., 2014; Almlund et al., 2011). Moreover, some of the effect of the other inputs of the education production function, like family or school, comes through their influence on soft skills. For instance, the effect of family stems not only from the amount of family resources, but also from how families are able to transmit soft skills like self-control, patience or motivation (Koch et al., 2015). Similarly, the literature has shown that teacher effects on long-run outcomes reflect effects on both cognitive skills (measured by test-scores) and non-cognitive skills (measured by non-test-score outcomes) (Jackson, 2012).

An additional component of the education production function is the quality of a student's peer group.

Researchers have long believed that peer effects are among the most important determinants of academic outcomes (e.g., Sacerdote 2001, Zimmerman 2003, Angrist and Lang 2004, Arcidiacono and Nicholson 2005, Ammermueller and Pischke 2009, Carrell, Fullerton and West 2009, Gould, Lavy and Daniele Paserman 2009). However, the literature has found small average effects of peer quality on cognitive educational outcomes like test scores, although nonlinear models have shown substantial effects experienced by different types of students (Sacerdote, 2011; Lavy et al 2011).

Similarly to the case of other inputs of the education production function, peer inputs effect on educational outcomes may be mediated by its effect on a student's non-cognitive skills. More specifically, a student's soft skills may be influenced by her class ability distribution and by the level a student's ability is with respect to her peers. For instance, comparison to high ability classmates can improve own student's conscientiousness by motivating her to perform better. However, it is also possible that having considerable lower ability than own classmates is detrimental because it increases neuroticism. Murphy and Weinhardt (2014) suggest that a student's academic rank in a school relative to other students strongly influences non-cognitive skills such as confidence, perseverance and resilience, which in turn have a big impact on future academic outcomes. Being ranked in top of the class cohort, the student becomes more confident and thereby enjoy learning more, consequently leading them to spend more time improving their skills.

In this paper, we study ability peer effect on students' non-cognitive skills. Next, we study whether this effect varies according to where a student is located with respect to her classmate ability distribution. Studying how peers ability influences a student's soft skills is important because non-cognitive attributes play an important role in reducing the negative effects of low cognitive

development. Put differently, personality and motivation would be just as important for predicting academic achievement as cognitive ability, and they can act as a substitute for it. Moreover, with our analysis we go into the black box of non-cognitive skills and contribute to understand how these skills are formed.

The empirical analysis of this paper is based on a unique and rich secondary school student dataset developed in Italy. The 4,511 students' sample comprises the universe of 9th to 13th grade students attending upper secondary school in the Valle d'Aosta region (located in Northern Italy). The age-range of the students in our sample is particularly suitable for our empirical analysis because during adolescence interactions with peers and influence from them are particularly intense.

In addition to standard information on socio-demographic characteristics, on past and current academic performance and on extra-curricular activities, we used a set of 15 questions to gather self-reported information on the big five personality traits (openness to experience, conscientiousness, extroversion, agreeableness, and neuroticism).

The specific institutional setting characterizing upper secondary education in Italy allows us to address the selection problem due to non-random classroom formation. More specifically, we use an identification strategy that relies on the conditional random assignments of students and teachers in classes within schools, school's specific curricula and grade.[1] In Italy, once families choose the secondary school and the curriculum for their children, the latter are usually assigned to a certain class regardless of families or children's preferences for specific teachers or schoolmates, due to the fact that the Italian law prescribes this. Then, once families have chosen the school type and the school-specific curriculum, class formation is random. The class is not identified by a certain grade, but by a subsection of a certain year. In order to have "equally heterogeneous" classes, principals of public schools usually group entering students with different ability and background (Poletto 1992). Each class does everything together, staying all day in the same room; it is the teachers who go from classroom to classroom. Everyone in a class takes the same courses because there are no electives in Italian high schools: the pool of subjects is determined by the type of high school and program initially chosen. This implies that the interactions within classes are particularly intense.

We address the reflection problem using as measure of peer ability classmates' lagged academic achievement obtained at the end of the lower secondary school (grade 8th). After the end of the

[1] The Italian secondary school system comprises three main types of high schools: Liceo high schools, specifically designed to prepare students for tertiary education; technical high schools, giving students the possibility to pursue either an occupation or additional education; vocational schools, preparing students for an occupation upon graduation. In some cases, it is also possible to choose different curriculum within each school type. Within school type, socio-economic backgrounds and learning levels tend to be homogeneous and different from the other types along a hierarchy, with Liceo at the top and vocational courses at the bottom (Schizzerotto and Barone 2006).

lower secondary school, Italian students change school and enter upper secondary school. Then, the vast majority of their schoolmates change.

The remainder of the paper is structured as follows: the next section presents some theoretical insight into the potential effects of peer ability on students' non-cognitive skills; Section 3 presents the data and the main variables used in the empirical analysis, including the big five personality traits used in the analysis; Section 4 explains the identification strategy, also paying attention to the specific institutional setting of the Italian school system; Section 5 presents the main results; a number of robustness checks and extensions are discussed in Section 6. Concluding remarks and some policy implications are provided in the last section.

2. Background

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3. Data

In this paper we use a unique and rich secondary school student dataset developed in Italy. The 4,511 students' sample comprises the universe of 9^{th} to 13^{th} grade students attending upper secondary school in the Valle d'Aosta region (located in Northern Italy). The age-range of the students in our sample is particularly suitable for our empirical analysis because during adolescence interactions with peers and influence from them are particularly intense. The survey was conducted in early 2015. None of the students present during the administration of the survey refused to fill the questionnaire. We collected standard information on socio-demographic characteristics, on past and current academic performance[2] and on extra-curricular activities. Finally, we added to our questionnaire some questions to measure also the Big Five personality traits.

3.1 Personality traits

Unlike other individual traits, personality traits cannot be directly measured (Almlund at al., 2011). Personality psychologists developed a taxonomy defining the principal facets within which a large numbers of specific personal attributes can be grouped. After decades of research, the field found broad consensus on a general taxonomy of broad personality traits, the "Big Five" personality dimensions (John and Srivastava, 1999), each of them capturing a large number of different personality characteristics. The five factors are: openness to experience, conscientiousness,

[2] Among other questions, we asked each student the average grade obtained in Italian language, math, foreign language and science at the end of the first term of the same school year (February) and the grade obtained at the end of lower Junior high school in the National Exam (Esame di stato).

extraversion, agreeableness and neuroticism (emotional instability). Research has shown that the Big Five personality traits are reasonably stable in adulthood (Cobb-Clark and Schurer, 2012), while they can be affected by factors like parental background and school environment up to adolescence (Cunha et al.,2006; Cunha and Heckman, 2008).

In order to measure personality traits, many personality questionnaires have been designed. The more widely used are the 240-item Costa and McCrae's NEO personality Inventory and the 44-item John, Donahue and Kentle's Big Five Inventory (BFI). Both of them have been carefully systematically tested and validated (Tavares, 2010).

The British Household Panel Study (BHPS), in order not to make the whole questionnaire too long, used a short 15-item version of the BFI. This questionnaire has strong internal coherence and reliability (Gerlitz and Schupp). In our survey, we used the same 15 questions (three for each trait) used and validated in the British Household Panel Study. In these questions, respondents were asked to rate themselves on a seven point scale from one ("does not apply") to seven ("applies perfectly"). The 15 questions are shown and grouped in the following Table 1, where the average value for each trait, also separately by gender, is reported as well.

Each of the five personality traits are measured as the average score obtained in the three correspondent questions. Before averaging, we reversed the score given to questions 5, 9, 10 and 15.

Females on average are ranked higher in all five personality traits, although only in the cases of openness, extraversion and neuroticism the differences between girls and boys are statistically significant.

Table 1. The Big Five personality traits in the BHPS

Personality trait	*Questions: I see I see myself as someone who*	*Mean (std dev) All*	*Mean (std dev) Male*	*Mean (std dev) Female*
Openness	1. Is original, comes up with new ideas 2. Values artistic, aesthetic experiences 3. Has an active imagination	5.2008 (1.1211)	5.1672 (1.0996)	5.2325 (1.1403)
Conscientiousness	4. Does a thorough job 5. Tends to be lazy	5.8943 (0.8581)	5.8791 (0.8543)	5.9086 (0.8616)

	6. Does things efficiently			
Extraversion	7. Is talkative 8. Is outgoing, sociable 9. Is reserved	4.6681 (1.1048)	4.6153 (1.0611)	4.7180 (1.1426)
Agreeableness	10. Is sometimes rude to others 11. Has a forgiving nature 12. Is considerate and kind to almost everyone	5.4903 (0.8966)	5.4834 (0.8723)	5.4969 (0.9191)
Neuroticism	13. Worries a lot 14. Gets nervously easily 15. Is relaxed, handles stress well	3.5286 (1.2041)	3.4882 (1.1899)	3.5668 (1.2163)

3.2 Descriptive statistics

Table 2 reports summary statistics. Female are around half of the sample and almost one student over three repeated a school year. Migrant students (i.e. born outside Italy) are 6% of the sample, while 10 and 13 percent respectively have a foreign-born father and mother. The average score at the end of the lower secondary school is 7.8 over 10. Students' parents education is slightly more than 10 years.

These average values however hide significant differences by type of school in all the variables considered. The share of female is considerably lower (36%) in the technical schools as compared to other types of schools, especially when considering non-traditional Lyceum (i.e. Lyceum different from those with a scientific or humanities curriculum). The academic performance varies considerably across school types, with traditional Lyceum at the top (12% of repeaters and average score at the end of the lower secondary school equal to 8.5) and professional schools at the bottom (44% of repeaters and average score at the end of the lower secondary school equal to 6.8). Students from traditional Lyceum have also a better family background. On average their parents have

around 13 years of education (i.e., they have completed upper secondary school), while in the case of other school types father's years of education ranges between 9.12 in professional schools and 10.76 in non-traditional Lyceum and mother's year of education between 10.08 in professional schools and 10.91 in technical schools. There are no substantial differences between school types in the distribution of parents' citizenship. Finally, when considering personality traits, we do not observe large differences by school type.

Table 2. Summary statistics

	All		Lyceum (math/hum)		Lyceum (other)		Technical school		Professional school	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Female	0.51	0.50	0.48	0.50	0.77	0.42	0.36	0.48	0.49	0.50
Repeater	0.28	0.45	0.12	0.33	0.23	0.42	0.34	0.47	0.44	0.50
Migrant	0.06	0.24	0.04	0.20	0.06	0.24	0.07	0.26	0.06	0.24
Score lower secondary school	7.59	1.24	8.53	1.08	7.70	1.10	7.26	1.05	6.81	1.03
Father education	10.68	3.83	12.56	3.79	10.76	3.71	10.01	3.44	9.12	3.53
Mother education	11.63	3.69	13.44	3.37	11.89	3.62	10.91	3.48	10.08	3.47
Father migrant	0.10	0.30	0.08	0.28	0.10	0.30	0.12	0.33	0.09	0.29
Mother migrant	0.13	0.33	0.11	0.31	0.11	0.32	0.15	0.36	0.12	0.33
Openness	5.15	1.17	5.11	1.02	5.23	1.22	5.15	1.17	5.36	1.03
Conscientiousness	5.91	0.87	5.79	0.82	5.82	0.94	5.91	0.87	6.07	0.76
Extraversion	4.69	1.01	4.57	1.12	4.63	1.19	4.69	1.01	4.80	1.10
Agreeableness	5.49	0.82	5.41	0.91	5.34	1.00	5.49	0.82	5.77	0.80
Neuroticism	3.47	1.15	3.63	1.35	3.59	1.18	3.47	1.15	3.42	1.10
Nr obs	4,026		1,044		928		1,201		853	

4. Methods

In estimating the relations between a student's non-cognitive ability and the non-cognitive abilities of his/her peers, we consider the following equation:

$$y_{icts} = \alpha + \beta_1 \bar{Y}_{-i,c,t\,s} + \beta_2 X_{icts} + \theta_t + \varphi_s + \varepsilon_{icts} \quad [1]$$

Where Y_{icts} is one of the five personality traits we described above for student i in class c who attend track t, in school s, $\bar{Y}_{-i,c,t,s}$ is the average level of the same traits within the class and excluding student i, X_{icts} are students covariates including gender, θ_t are track fixed effects, $\varphi_s$are school fixed effects and ε_{icts} is a residual standard error.

The estimation of peer effects poses some challenging econometric problems, with the main one being students self-selection into class, which is usually far from random. Endogenous sorting may arise because families choose specific schools for their children. In a way, the specific institutional setting characterizing upper secondary education in Italy allows us to partially address the problem of endogenous matching between student and peers: once families choose the school and track for their children, the latter are usually assigned to a certain class regardless of families or children's preferences for specific schoolmates, due to the fact that the Italian law prescribes this. The class is not identified by a certain grade, but by a subsection of a certain year. In order to have "equally heterogeneus" classes, principals of public schools usually group entering students with different ability and background (Poletto 1992) within each track. Furthermore, the class is the same for all of the subjects taught and for the entire duration of high school: minor changes each year are due to students who have to repeat a year (a fact happening frequently in Italian high schools) or who change school (a rare event) or who move to another town (an exceptional event). In this perspective, the same group of students could expect to be together for five years. Each class does everything together, staying all day in the same room. Everyone in a class takes the same courses because there are no electives in Italian high schools: the pool of subjects is determined by the type of high school and program initially chosen. If the student realizes that this is not what she is really interested in, she will change the program or even the school. This is usually done by the end of the first year of high school (i.e., 9^{th} grade) because later changes are usually very costly in terms of needed prerequisites for entering the new program/school, often requiring starting again from the first year. We exploit this institutional setting and work under the assumption that once the student choose track and school, assignation to class is as good as random.

A second difficulty in the estimation of peer effects involves the measurement of peer ability. The direct approach that regresses own achievement on contemporaneous or lagged achievement of peers is problematic, as these variables are determined simultaneously with own achievement (Manski, 1993). Therefore, the empirical evidence on ability peer effects in schools comes primarily from studies that examine the effect of peers' background characteristics, such as parental schooling, race and ethnicity on student outcomes. A wide variety of approaches are used in these studies to identify

peer effects. A limitation of these studies is that they usually do not measure directly the ability of students' peers but rely on socioeconomic background characteristics as proxies for ability and once socioeconomic background is accounted for, one's peers have little or no effects on students' outcomes. The alternative approach that measures peer quality directly using lagged academic achievements has its own shortcomings: as a student's peer group is usually constant during his or

her time in school, lagged peer non-cognitive ability is unlikely to be exogenous to own current non-cognitive ability and therefore it may still suffer from the reflection problem. Thus, we use as a proxy for peers' quality the mark they earned at the end of junior high school. At the end of junior high school in Italy students choose a track and a school and move on, often without any peer with whom they shared a class in junior high. This implies that students had very little interactions with their high school peers before they started high school. So, rather than estimating equation (1) as it is, we substitute, in a reduced form fashion, the average level within the class of the psychological trait with the average mark at the end of junior high school. We then assume that past cognitive skills are positively related also to current non-cognitive ones. This is one of the main conclusions of Heckman's model on investment in human capabilities, in which technology characterizing lifetime investment in cognitive skills, non-cognitive skills and health allows for cross-productivity effects: cognitive skills may affect the accumulation of non-cognitive skills and viceversa (Heckman, 2007).

In order to better explain the non-monotonic relationship between quality of the peer and one's own personality traits, we include in our specification the share of students with a high/low mark earned at end of junior high school. Finally, in order to investigate gender differences in the effect of peers on non-cognitive skills, we interact this non-linear term with gender.

5. Results

Table 3 reports our main estimates of the peer effects on the Big Five personality traits. The latter have been computed using the methodology discussed in Section 3. Columns differ for the personality trait used as dependent variable: conscientiousness (column 1), extraversion (column 2), openness (column 3), agreeableness (column 4) and neuroticism (column 5). Regardless of the dependent variable used, model specification includes controls for gender, enrollment year, track and school fixed effects.

In general, our estimates show negative peer effects on all the personality traits considered, but the estimated coefficient is statistically significant only in the case of openness: the higher is the quality of peers, the lower is the degree of openness to experience.

Results for the other controls are also interesting. More specifically, gender statistically influences extraversion, agreeableness and neuroticism: ceteris paribus, men report a significantly lower degree of both agreeableness and neuroticism compared to women, while they are significantly more extraverted.

Estimates by enrollment year show in most cases a clear-cut gradient, albeit with different signs: while conscientiousness and openness increase with the enrollment year (and presumably with students' age), extraversion and agreeableness decrease with it.

Finally, statistically significant differences in personality traits emerge also by school track, with students in humanities (*liceo classico*) reporting a significantly higher degree of conscientiousness and openness, combined with a lower degree of neuroticism with respect to students in other tracks.

Table 3. Peer effects on non-cognitive skills

VARIABLES	(1) C_s	(2) E_s	(3) O_s	(4) A_s	(5) N_s
Mean grade junior hs	-0.0521	-0.0702	-0.195***	-0.0650	-0.0721
	(0.0577)	(0.0669)	(0.0482)	(0.0653)	(0.0487)
male	-0.114	0.157***	0.0720	-0.0788**	-0.676***
	(0.0689)	(0.0273)	(0.0527)	(0.0327)	(0.0303)
Year in sec school (ref: 1st year)					
2nd year	0.0921*	-0.0873*	0.218***	-0.0317	0.0653
	(0.0506)	(0.0494)	(0.0464)	(0.0500)	(0.0507)
3rd year	0.144	-0.185***	0.280***	-0.0373	0.0436
	(0.0939)	(0.0527)	(0.0475)	(0.0493)	(0.0468)
4th year	0.269***	-0.339***	0.268***	-0.238***	0.121**
	(0.0776)	(0.0416)	(0.0432)	(0.0606)	(0.0500)
5th year	0.408***	-0.245***	0.420***	-0.108**	0.102
	(0.0657)	(0.0502)	(0.0560)	(0.0409)	(0.0627)
Track (ref: Humanities)					
Maths & Science	-1.186***	-0.484*	1.113**	0.402	1.180***
	(0.227)	(0.268)	(0.417)	(0.614)	(0.0536)
Arts	-0.549***	-0.200**	0.155**	-0.0538	0.172**
	(0.0834)	(0.0966)	(0.0706)	(0.0921)	(0.0694)
Music	-0.542***	-0.0931	-0.279***	0.219**	0.107
	(0.0745)	(0.0894)	(0.0668)	(0.0880)	(0.0653)
Languages	-1.171***	-0.414	1.042**	0.328	1.282***
	(0.233)	(0.276)	(0.415)	(0.616)	(0.0590)
Human sciences	-1.313***	-0.533*	1.036**	0.272	1.328***
	(0.237)	(0.278)	(0.431)	(0.617)	(0.0642)
Technical school	-1.219***	-0.266	0.888**	0.201	1.197***
	(0.241)	(0.284)	(0.415)	(0.620)	(0.0775)
Vocational school	-1.303***	-0.316	0.898**	0.131	1.369***
	(0.248)	(0.286)	(0.421)	(0.626)	(0.0992)
School FE	YES	YES	YES	YES	YES
Constant	5.149***	5.370***	6.425***	5.643***	5.188***
	(0.509)	(0.594)	(0.434)	(0.560)	(0.429)
Observations	4,511	4,511	4,511	4,511	4,511
R-squared	0.035	0.020	0.059	0.017	0.094

In order to investigate the presence of non-linear peer effects, in Table 4 we introduce the share of low ability peers as an additional regressor.[3] Our estimates show that, given a certain mean ability, the peer effect on openness is driven by the share of low ability peers.

Table 4. Peer effects on non-cognitive skills: the role of low ability peers

VARIABLES	(1) C_s	(2) E_s	(3) O_s	(4) A_s	(5) N_s
%low ability peers	-0.239	-0.0596	0.464*	-0.476	0.109
	(0.253)	(0.225)	(0.255)	(0.295)	(0.279)
Mean grade junior hs	-0.128	-0.0891	-0.0480	-0.216*	-0.0375
	(0.0967)	(0.0709)	(0.0991)	(0.115)	(0.0951)
Other controls	YES	YES	YES	YES	YES
Constant	5.845***	5.544***	5.075***	7.029***	4.871***
	(0.874)	(0.644)	(0.906)	(1.036)	(0.871)
Observations	4,511	4,511	4,511	4,511	4,511
R-squared	0.035	0.020	0.059	0.017	0.094

Note: Other controls are: gender, enrollment year, track and school fixed effects

When we interact the share of low ability peers with gender (Table 5), we find that low ability peers are detrimental especially for females, particularly in terms of conscientiousness and agreeableness. On the contrary, a higher share of low ability peers is significantly associated with higher openness only in the case of females.

Table 5. Peer effects on non-cognitive skills: differences by gender in the role of low ability peers

VARIABLES	(1) C_s	(2) E_s	(3) O_s	(4) A_s	(5) N_s
F*% lo ability peers	-0.464*	-0.111	0.572**	-0.550*	0.117
	(0.257)	(0.224)	(0.252)	(0.295)	(0.284)
M*% lo ability peers	-0.0126	-0.00760	0.354	-0.401	0.101
	(0.287)	(0.238)	(0.281)	(0.304)	(0.282)
Mean grade junior hs	-0.116	-0.0863	-0.0540	-0.212*	-0.0379
	(0.101)	(0.0707)	(0.0996)	(0.114)	(0.0954)
male	-0.344***	0.104	0.183**	-0.154***	-0.668***
	(0.0584)	(0.0738)	(0.0734)	(0.0455)	(0.0535)
Other controls	YES	YES	YES	YES	YES
Constant	5.822***	5.538***	5.087***	7.021***	4.871***
	(0.906)	(0.637)	(0.905)	(1.037)	(0.871)
Observations	4,511	4,511	4,511	4,511	4,511
R-squared	0.038	0.020	0.060	0.018	0.094

Note: Other controls are: enrollment year, track and school fixed effects

[3] We consider as low ability peers those who completed junior high school with a grade of 6 or 7 on a 10-point scale, knowing that 6 is the minimum required grade to pass to any secondary school in Italy.

In the previous tables we investigated non-linear peer effects focusing on the concentration of low ability peers in the classroom. In the following tables, we replicate the same exercise looking at the concentration of high ability peers[4] (Table 6), paying attention also to its interaction with gender (Table 7). Estimates in Table 6 do not show statistically significant effects of the share of high ability peers on any measure of non-cognitive skills.

However, when we interact the share of high ability peers with gender, we find some statistically significant effects in the case of males. More specifically, a high share of high ability peers is associate with lower conscientiousness and agreeableness (see columns (1) and (4) in Table 7).

Table 6. Peer effects on non-cognitive skills: the role of high ability peers

VARIABLES	(1) C_s	(2) E_s	(3) O_s	(4) A_s	(5) N_s
% high ability peers	-0.371	-0.0534	0.237	-0.403	-0.148
	(0.297)	(0.304)	(0.275)	(0.257)	(0.231)
Mean grade junior hs	0.0325	-0.0580	-0.249***	0.0268	-0.0383
	(0.0749)	(0.101)	(0.0670)	(0.0841)	(0.0693)
Other controls	YES	YES	YES	YES	YES
Constant	4.640***	5.297***	6.749***	5.091***	4.985***
	(0.550)	(0.756)	(0.474)	(0.641)	(0.520)
Observations	4,511	4,511	4,511	4,511	4,511
R-squared	0.035	0.020	0.059	0.017	0.094

Note: Other controls are: gender, enrollment year, track and school fixed effects

Table 7. Peer effects on non-cognitive skills: differences by gender in the role of high ability peers

VARIABLES	(1) C_s	(2) E_s	(3) O_s	(4) A_s	(5) N_s
F*% high ability peers	-0.177	-0.0358	0.145	-0.333	-0.140
	(0.303)	(0.328)	(0.286)	(0.252)	(0.240)
M*% high ability peers	-0.740**	-0.0867	0.410	-0.535*	-0.164
	(0.301)	(0.288)	(0.301)	(0.266)	(0.230)
Mean grade junior hs	0.0545	-0.0561	-0.259***	0.0346	-0.0374
	(0.0769)	(0.0995)	(0.0656)	(0.0822)	(0.0702)
male	0.0133	0.169***	0.0117	-0.0318	-0.670***
	(0.0944)	(0.0434)	(0.0771)	(0.0472)	(0.0427)
Other controls	YES	YES	YES	YES	YES
Constant	4.401***	5.275***	6.862***	5.005***	4.975***
	(0.576)	(0.749)	(0.464)	(0.619)	(0.533)
Observations	4,511	4,511	4,511	4,511	4,511
R-squared	0.038	0.020	0.059	0.017	0.094

Note: Other controls are: enrollment year, track and school fixed effects

[4] We consider as high ability peers those who completed junior high school with a grade of 9 or 10 on a 10-point scale.

Hence, an overall reading of the results by gender reveals that conscientiousness and agreeableness are negatively influenced by the concentration of peers in the lower part of the ability distribution in the case of females, in the upper part of the same distribution in the case of males.

Finally, we test the peer effect on non-cognitive skills of being in a classroom with similar peers in terms of ability. To this end, we use an indicator of similarity, which is defined as the share of classmates with a junior high school mark that is one point higher or lower with respect to the final mark of each student.

Estimates in Table 8 reveal a positive effect of similarity on both extraversion and agreeableness, but also on neuroticism.

Table 8. Peer effects on non-cognitive skills: the role of similar peers

VARIABLES	(1) C_s	(2) E_s	(3) O_s	(4) A_s	(5) N_s
similarity	-0.0785	0.144*	0.0858	0.182**	0.200**
	(0.0798)	(0.0850)	(0.0865)	(0.0795)	(0.0841)
Mean grade junior hs	-0.0579	-0.0595	-0.189***	-0.0516	-0.0573
	(0.0580)	(0.0619)	(0.0629)	(0.0578)	(0.0612)
Other controls	YES	YES	YES	YES	YES
Constant	5.254***	5.176***	6.310***	5.399***	4.919***
	(0.523)	(0.558)	(0.567)	(0.521)	(0.551)
Observations	4,511	4,511	4,511	4,511	4,511
R-squared	0.035	0.020	0.059	0.018	0.095

Note: Other controls are: gender, enrollment year, track and school fixed effects

Table 9. Peer effects on non-cognitive skills: gender differences in the role of similar peers

VARIABLES	(1) C_s	(2) E_s	(3) O_s	(4) A_s	(5) N_s
F*similarity	-0.366***	0.122	-0.0876	-0.0419	0.357***
	(0.128)	(0.124)	(0.141)	(0.116)	(0.131)
M*similarity	0.169	0.163	0.235*	0.374***	0.0645
	(0.137)	(0.116)	(0.131)	(0.126)	(0.124)
Mean grade junior hs	-0.0524	-0.0591	-0.185***	-0.0473	-0.0603
	(0.0662)	(0.0592)	(0.0601)	(0.0588)	(0.0596)
male	-0.517***	0.130	-0.167	-0.385***	-0.452***
	(0.150)	(0.128)	(0.142)	(0.127)	(0.135)
Constant	5.420***	5.189***	6.410***	5.528***	4.829***
	(0.605)	(0.541)	(0.555)	(0.520)	(0.550)
Observations	4,511	4,511	4,511	4,511	4,511
R-squared	0.038	0.020	0.059	0.019	0.096

Note: Other controls are: enrollment year, track and school fixed effects

When we interact the indicator of similarity with gender, we find very interesting results (see Table 9). More specifically, while males seem to benefit from being in a classroom with similar peers in

terms of ability, the opposite result emerges for females. In the case of males, both openness and agreeableness significantly increase with the share of similar peers, while in the case of females the latter reduces conscientiousness and it increases neuroticism.

6. Robustness check

TBW

7. Conclusion

TBW

References

Almlund, M., Duckworth, A. Heckman, J. and Kautz, T. (2011). Personality psychology and economics. In Hanushek, E., Machin, S. and Woessmann, L. (eds), Handbook of the economics of education, vol. 4, 1–182. Amsterdam: North-Holland, Elsevier Science.

Ammermueller, A. and Pischke J.S. (2009). Peer effects in European primary schools: Evidence from the progress in international reading literacy study. Journal of Labor Economics, 27(3):315–348.

Angrist, J. and Lang, K. (2004). Does school integration generate peer effects? Evidence from Boston's Metco Program. American Economic Review 94(5),1613–34.

Arcidiacono, P, and Nicholson, S. (2005). Peer Effects In Medical School. Journal of Public Economics, 2005, 89(2-3), 327-350.

Carrell, S., Fullerton, R. and West, J. (2009). Does Your Cohort Matter? Measuring Peer Effects in College Achievement. Journal of Labor Economics, 27(3), 439-464.

Eckstein, Z. and Wolpin, K, (1999). Why Youths Drop Out of High School: The Impact of Preferences, Opportunities, and Abilities. Econometrica, 67(6), 1295-1339.

Gerlitz, J. and Schupp, J. (2005). Zur Erhebung der Big-Five-basierten Persnlichkeitsmerkmale im SOEP, DIW Research Notes 2005-4. Berlin: DIW Berlin.

Gould, E., Lavy, V. and Paserman, D. (2009). Does immigration affect the long-term educational outcomes of natives? Quasi-experimental evidence. The Economic Journal, 119 (October), 1243–1269.

Heckman, J. (2007). The economics, technology, and neuroscience of human capability formation. Proceedings of the National Academy of Sciences, 104 (33), 13250-13255.

Jackson, C. (2012). Non-cognitive ability, test scores, and teacher quality: evidence from 9th grade teachers in North Carolina, NBER Working Paper 18624.

Lavy, V., Paserman, D. and Schlosser, A. (2012). Inside the Black Box of Ability Peer Effects: Evidence from Variation in Low Achievers in the Classroom. The Economic Journal, 122(559), 208-237

Lavy, V., Silva, O. and Weinhardt, F. (2012). The Good, The Bad and The Average: Evidence on Ability Peer Effects in Schools. Journal of Labor Economics, 30(2), 367-414.

Manski, C. F. (1993), Identification of Endogenous Social Effects: The Reflection Problem. Review of Economic Studies, Vol. 60, No. 3, pp. 531-542.

Murphy, R. and Weinhardt, F. (2014). Top of the Class: The Importance of Ordinal Rank, CESIFO Working Paper 4815.

Oreopoulos, P. (2007). Do dropouts drop out too soon? Wealth, health and happiness from compulsory schooling. Journal of Public Economics, 91(11-12), 2213-2229.

Poletto, S., (1992), La formazione delle classi, in Bartolini, D. (ed.), L'uomo, la scuola Nuova Dimensione, Portogruaro (Italy).

Sacerdote, B. (2001). Peer effects with random assignment: Results for Dartmouth roommates. Quarterly Journal of Economics 116(2), 681–704.

Zimmerman, D. (2003). Peer effects in academic outcomes: Evidence from a natural experiment. Review of Economics and Statistics 85(1), 9–23.