The Impact of College Peers on Academic Performance: Evidence from a Natural Experiment in Chile

Sandro Díez-Amigo

Massachusetts Institute of Technology (Department of Economics), Inter-American Development Bank (Multilateral Investment Fund)

11 May 2014

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Sandro Díez-Amigo*

August 15th, 2014

Abstract

First year students at the Pontificia Universidad Católica de Chile, one of the leading Chilean universities, are randomly assigned to their first semester college class groups. This paper takes advantage of this natural experiment in order to robustly estimate the impact of peer characteristics on undergraduate academic performance. The research hypothesis is that being assigned as a freshman to a group with more or less students from a same school, or from a given socioeconomic background, may result in very different patterns of adaptation, potentially impacting academic performance. This paper finds evidence which suggests that, contrary to the results found in most of the existing literature, the average college admission score of first semester classmates not only has no positive impact on the academic performance of undergraduate students, but may actually be negatively affecting their grades. Also, although there are some differences across degrees and secondary school types, in general undergraduate students are more likely to be dismissed, and have lower grades, when they share their first semester college class with a secondary schoolmate. Moreover, students assigned to first semester college classrooms with a higher concentration of classmates who attended the same secondary school(s) generally have significantly lower grades, and are less likely to graduate. Finally, students sharing their first semester college classroom with students from public or subsidized secondary schools are more likely to be dismissed due to poor academic performance. The fact that these peer effects are persistent in time points to the existence of a path dependence pattern, suggesting that this initial period in college is key for student adaptation. These findings have important implications for the design of policies intended to improve the adaptation of freshman college students and the access to higher education, suggesting that students would benefit from targeted first semester college class group assignment policies, as well as from additional transitional aid tailored to their profiles.

The views expressed in this paper are solely those of its author, and do not necessarily represent the views of, and should not be attributed to, any other individual or institution.

*MIT (Department of Economics) and Inter-American Development Bank (Multilateral Investment Fund). Email: *diez@mit.edu*.
First draft dated May 11th, 2014. The latest version of this paper is available at *http://www.diez-amigo.com*.

The author would like to first of all thank his thesis advisors Abhijit Banerjee, Benjamin Olken, Francisco Gallego and Michael Piore for their exceptional guidance during his graduate studies. He is also particularly grateful to Benjamin Golub, Gastón Illanes, Jeanne Lafortune, José Miguel Sánchez, José Tessada, and Victoria Valdés, and to one anonymous referee and several participants in seminars at the MIT Department of Economics for their helpful comments at different stages of this research project. Moreover, this endeavour would have been fruitless without the support of the Pontificia Universidad Católica de Chile and its Faculty of Economic and Administrative Sciences, or the Abdul Latif Jameel Poverty Action Lab (J-PAL) and its office for Latin America and the Caribbean, and the author would like to thank Ryan Cooper, Alexandra Cuchacovich, José Ignacio Cuesta, Amanda Dawes, Juan Echeverría, Guillermo Marshall, Bárbara Prieto, Francisco Rosende, Ignacio Sánchez, Ana María Silva, and many others at those institutions. Finally, funding for this research project was generously provided by the Caja Madrid Foundation, the Rafael del Pino Foundation, the "la Caixa" Foundation, the MIT Department of Economics, the Abdul Latif Jameel Poverty Action Lab (J-PAL) and its office for Latin America and the Caribbean, and the Pontificia Universidad Católica de Chile and its Faculty of Economic and Administrative Sciences. It is hereby very gratefully acknowledged.

JEL Classification Codes: I2, J15, O15

Keywords: Peer Effects, Higher Education, Education Policy, Economic Development

1. Introduction

The interaction among peers is a very difficult subject to study, given its complexity and the fact that peer group formation is usually endogenous (e.g. individuals self-select into peer groups, or are assigned to them according to observable characteristics). Therefore, natural experiments in which students have been randomly assigned to their peer groups provide a unique opportunity to exploit exogenous group formation, allowing to robustly estimate peer effects[1]. For example, in his seminal paper Sacerdote (2001) uses random assignment of college roommates to evaluate the impact of room sharing on grades and socialization patterns. This has spurred a series of related papers which also take advantage of natural experiments[2], but these generally focus on non-academic dimensions and non-classroom interactions, so that there is ample scope to improve our understanding of the impact of college peers on undergraduate academic performance.

Chile, albeit a middle-income country and an OECD member, faces substantial gaps in the provision of higher education. For example, while the OECD average net coverage of higher education (i.e. the ratio of students 18-24 years old enrolled in higher education) is 59 %, the net coverage of higher education in Chile is 36.3 %, and the net coverage for the poorest decile of the population is 16.4 % (OECD, 2011). Moreover, poor students usually attend public or subsidized secondary schools, while rich students usually attend private schools of higher quality. Only 10 % of public school graduates attend elite universities, versus 31 % for private schools, resulting in a clear majority of private school students in those institutions. Then, it is not surprising that the access to higher education is currently one of the most important issues for Chilean society (see for example Loofbourow, 2013), and the main reason behind the notorious student protests which have taken place there during the last years. Therefore, there is an ongoing debate both at the government and university levels regarding which is the best way to increase the access to higher education, and to ensure equality of opportunity for all.

In view of all of the above, this paper takes advantage of a natural experiment in Chile in order to estimate the impact of college peers on academic performance. In particular, it exploits the random assignment of first year students to their first semester college class groups at the Pontificia Universidad Católica de

[1]For alternative methodologies see for example: Manresa (2013), who discusses in depth the estimation of social interactions using panel data; De Giorgi et al (2010) who discuss the identification of social interactions through partially overlapping peer groups; Bramoullé et al (2009) or Boucher et al (2014), who estimate a linear-in-mean model of secondary school students in the context of recreational services consumption and student achievement, respectively; or Calvo-Armengol et al (2009) and Patacchini et al (2011), who develop and estimate models to study the impact of adolescent friendship networks on school performance and educational attainment, respectively.

[2]See for example: Boisjoly et al (2006), who study the impact of random first year roommate assignment on attitudes towards other ethnic groups; Burns et al (2013), who take advantage of random assignment of peers at one of the leading South African universities to also study racial relations; or Kremer and Levy (2008), who use the same strategy of random assignment of roommates to study the impact of peers on alcohol use among college students.

Chile, one of the leading Chilean universities. It relies on anonymous administrative data, collected by the university on a regular basis for academic and administrative purposes. The analysis includes all students who entered the Engineering and Commercial Engineering[3] degrees via ordinary admission between 2000 and 2006. These students are randomly assigned to first semester groups of 40-60 students, with whom they share the classroom when taking "core" non-elective courses (which make up the majority of the first semester curriculum). The research hypothesis is that, ceteris paribus, being assigned as a freshman to a class group with more or less students from the same school(s) or from a given socioeconomic background may result in very different patterns of adaptation (e.g. determining how the student evolves in the new environment, or the size and characteristics of the network of college contacts acquired). This idea is similar to Shue (2013), who taking advantage of the random assignment of students to MBA sections at Harvard Business School, estimates how executive peer networks can affect managerial decision-making and firm policies. However, by focusing on undergraduate degrees instead than on a MBA program, this paper tries to improve our understanding of college student adaptation in general, and of peer effects on academic performance in particular. This includes exploring whether causal adaptation mechanisms may rely on different socialization patterns triggered by the heterogeneous composition of first semester class groups, in terms of (i) admission score, (ii) number of students from the same secondary school, (iii) concentration of students from the same secondary school type[4], and (iv) secondary school type. All these dimensions have clear implications for the design of policies intended to improve the academic performance and adaptation of college students in general, and of those from disadvantaged socioeconomic backgrounds in particular.

It is not trivial to anticipate, *a priori*, what should be the impact on undergraduate academic performance of sharing the classroom with peers who obtained a better admission score. On the one hand, students may be able to benefit from potential positive learning externalities, but on the other hand it is also conceivable to think that peers with a better admission score may be more likely to procrastinate (e.g. if they feel that they can still achieve good grades with reduced effort). However, this paper not only rules out a positive impact of average college admission score of first semester classmates, but finds evidence of a negative impact on undergraduate grades (both short, medium and long term). This differs from previous findings in most of the literature, suggesting that the above mentioned negative "drag" effect outweighs potential positive learning externalities.

Similarly, it is not trivial to anticipate, *a priori*, what should be the impact on undergraduate academic performance of sharing the same first semester college classroom with secondary schoolmates. On the one

[3]Note that the Commercial Engineering undergraduate degree offered by Chilean universities usually encompasses the Economics and Business undergraduate majors offered by universities in the United States.

[4]It is an stylized fact of Chilean education that there is a very high correlation between secondary school type and socioeconomic status, as well as between tuition rates and the quality of secondary education. The vast majority of students from the top quintile of the income distribution attend private secondary schools, while students from the lowest quintiles usually attend subsidized secondary schools (or if their parents cannot even afford the subsidized tuition, public ones).

hand, being in a classroom with familiar faces may ease the transition from secondary school to college, but on the other hand it is also conceivable to imagine that the presence of secondary schoolmates may increase the temptation to procrastinate, at the expense of academics. This paper finds that secondary schoolmate presence in the first semester college classroom has a significant negative impact on undergraduate academic performance, both in terms of lower medium and long term grades, and of an increased likelihood of being dismissed due to poor academic performance. This suggests that the negative effect of a familiar face in the classroom outweigh its potentially positive ones.

Also, it is not trivial to anticipate what should be, *a priori*, the impact on academic performance of being assigned to a first semester college classroom with a higher concentration of students from the same secondary school(s). On the one hand, if a large proportion of students already know each other from secondary school, others may be shut off the main social group(s). But on the other hand, new students may find it easier to assimilate into an already structured social group. Moreover, it is not trivial to anticipate how being left out or assimilated should affect academic performance. Similarly to the case of secondary schoolmate presence, already discussed above, on the one hand students may benefit from more academic and social interaction with their college classmates. However, on the other hand this may also increase the opportunities for procrastination and the time devoted to non-academic activities, at the expense of academic performance. This paper finds a persistent and significant negative impact of secondary school concentration in the first semester college classroom on both short and long term undergraduate grades, as well as on the likelihood of dismissal due to poor academic performance. This suggests that having a large proportion of classmates who attended the same few secondary schools is detrimental to academic performance.

Furthermore, it is again not trivial to anticipate what should be, *a priori*, the impact on academic performance of being randomly assigned to a first semester college classroom in which there is a larger presence of public or subsidized secondary school students. On the one hand, as already mentioned above these students, and particularly the former, usually have had a secondary education of lower quality. They therefore may have significant formative gaps, which may potentially be the cause of negative learning externalities. However, on the other hand these students have obtained admission to very competitive degrees, despite the fact that they often faced considerably more difficulties than their peers. They therefore may have a comparable, or even greater, innate ability than their private school counterparts, and/or be more motivated[5]. This paper finds evidence that students assigned to a first semester college classroom with a higher percentage of public or subsidized secondary school students are more likely to be dismissed. However, while there is some evidence that an increased presence of public school students may, *ceteris paribus*, result in slightly lower undergraduate grades for their peers, this paper finds that an increased presence of subsidized school

[5]Since students from private secondary schools usually come from the top quintile of the income distribution their outside option may be much higher than that of public or subsidized school students from lower quintiles, potentially reducing motivation and effort.

students may have the opposite effect. This suggests that although positive learning externalities may in some cases be overshadowed by other factors, they still matter.

Finally, when looking separately at students admitted to each of the two degrees included in the analysis (Engineering and Commercial Engineering), or when allowing for the coefficients of interest to vary by the type of secondary school of origin, the results are generally consistent with the main findings discussed above. However, although there is evidence of some differences across students from the two degrees, and across students from different secondary school types, the results are noisier and no robust pattern is observed. These results are therefore no presented on this paper.[6]

It is worth noting that the above presented results are generally time-persistent, pointing to the existence of a path dependence pattern, and suggesting that this initial period in college is key for the student adaptation. These findings have important implications for the design of policies intended to improve the adaptation of freshman college students, and the access to higher education. In particular, they suggest that students would benefit from targeted first semester college class group assignment policies, as well as from additional transitional aid tailored to their profile.

The rest of this paper is organized as follows: Section 2 presents the motivation and background for the paper; Section 3 provides a description of the data used in the analysis; Section 4 provides a detailed description of the research methodology; Section 5 outlines the main findings; Section 6 discusses the robustness of the analysis; Section 7 concludes.

2. Motivation

Chile, albeit a middle-income country and a member of the OECD, faces substantial gaps in the provision of higher education. For example, while the OECD average net coverage of higher education (i.e. the ratio of students 18-24 years old enrolled in higher education) is 59 %, the net coverage of higher education in

[6] When making cross-degree comparisons it is worth noting that the assignment to each degree is not random, allowing for self-selection and potentially resulting in very different student profiles in Engineering and Commercial Engineering. Also, note that population size problems may be aggravated when looking at each degree separately. This may be the reason why some significant effects are only found on the Engineering subpopulation, since it is much larger than the Commercial Engineering one. Therefore, this type of differential impacts across degrees should not be viewed as exceedingly robust. Finally, note also that the limited number of students from subsidized and public schools results in limited power to detect differential impacts by school type, and may potentially be causing near-complete determination problems, as well as increased sensibility of point estimates to alternative specifications and estimation methods. However, this is only a concern when looking at the differential impact by school type, and in principle should not affect the general results presented in this paper, which are applicable to all school types.

Chile is 36.3 %, while the net coverage for the poorest decile of the population is 16.4 %. Also, students from low income families usually attend public or subsidized public schools, while students from the top of the income distribution usually attend private schools featuring higher quality. It is then not surprising that only 10 % of public school graduates attend elite universities, versus 31 % for private schools, resulting in a clear majority of private school students in high quality undergraduate institutions. Moreover, lengthy degrees (lasting 13.6 semesters on average) make education comparatively costly, and there is great variance (3:1 to 5:1) in income among graduates with the same degree (for more details about these stylized facts see Comisión de Financiamiento Estudiantil para la Educación Superior, 2012).

The university in which this study was carried out, one of the top in the country, is a good example of the above: 71.7 % of students are from households in the upper quintile of the income distribution, versus 3.4 % from its lower quintile. The pattern is even more pronounced in the most prestigious degrees: for example, ordinary admission into its Commercial Engineering degree usually requires a score of at least 730 points in the "Prueba de Selección Universitaria" (PSU), the standardized admission test administered at the national level. This score corresponds to the 98 % percentile of the distribution, so that the overwhelming majority of the 250 new students admitted each year attended private secondary schools, and belong to households in the two upper quintiles of the income distribution (see DEMRE, 2011, and Dirección de Servicios Financieros Estudiantiles, 2011).

Then, it is not surprising that the access to higher education is currently one of the most pressing issues for Chilean society, and the main reason behind the notorious student protests which have taken place there during the last years (see for example Loofbourow, 2013). Therefore, there is an ongoing debate at both the government and university levels regarding which is the best way to increase the access to higher education, and to ensure equality of opportunity. At its forefront is the role of the PSU, the standardized admissions test, which some argue that may be discriminating against talented students from poor backgrounds. This is both because due to its alleged focus on knowledge instead of ability (talented but poor students who attended public or subsidized secondary schools may have very significant knowledge gaps compared to their private secondary school peers), and to the prevalence of test preparation courses, or "preuniversitarios". The latter are attended by most private school students, but are generally not affordable for poorer students from public and subsidized secondary schools (for a related study on the subject in Chile see Banerjee et al (2012), who provide test preparation courses to students from disadvantaged backgrounds, and experimentally evaluate their impact). Another factor which is generally perceived as an important barrier to access higher education is its cost, which makes it prohibitive for many households. The Chilean government has been expanding public funding, but many times this doesn't cover the full tuition fees, and stipends to cover living expenses are very rare. Moreover, in order to address potential incentive problems, this funding often takes the shape of loans. However, this may have information and risk aversion implications which are not trivial, particularly in a middle- or low- income development country setting, with high uncertainty regarding the returns to education (see Dinkelman and Martinez, 2011, who using an experimental design evaluate the role of information about financial aid in the access to higher education in Chile; or Hoxby and Turner, 2012, who also look at the issue in the United States using a randomized control trial).

In order to bypass the potential admission test bias and/or funding problems, in the last few years many universities have created special admission programs. These are intended to improve the access to undergraduate education for secondary school students from disadvantaged backgrounds, but their impact is not yet clear. Moreover, many students admitted via those programs seem prone to experience adaptation problems, leading to student drop out (anecdotical evidence suggests that similar adaptation problems arise with ordinary admission students from the lower quintiles of the income distribution). [7]. In the United States, Arcidiacono et al (2011) study the on-campus interracial interaction among college students, and find empirical evidence that the probability of interaction between races on a campus is sensitive to the degree of mismatch between racial groups[8]. Therefore, it is plausible that the probability of interaction between students from different socioeconomic backgrounds on a campus or degree may also be sensitive to the degree of mismatch between socioeconomic groups (see for example Rao, 2013, who analyses how mixing students from different socioeconomic backgrounds in Indian schools affects social preferences and behaviors). This could be affecting the socialization patterns of students from disadvantaged backgrounds, which in turn may be affecting their adaptation to college.

However, it seems that ordinary admission students from disadvantaged backgrounds who do not drop out have an academic performance comparable to that of their counterparts, although some may be choosing "softer" courses with a more reduced mathematical component. The latter would be consistent with Arcidiacono et al (2012), who find that minority students in at Duke University in the United States catch up with their majority counterparts in terms of grades, but that this is at the expense of switching to the above mentioned less quantitative "softer" courses. Also, existing evidence suggests that there is a very high variance, in terms of labor market outcomes, across individuals with the same undergraduate education degree (this is often true even for graduates of the same university). In view of Sacerdote (2001), who using random assignment of college roommates finds an impact of room sharing on grades and socialization patterns, it is plausible that this labor market heterogeneity may at least partly be due not only to peer effects, but also to differential socialization patterns. These may lead to differences in the characteristics of the network of contacts acquired during college, which in many cases may impact not only undergraduate academic performance, but also choice of subjects or labor market outcomes after graduation.

[7] For related research in the U.S. and Canada see, for example, Arcidiacono et al (2011) or Angrist et al (2006).

[8] See also Burns et al (2013) for an analysis of the relationship between social interaction and racial prejudice in South Africa using randomly assigned university peers.

Finally, it is worth noting that the interaction among peers is in general terms a very difficult subject to study. This is due to its complexity, but also because peer group formation is usually endogenous (e.g. students self-select into peer groups, or assigned according to observable characteristics). Therefore, natural experiments in which students have been randomly assigned to their peer groups provide a unique opportunity to estimate peer effects (for alternative methodologies see for example: Manresa (2013), who discusses in depth the estimation of social interactions using panel data; De Giorgi et al (2010) who discuss the identification of social interactions through partially overlapping peer groups; Bramoullé et al (2009) or Boucher et al (2014), who estimate a linear-in-mean model of secondary school students in the context of recreational services consumption and student achievement, respectively; or Calvo-Armengol et al (2009) and Patacchini et al (2011), who develop and estimate models to study the impact of adolescent friendship networks on school performance and educational attainment, respectively). The above mentioned seminal paper by Sacerdote (2001) has spurred a series of related papers using other natural experiments (see for example: Boisjoly et al (2006), who study the impact of random first year roommate assignment on attitudes towards other ethnic groups; Burns et al (2013), who take advantage of random assignment of peers at one of the leading South African universities to also study racial relations; or Kremer and Levy (2008), who use the same strategy of random assignment of roommates to study the impact of peers on alcohol use among college students). However, these generally focus on non-academic dimensions and non-classroom interactions, so that there is ample scope to improve our understanding of the impact of peer effects on academic performance.

In view of all of the above, this paper takes advantage of a natural experiment in Chile in order to estimate the impact of class composition on academic performance. In particular, it exploits the random assignment of freshmen to their first semester college class groups at the Pontificia Universidad Católica de Chile, one of the leading Chilean universities. The research hypothesis is that being assigned as a freshman to a group with more or less students from the same school(s), or from a given socioeconomic background, may ceteris paribus result in very different patterns of socialization. The latter may determine how the student adapts to the new environment, as well as the size and characteristics of the network of contacts acquired during college. This idea is similar to Shue (2013), who in order to estimate how executive peer networks can affect managerial decision-making and firm policies, exploits the random assignment of students to MBA sections at Harvard Business School. However, this paper focuses on college education, instead than on MBA students. By doing so, it intends to help to improve our understanding of student adaptation mechanisms, and the relationship between peer characteristics and undergraduate academic performance. In particular, this paper tries to estimate the impact of being randomly assigned to a first semester classgroup with peers which may differ along several dimensions, i.e. (i) admission score, (ii) presence of secondary schoolmates, (iii) concentration of students from the same secondary school type, and (iv) presence of public or subsidized secondary school students (note that it is an stylized fact of Chilean education that there is a very high correlation between secondary school type and socioeconomic status, and between tuition rates and the quality of secondary education; the vast majority of students from the top quintile of the income distribution attend private secondary schools, while students from the lowest quintiles usually attend subsidized secondary schools, or if their parents cannot afford even the subsidized tuition, public ones). All of the above have clear implications for the design of policies intended to improve the adaptation of all college students in general, and of those from disadvantaged socioeconomic backgrounds in particular.

3. Data

This study relies on anonymous administrative data from undergraduate students, collected by the Pontificia Universidad Católica de Chile on a regular basis, for academic and administrative purposes. This includes standard administrative data required for the admission process (such as secondary education details and standardized test scores), but also information about socioeconomic status (necessary to determine benefit eligibility). Moreover, once students are enrolled in the university, their grades, courses taken, class groups and academic status are all recorded each semester, in order to allow for the effective monitoring of their progress during their undergraduate studies.

Data is available for all students enrolled in the university from 2000 to 2012.[9] However, the analysis is limited to students admitted from 2000 to 2006, so that a complete record from admission to graduation exists for all the studied cohorts. Also, the analysis is limited to students enrolled in the Engineering and Commercial Engineering degrees (note that the Commercial Engineering undergraduate degree offered by Chilean universities usually encompasses the Economics and Business undergraduate majors offered by universities in the United States). This is because these are among the largest degrees in terms of student enrollment, but also because other degrees were affected by curricular changes, making it impossible to reliably compare cohorts across time.[10]

Students seeking admission to the university must take a standardized test, administered at the national levels

[9] Records exist before the year 2000. However, due to the use of outdated databases and inconsistent data gathering and storage protocols, they were not deemed reliable by the university, and were not made available for the purpose of this analysis. It is also worth noting that, due to the country's location in the Southern hemisphere, the Chilean academic year starts in March and ends in December.

[10] Note that *ceteris paribus* a smaller population size will result in more limited statistical power, i.e. an increase in the minimum effect size which can be inferred to be significantly different from zero. In other words, in the absent of sufficient statistical power, if no impact is observed it is impossible to establish whether it is truly non-existent, or whether its size is simply below the observable threshold. Pooling degrees may alleviate this problem, allowing for increase statistical power, and pushing the minimum detectable effect threshold upwards. However, this would only allow to estimate aggregate peer effects, as opposed to degree-specific. Also, note that even the Engineering and Commercial Engineering degrees have undergone curricular changes during the period of study. However, those changes were sufficiently limited so that it still possible to perform a reliable comparison of cohorts across time.

to all Chilean students interested in accessing higher education[11]. This test consists of two compulsory parts (language and mathematics), and two or more optional ones. Together, they generate a weighted admission score, which is then used to determine admission in a centralized clearing process performed at the national level. First, each university decides whether or not to participate in the centralized admission process (the majority do, and certainly the best regarded ones). If so, it submits the admissions criteria (i.e. weighted admission score formula) to the centralized authority. Then, after taking the standardized admissions tests, students are asked to rank their university-degree preferences. Finally, the system clears in several rounds, by allocating the highest ranked students (in terms of admissions score) to their most preferred choice, and using ranked waiting lists to resolve conflicts (for more details see DEMRE, 2011-2013).

Both the Engineering and the Commercial Engineering degrees at the Pontificia Universidad Católica de Chile are highly competitive. Weighted admission scores are invariably very close to the maximum possible (850 points), with minimum admission scores ranging between 705-710 points, and maximum ones ranging between 825-830 points. The Engineering degree generally takes 6 years to complete, while the Commercial Engineering degree usually takes 5 years to complete. There are several financial aid options available for students who qualify, in terms of both socioeconomic and academic criteria. During their secondary schooling students may have attended a public (fully paid for by the government), subsidized (partly paid for by the government) or private (paid for in full by the student) school. The quality of secondary education in subsidized schools is generally lower than in private ones, while the quality of secondary education in public schools is in turn generally lower than in subsidized ones (note that a few but important exceptions to this stylized fact exist, most notably the "Instituto National" or *National Institute*, an elite secondary school funded by the government). This, together with the high cost of test preparation courses, results in students from private secondary schools usually obtaining substantially higher scores in the standardized admission test. Therefore, the majority of students admitted to the most demanded degrees at elite universities (including the two studied in this paper) attended private secondary schools. Moreover, many students who attended the same secondary school then enroll in the same degree, at the same university, sometimes even sharing their first semester college classroom (for example, the database used for this analysis shows that some students shared their first semester college classroom with up to 8 secondary school classmates).

Table I provides a summary of the number of students by school type in each degree. As observed there, each year there are usually four first semester class groups in the Commercial Engineering degree, and at least six class groups in the Engineering degree.[12] Each first semester class group usually features 50-60 students in the Commercial Engineering degree, and 40-50 students in the Engineering one. Each year between 200

[11]Note that the standardized admissions test format changed in 2003 from the old PAA ("Prueba de Aptitud Académica" or *Academic Aptitude Test*, to the new PSU ("Prueba de Selección Universitaria" or *University Selection Test*.

[12]Note that the actual group numbers in the Engineering degree are not always correlative. Also, the variation in the number of groups in the Engineering degree seems to be due to a larger intake of new students via ordinary admission in 2000 and 2006.

and 250 students are admitted to the Commercial Engineering degree via ordinary admission, while between 250-300 are admitted to the Engineering school.

4. Methodology

This paper takes advantage of the natural experiment created by the random assignment of incoming undergraduate students to first semester class groups at the Pontificia Universidad Católica de Chile. Freshmen are ranked according to their weighted admission score, and randomly assigned to one of the first semester class groups (the latter are referred to as “secciones”, or *sections*). Students in each of these class groups share the classroom when attending their first semester non-elective “core” courses. These are the majority (and many times the only) courses taken by freshmen during their first college semester, and students in the same class group therefore spend most of their first semester together. It is then plausible to think that many newly arrived students form the majority of their college social links during this period, and that assignment to one class group or another will influence the social networks of the student during their undergraduate years (and potentially even after graduation).

Therefore, this random assignment to first semester class groups allows to robustly estimate the impact of peer characteristics on undergraduate academic performance. Linear[13] specifications with fixed effects and clustered standard errors are used (i.e. the analysis takes into account that there may be correlation within each class group, and corrects for this fact by clustering at the class group and year level - class groups are considered distinct across admission years). Academic performance variables of interest include: (1) Graduation (i.e. whether the student graduated); (2) Drop Out (i.e. whether student decided to abandon studies); (3) Dismissal (i.e. whether the student was dismissed due to poor academic performance)[14]; (4) First Semester GPA (Grade Point Average); (5) First Year GPA; (6) Final Undergraduate GPA.

First, this paper analyzes the impact on the above mentioned outcome variables of secondary schoolmate presence in a student’s first semester college class group. For this purpose two linear functional forms are specified: a baseline specification (which includes only the independent variable of interest and the appropriate fixed effects), and a extended specification (which includes six additional control variables for robustness purposes). These two linear regression models are respectively represented as

[13] More sophisticated and non-linear specifications have also been explored, but the structure of the data is such that, given the available population size, the simpler linear specifications already provide limited statistical power. Therefore, more complex specifications run into standard small population size problems.

[14] It is worth noting that a student dropping out is likely to be a proxy for lack of adaptation to the new environment, while a student being dismissed is likely to be a proxy for gaps in secondary education, particularly in the case of public and subsidized secondary school students.

$$\text{(III.1)} \quad y_{ijkl} = \beta_0 + \delta_1 m_{ijkl} + \gamma_{jl} + \mu_{kl} + e_{ijkl}$$

$$\text{(III.2)} \quad y_{ijkl} = \beta_0 + \delta_1 m_{ijkl} + \sum_{h=1}^{6} \beta_h x_{hijkl} + \gamma_{jl} + \mu_{kl} + e_{ijkl}$$

where y_{ijkl} is one of the six college academic performance outcome variables described above, and m_{ijkl} is an indicator variable equal to one if student i in first semester college class group j shares the classroom with any other students from their same secondary school k who were also admitted to the same degree during academic year l[15]. As mentioned, for robustness purposes six additional student level individual controls $x_{hijkl} h = \{1, ..., 6)\}$ are introduced in the second specification. These are: (i) Gender (1 = Male); (ii) Weighted Admission Score; (iii) Mother's Educational Level; (iv) Father's Educational Level; (v) Housing Status (1 = Student lives with both parents); and (vi) Region (1 = Santiago Metropolitan Region). Two sets of fixed effects are also specified in the functional form: (a) γ_{jl} accounts for any unobservable idiosyncratic characteristics of first semester college class group j in academic year l; (b) μ_{kl} is the number of students from secondary school k admitted in academic year l to the same degree (note that μ_{kl} is included in place of η_{kl} - i.e. secondary school fixed effects - because, although this also guarantees that m_{ijkl} satisfies the standard exogeneity assumption, the number of required fixed effect terms in the specification goes down, increasing the precision of the estimation.). Finally, as already mentioned the analysis takes into account that there might be correlation across class groups, and corrects for this fact by clustering at the class group and year level (class groups are considered distinct across admission years).

Secondly, this paper also analyzes the impact on academic performance of the average weighted admission score of any secondary schoolmates in a student's first semester college class group. As before, two linear functional forms are specified: a baseline specification (which includes only the independent variable of interest and the appropriate fixed effects), and a extended specification (which for robustness purposes includes six additional control variables). These two linear regression models are respectively represented as

$$\text{(IV.1)} \quad y_{ijkl} = \beta_0 + \delta_1' m_{ijkl} + \delta_2 s_{ijkl} m_{ijkl} + \gamma_{jl} + \eta_{kl} + e_{ijkl}$$

$$\text{(IV.2)} \quad y_{ijkl} = \beta_0 + \delta_1' m_{ijkl} + \delta_2 s_{ijkl} m_{ijkl} + \sum_{h=1}^{6} \beta_h x_{hijkl} + \gamma_{jl} + \eta_{kl} + e_{ijkl}$$

where as before y_{ijkl} is one of the six college academic performance outcome variables described above, and m_{ijkl} is an indicator variable equal to one if student i in first semester college class group j shares the classroom with any other students from their same secondary school k who were also admitted to the same degree during academic year l. However, in this case the variable of interest is s_{ijkl}, which represents the average weighted admission score of secondary school k mates of student i in their first semester college

[15]As discussed in Section 6, the results of the analysis are robust to the substitution of the binomial presence variable for the actual number of secondary schoolmates in the first semester college class group.

class group j in academic year l. This is interacted with m_{ijkl} to account for the fact that many students do not share their first semester college class group with any secondary schoolmates. As before, six additional student level individual controls $x_{hijkl} h = \{1, ..., 6)\}$ are introduced in the third specification for robustness purposes. These are: (i) Gender (1 = Male); (ii) Weighted Admission Score; (iii) Mother's Educational Level; (iv) Father's Educational Level; (v) Housing Status (1 = Student lives with both parents); (vi) Region (1 = Santiago Metropolitan Region). However, in this case two slightly different sets of fixed effects are specified in the functional form: (a) γ_{jl} again accounts for any unobservable idiosyncratic characteristics of first semester college class group j in academic year l; (b) η_{kl} accounts for any unobservable idiosyncratic characteristics of students from secondary school k in academic year l (note that in this case it is not possible to substitute η_{kl} with μ_{kl} to increase precision as before, since the latter does not guarantee that s_{ijkl} satisfies the standard exogeneity assumption. Finally, as always the analysis takes into account the potential correlation within class groups, and corrects for this fact by clustering at the class group and year level (class groups are considered distinct across admission years).

Finally, this paper also analyzes the impact on academic performance of other characteristics of first semester college class group peers, as detailed below. As always, two linear functional forms are specified: a baseline specification (which includes only the independent variables of interest and the appropriate fixed effects), and a extended specification (which includes six additional controls for robustness purpose)s. These two linear regression models are respectively represented as

$$\text{(V.1)} \quad \mathrm{y}_{ijkl} = \beta_0 + \delta_1' m_{ijkl} + \delta_2 s_{ijkl} m_{ijkl} + \delta_3 s_{ijl} + \delta_4 H_{ijkl} + \delta_5 p_{1ijl} + \delta_6 p_{2ijl} + \eta_{kl} + e_{ijkl}$$

$$\text{(V.2)} \quad \mathrm{y}_{ijkl} = \beta_0 + \delta_1' m_{ijkl} + \delta_2 s_{ijkl} m_{ijkl} + \delta_3 s_{ijl} + \delta_4 H_{ijkl} + \delta_5 p_{1ijl} + \delta_6 p_{2ijl} + \sum_{h=1}^{6} \beta_h x_{hijkl} + \eta_{kl} + e_{ijkl}$$

where as before y_{ijkl} is one of the six college academic performance outcome variables described above, m_{ijkl} is an indicator variable equal to one if student i in first semester college class group j shares the classroom with any other students from their same secondary school k who were also admitted to the same degree during academic year l, and s_{ijkl} represents the average weighted admission score of secondary school k mates of student i in their first semester college class group j in academic year l. However, in this case the variables of interest are the characteristics of all first semester college class group peers. To begin with, s_{ijl} represents the average weighted admission score of (all) student i's first semester college class group j mates in academic year l (note that s_{ijl} refers to the average weighted admission score of all first semester college classmates, while s_{ijkl} refers only to secondary schoolmates in the first semester class group). Then, H_{ijkl} measures the concentration of secondary schools[16] in class group j in academic year l, excluding student

[16]Concentration of secondary schools in the class group is measured as the Herfindahl index of secondary school share, constructed by squaring and adding each secondary school's share in the classroom (i.e. the percentage of students who attended it before being admitted to the university). In particular:

i's secondary school k (once again, as mentioned in Section 6, the results of the analysis are robust to the substitution of the Herfindahl index for other secondary school concentration measures). Finally, p_{1ijl} and p_{2ijl} represent the percentage of student i's first semester college class group j mates in academic year l who attended a public or subsidized secondary school, respectively (note that neither s_{ijl}, H_{ijkl}, p_{1ijl} and p_{2ijl} include student i). Also, as always six additional student level individual controls $x_{hijkl}h = \{1, ..., 6)\}$ are introduced in the third specification for robustness purposes. These are: (i) Gender (1 = Male); (ii) Weighted Admission Score; (iii) Mother's Educational Level; (iv) Father's Educational Level; (v) Housing Status (1 = Student lives with both parents); (vi) Region (1 = Santiago Metropolitan Region). However, in this case only one set of fixed effects is specified in the functional form[17]: η_{kl} accounts for any unobservable idiosyncratic characteristics of students from secondary school k in academic year l (note that in this case it is again not possible to substitute η_{kl} with μ_{kl} to increase precision, as the latter does not guarantee that s_{ijl}, H_{ijkl}, p_{1ijl} and p_{2ijl} satisfy the standard exogeneity assumption). Finally, as always the analysis takes into account the potential correlation within class groups, and corrects for this fact by clustering at the class group and year level (class groups are considered distinct across admission years).

It is worth noting that the parameters of interest are the δ coefficients, which identify the impact of independent variables in each specification on the academic performance outcome variables described above (note that $\delta_1 \neq \delta_1'$, and that while in equations III we have that $E(y_{ijkl}|m_{ijkl} = 1) - E(y_{ijkl}|m_{ijkl} = 0) = \delta_1$, in equations IV and V it is the case that $E(y_{ijkl}|m_{ijkl} = 1) - E(y_{ijkl}|m_{ijkl} = 0) = \delta_1' + \delta_2 s_{ijkl})$.

Table II provides an overview of the balance by first semester class group of the additional control variables listed above, i.e. (i) Gender (1 = Male); (ii) Weighted Admission Score; (iii) Mother's Educational Level; (iv) Father's Educational Level; (v) Housing Status (1 = Student lives with both parents); (6) Region (1 = Santiago Metropolitan Region). Despite the multidimensionality of the data, and the reduced size of each first semester college class group, the balance seems to be reasonably good. In general, the null hypothesis of joint orthogonality across class groups during the same admission year cannot be rejected at the 90% confidence level or higher. However, this null hypothesis is indeed rejected in a few instances, which means that the balance of the random assignment is not perfect. As discussed in Section 6 this may potentially cause some robustness concerns.

$$H_{ijkl} = \sum_k \left\{ \frac{n_{jkl}}{\sum_{k'} n_{jk'l}} \right\}^2 \text{ for } k \neq k_i \text{ and } k' \neq k_i'$$

where and s_{kj} is the share of students in class group j who attended secondary school k.

[17]Note that in this case γ_{jl} class group fixed effects are not included because although neither s_{ijl}, H_{ijkl}, p_{1ijl} and p_{2ijl} include student i and therefore differ across students within the same class group, the variation at that level is not enough to avoid acute multi-collinearity problems.

5. Findings

5.1. Impact of Presence of Secondary Schoolmates

It is not trivial to anticipate what should be, *a priori*, the impact on undergraduate academic performance of sharing the same first semester classroom with secondary schoolmates. On the one hand, being in a class group with familiar faces and old acquaintances may ease the adaptation from secondary school to college. Also, this may allow students to better learn from their classmates, allowing them to benefit from potential positive learning externalities. However, on the other hand it is also conceivable to imagine that the presence of secondary schoolmates may increase the temptation to procrastinate, at the expense of academics. Also, secondary schoolmate presence may discourage students to expand their social network (e.g. if they tend to orbit towards known acquaintances at the expense of developing new relationships). This may limit the interaction with other classmates, decreasing the opportunities to benefit from potential positive learning externalities.

This paper finds that there is a significant negative impact of secondary schoolmate presence in the first semester college classroom, both in terms of lower grades in the medium and long term, and of an increased likelihood of being dismissed due to poor academic performance. This suggests that the potential negative effects of a familiar face in the classroom discussed above outweigh its positive ones. In particular, as in can be observed on Table III.1, students who share their first semester college class group with a secondary schoolmate are 2.7 % less likely to graduate (in particular, because they are 1.5 % more likely to be dismissed due to poor academic performance). Also, students who share their first semester college class group with a secondary schoolmate have first year and final undergraduate Grade Point Averages which are respectively 0.39 and 0.5 points lower (in the Chilean educational system grades range from 1 to 7, which are respectively the lowest and highest possible scores, and 4 generally is the lowest passing grade). These coefficients are significant with a 90 % confidence, and as it can be observed on Table III.2, the results are qualitatively robust to the inclusion of other student characteristics as additional controls (given the complex nature of the data exact point estimates can be noisy, and the precision of the analysis decreases as new control variables are included, but the sign of coefficients is the same and their magnitudes are roughly comparable when other student characteristics are considered).

Although the fact that no significant impact is observed on the likelihood of a student choosing to drop out may be attributable to limited statistical power, it nonetheless suggests that the negative impact of secondary schoolmate presence on the first semester college class group is mainly attributable to academic adaptation problems, which result in poor academic performance (as opposite to social adaptation problems, which result in the student choosing to abandon the undergraduate studies). Also, the fact that the presence of secondary schoolmates in the first semester college classroom still has a significant impact on grades after many years points to the existence of a path dependence pattern, and suggests that this initial period is key for student adaptation.

5.2. Impact of Admission Score of Secondary School Mates

It is again not trivial to anticipate what should be, *a priori*, the impact on undergraduate academic performance of sharing the classroom with secondary schoolmates who have a better weighted admission score. On the one hand, students may be able to benefit from potential positive learning externalities if the peers with whom they are most likely to interact have a better admission score. However, on the other hand it is also conceivable to think that those peers with a higher admission score may be more likely to procrastinate (e.g. if they feel that they can still obtain good grades with reduced effort). In that case, they may "drag" the student with them, negatively affecting academic performance.

This paper finds a significant negative impact on short, medium and long term grades of average weighted admission score of secondary schoolmates in the classroom. This suggests that the above discussed negative impact of secondary schoolmate presence seems to be aggravated when those secondary schoolmates have better admission scores. In particular, as it can be observed on Table IV.1 an additional average weighted admission score[18] point in average for secondary schoolmates in the first semester class group translates into between 0.003 and 0.002 less GPA points in the short and medium/long term, respectively (as already mentioned, in the Chilean educational system grades range from 1 to 7, which are respectively the lowest and highest possible scores). These coefficients are significant with a 95 % confidence in the case of short and medium term grades, and with a 90 % confidence in the case of long term grades.

This is perhaps a counter-intuitive result, and it contradicts the findings of most of the existing literature. But as already mentioned, the significant negative impact of secondary schoolmates' admission scores may be attributable to secondary schoolmates with better admission scores being more prone to procrastinate (e.g. if they feel more confident about still obtaining good grades with reduced effort), and then "dragging" the student with them. However, it is worth noting that this impact may also be attributable to other factors, such as the use of "curve grading", existence of "teaching to the top" practices, and/or expectational or motivational issues. In any case, the fact that both short and long term grades are affected suggests the existence of a path-dependence pattern, and/or strong persistence of social ties formed during the first college semester. This points towards "teaching to the top" or expectational or motivational factors (which affect

[18]As already mentioned, weighted admission scores for students in both degrees included in the analysis are invariably very close to the maximum of 850 points, with minimum scores ranging between 705-710 points and maximum ones ranging between 825-830 points.

the absolute performance of the students in the long term), as opposed to "curve grading" (which would just affect relative performance in the short term).[19] Also, note that this result does not imply that there do not exist positive learning externalities from sharing the classroom with students with a better admission score, but rather, that if they exist, they are more than compensated for by the former (and in fact, there could be other non-learning positive externalities at play, such as research training or familiarity with the university environment).

Finally, note that as it can be observed on Table IV.2, in this case the results are not robust to the inclusion of other student characteristics as additional controls (the coefficients of interest become insignificant, and in the case of short term grades even seem to change sign). This is to be expected if those characteristics are very predictive of test scores (something that the existing literature seems to suggest), but it may also be pointing to some potential robustness concerns. These are discussed on Section 6.

5.3. Impact of Admission Score of Classmates

Analogously to the previous case, it is not trivial to anticipate what should be, *a priori*, the impact on undergraduate academic performance of sharing the classroom with peers who have a better admission score. As before, on the one hand students may be able to benefit from potential positive learning externalities. However, on the other hand it is also conceivable to think that those peers with a better secondary education may be more likely to procrastinate (e.g. if they feel that they can still obtain good grades with reduced effort), "dragging" other students with them and negatively impacting their academic performance. Moreover, it is also not trivial to predict whether the impact of the average admission score of all first semester classmates should be larger or smaller than that of just secondary schoolmates. On the one hand, it is plausible to imagine that any impact may be amplified by the larger number of other students, compared to secondary schoolmates. But on the other hand, if a student interacts mostly with the latter, the impact of the admission score of all classmates may be more limited.

This paper finds evidence of a significant and persistent negative impact on academic performance of the average admission score of first semester college classmates. This suggests that the above discussed negative impact of admission score of secondary schoolmates also holds for other students, irrespective of their secondary school of origin. In particular, as it can be observed on Table V.1, an additional average weighted admission score point for classmates in the first semester college class group translates, *ceteris paribus*, into a reduction of between 0.041 and 0.026 GPA points in the short and medium term, and into 0.018 less GPA

[19] Note, however, that if students tend to choose the same electives, and try to continue sharing the classroom with their first semester classmates during the rest of their undergraduate studies, "curve grading" may indeed explain the persistence of lower grades in the medium and long term.

points in the long term. These coefficients are significant with a 99 % confidence in the case of short and medium term grades, and with a 95 % confidence in the case of long term grades.

As discussed in the previous section, this is again a counter-intuitive result, and it contradicts the findings of most of the exiting literature. But as already mentioned, this significant negative impact may be attributable to secondary schoolmates with better admission scores feeling more confident of still obtaining good grades with reduced effort. If this is the case, it is plausible to think that they are more prone to procrastinate, “dragging” other students with them. However, once again it is worth noting that this impact may also be attributable to other factors, such as the use of “curve grading”, existence of “teaching to the top” practices, and/or expectational or motivational issues. Although in this case the negative impact clearly diminishes as time passes, the fact that both short and long term grades are affected again suggests the existence of a (time-attenuated) path-dependence pattern, and/or time persistence of social ties formed during the first college semester. In principle this could again point towards “teaching to the top” or expectational/motivational factors (which affect the absolute performance of the students in the long term), but the clear attenuation and the magnitude of the significant coefficients would be also be consistent with (explicit or implicit) “curve grading”. Also, once again it is important to note that this result does not imply that there do not exist positive learning externalities from sharing the classroom with students with a better admission score, but rather that if they exist, they are more than compensated for by the former.

Finally, note that, as it can be observed on Table V.2, these results are again not robust to the inclusion of other student characteristics as additional controls (the coefficients of interest become much smaller and insignificant). As before, this is to be expected if those characteristics are very predictive of test scores (as the existing literature seems to suggest), but as already mentioned it may also be pointing to some potential robustness concerns which are discussed on Section 6.

5.4. Impact of Secondary School Concentration

Similarly to the case of secondary schoolmate presence, it is not trivial to anticipate what should be the impact on undergraduate academic performance of being in a first semester college classroom in which there is a higher concentration of students from the same secondary school(s). On the one hand, having a large proportion of students who already know each other from secondary school may shut others off. But on the other hand, if the main group is already structured, this may facilitate the assimilation of new students into it. Moreover, it is not trivial to anticipate how being left out (or assimilated) will affect academic performance. Once again, on the one hand students may benefit from more interaction with their classmates, but on the other hand that may also increase the opportunities for procrastination and the time devoted to non-academic activities, at the expense of academic performance.

This paper finds a persistent and significant negative impact of secondary school concentration in the first semester college classroom, on both short and long term grades, and the likelihood of dismissal. This suggests that that having a large proportion of classmates who come from the same few secondary schools is detrimental to academic performance. In particular, as it can be observed on Table V.1, an increase of one decimal point in secondary school concentration (as measured by a Herfindahl index)[20] *ceteris paribus* makes a student's likelihood to be dismissed increase 14 percentage points. Also, it results in 0.97 and 0.79 less GPA points in the short and medium term, respectively. These coefficients are significant with a 90 % confidence in the case of dismissal likelihood, and with a 99 % confidence in the case of short and long term grades. Also, as it can be observed on Table V.2, the results are qualitatively robust to the inclusion of other student characteristics as additional controls[21].

The above is consistent with the already discussed negative impact of secondary schoolmates in the first semester class group, but suggests that having too many students from a few secondary schools in the first semester class group is detrimental to all students in the group, and not only to their secondary schoolmates. Also, the very large size of the estimated coefficients points to this being a very important issue. Moreover, the fact that secondary school concentration in the first semester class group impacts the likelihood of dismissal, but not the likelihood of drop out, suggests that it causes academic adaptation problems (as opposed to social adaptation ones).[22]

5.5. Impact of Presence of Public and Subsidized Secondary School Students

As always, it is not trivial to anticipate what should be the impact on academic performance of being randomly assigned to a first semester college classroom in which there is a larger presence of public or subsidized school students. Those students, and particularly the former, usually have had a secondary education of lower quality, and may therefore have significant formative gaps (as already mentioned, it is an stylized fact of

[20] Constructed by squaring and adding each secondary school's share in the classroom, i.e. the percentage of students who attended it before being admitted to the university. In particular:

$$H_{ijkl} = \sum_{k} \left\{ \frac{n_{jkl}}{\sum_{k'} n_{jk'l}} \right\}^2 \text{ for } k \neq k_i \text{ and } k' \neq k'_i$$

where and s_{kj} is the share of students in class group j who attended secondary school k.

[21] As in the case of secondary schoolmate presence, given the complex nature of the data, exact point estimates can be noisy, and the precision of the analysis decreases as new control variables are included. However, although the size of the estimated coefficient is smaller, the sign of the coefficients of interest is still the same.

[22] It is also worth noting that in this case there is no evidence of any impact on medium term grades, which goes against the monotone time patterns observed for the impact of the other variables of interests discussed so far. This suggests that the relationship between secondary school concentration and academic performance may be more complex, although unfortunately the reduced form analysis in this paper does not allow to disentangle its exact mechanism.

Chilean education that there is a very high correlation between secondary school type and socioeconomic status, as well as between tuition rates and the quality of secondary education: the vast majority of students from the top quintile of the income distribution attend private secondary schools, while students from the lowest quintiles usually attend subsidized secondary schools, or public ones if their parents cannot afford even the subsidized tuition). However, at the same time these students have obtained admission to very competitive degrees, while often facing much more difficulties to do so than their counterparts. Therefore, they may have comparable or even greater innate skills than their private school peers, and/or they may be more motivated (since students from private secondary schools usually come from the top quintile of the income distribution, their outside option may be much higher than that of public or subsidized school students from lower quintiles, potentially reducing motivation and effort).

This paper finds evidence that students assigned to a first semester college classroom with a higher percentage of public or subsidized secondary school students are more likely to be dismissed. However, while there is some evidence that an increased presence of public school students may *ceteris paribus* result in slightly lower grades, this paper finds that an increased presence of subsidized school students may conversely result in slightly higher grades. In particular, as it can be observed on Table V.1, an increase of one percentage point in the share of public secondary school students in the first semester classroom *ceteris paribus* makes a student's likelihood to graduate and be dismissed decrease 0.29 and increase 0.21 percentage points, respectively.[23] Similarly, an increase of one percentage point in the share of subsidized secondary school students in the first semester classroom *ceteris paribus* makes a student's likelihood to be dismissed increase 0.16 percentage points. However, an increase of one percentage point in the share of subsidized secondary school students in the first semester classroom *ceteris paribus* results in about 0.009 and 0.007 more GPA points in the short and medium term, respectively. These coefficients are significant with a 95 % and 90 % confidence in the case of public and subsidized secondary school presence, respectively, and are qualitatively robust to the inclusion of other student characteristics as additional controls.

The above suggests that although positive learning externalities may in some cases be overshadowed by other factors (as discussed in previous sections), they still matter. The lower average quality of the education of subsidized and public secondary school students, and particularly of the latter, seems to not only affect their performance, but also that of their first semester college classmates. Also, note that although the size of both effects seems to be small, the negative impact of increased public secondary school presence on the dismissal likelihood seems to be larger than that of a higher percentage of subsidized secondary school students. This is consistent with the stylized fact of subsidized secondary schools generally offering a education of higher quality, compared to their public counterparts. Moreover, the fact that a larger presence of subsidized school

[23] Although the coefficients are not significant at the 90 % level, as mentioned there is some evidence that an increase of one percentage point in the share of public secondary school students in the first semester classroom *ceteris paribus* may result in about 0.005 less GPA points in the short and medium term.

students in the first semester college class group has a positive impact on grades suggests that, in their case, increased motivation and effort may more than compensate for any gaps in their secondary education [24]. Finally, the fact that this positive impact on grades only lasts until the medium term again suggest that learning externalities may be the main driver behind this impact. However, in any case the fact that there is still some persistence beyond the first semester once more points to the existence of a path-dependence pattern.

5.6. Differences by Degree

When looking separately at students admitted to each of the two degrees under study, the results are consistent with the above discussed findings. There is evidence of some differences across students from the two degrees, but the results are noisier and no robust pattern is observable, and they are therefore no presented on this paper.[25]

5.7. Differences by Secondary School Type

As in the previous case, when allowing for the coefficients of interest to vary with the type of secondary school of origin, the results are qualitatively comparable to the above discussed findings. There is evidence of some differential impacts across secondary school type, but once again the results are noisier and, no robust pattern is observable. These results are therefore no presented on this paper.[26].

[24]Note, however, that the opposite signs of the impact on grades and likelihood of dismissal could also likely be due to students with lower grades being dismissed, therefore increasing the average grades for those who continue their studies.

[25]When making cross-degree comparisons it is worth noting that the assignment to each degree is not random, allowing for self-selection and potentially resulting in very different student profiles in Engineering and Commercial Engineering. Also, note that, as expected, population size problems are aggravated when looking at each degree separately. This may be the reason why some significant effects are only found on the Engineering subpopulation, since it is much larger than the Commercial Engineering one. Therefore, this type of differential impacts across degrees should not be viewed as exceedingly robust.

[26]Note that the limited number of students from subsidized and public schools results in limited power to detect differentiated impacts by school type, and may potentially be causing near-complete determination problems and increased sensibility of on point estimates to alternative specifications and estimation methods. This is only a concern when looking at the differentiated impact by school type, and should not affect the general results presented in this paper, which are applicable to all school types.

6. Robustness

The main results presented in this paper are robust to the use of Huber-White heteroskedasticity-consistent estimation, instead of clustered standard errors at the class group level. Also, results regarding the negative impact of secondary school classmate presence on academic performance are robust to alternative specifications (e.g. including school*year*degree fixed effects, or the use of number of secondary school class mates variable, instead of a binomial one simply denoting presence or absence). Moreover, results regarding the negative impact of peer admission score on academic performance are robust to the inclusion of secondary school class mate presence as an independent variable in the specification. Results regarding the negative impact of secondary school concentration on academic performance are also robust to the use of alternative measures of school concentration (e.g. number of schools with more than a 5 % or 10 % share of students in the classroom, or the share of students in the class group belonging to the top 1, top 2, top 3, top 5 and top 10 most represented schools).

Although the additional controls included in the full specification are not guaranteed to be exogenous in this context (and are therefore not discussed in this paper), it is worth noting that their estimated coefficients are consistent with the literature findings, as well as with the anecdotical evidence.[27]

However, it is worth noting that, although a population consisting of a few thousand observations is analyzed, given the complexity of the data structure at the end of the day there is limited statistical power, and small size effects may go undetected. Therefore, the discussion of the findings in this paper focuses on the significant impacts found, rather than on the lack of impact, which could be attributable to low statistical power problems. Also, point estimates should be used with caution for policy purposes, since they are usually more sensitive to the structure of the data than the sign of estimated coefficient.

Similarly to the above, although it would in principle be possible to perform the analysis on other degrees, the reduced number of students enrolled in them (and/or the number of suitable yearly data available) mean that the resulting population size would only allow for a very limited statistical power. Therefore, only very large effects could be detected, unless the information was pooled across degrees (in which case only aggregated peer effects could be estimated with more precision). However, other degrees also experienced curricular changes, which make the comparison across time cohorts very difficult (or outright impossible).

[27] For example, the weighted average admission score is the best predictor of academic performance. Also, students from public and subsidized secondary schools are less likely to graduate and have lower grades, while male students have lower grades than female ones. The educational level of parents has a positive impact on academic performance, and students who live with their parents perform better during their undergraduate studies. Finally, students from the Santiago metropolitan region have a better academic performance than their peers from other areas of the country.

Moreover, as expected non-linear models (such as probit or logit) are very problematic in this setting, due to the large number of fixed effects which need to be included in the specifications (i.e. in order to account for the idiosyncratic differences across secondary schools of origin and class groups). However, note that the linear specifications discussed in this paper have a better fit (as measured by the adjusted R^2 coefficient) when applied to grades as the dependent variable, instead than to the likelihood of graduation, drop out or dismissal. This is to be expected, given the binomial nature of the latter, and means that *ceteris paribus* it will be easier to detect and measure the impact of peers on grades.

Finally, as already mentioned, note that the results concerning the impact of admission scores of first semester college classmates are not robust to the inclusion of other student characteristics as additional controls (the coefficients of interest become insignificant, and in an instance even seem to change sign). As discussed in the relevant sections above, this is to be expected if those characteristics are very predictive of test scores (something that the existing literature seems to suggest). However, in principle this may also point to balance problems. Or, given that (according to Table II) the additional control variables do not seem to be particularly imbalanced across class groups, this may also suggest that the impact of the admission score of first semester college classmates varies with some of the additional control variables included in the extended specification. This would mean that the coefficients for the admission score of first semester college classmates in the regression can no longer be interpreted a simple differential impact, and that interaction terms between the variable of interest and the additional controls must be included.

7. Conclusion

This paper takes advantage of a natural experiment, by which first year college students at one of the leading Chilean universities are randomly assigned to their first semester college class groups, in order to robustly estimate peer effects on undergraduate academic performance. The research hypothesis is that being assigned as a freshman to a group with more or less students from a same school, or from a given socioeconomic background, may result in very different patterns of adaptation and impact academic performance. This paper finds that, contrary to the evidence in most of the existing literature, the average standardized admission score of first semester college classmates no only seems to have no positive impact on undergraduate grades, but actually may have a negative one. Also, although there are some differences across degrees and secondary school type, college students who share their first semester classroom with a secondary schoolmate are generally more likely to be dismissed due to poor academic performance, and have lower grades. Moreover, students assigned to first semester college classrooms with a higher concentration of classmates who attended the same secondary school(s) have significantly lower grades, and are less likely to graduate. Finally, students who share their first semester college classroom with peers from public or subsidized secondary schools are more likely to be dismissed due to poor academic performance. All these impacts are generally persistent in time, pointing to the existence of a path dependence pattern, and suggesting that this initial period in college is key for student adaptation.

All the above has important implications for educational policy. First of all, the negative impact of secondary schoolmate presence for all types of students suggests that it would be advisable to assign freshmen to college class groups so that, whenever possible, they do not share their first semester classroom with any secondary schoolmates. Moreover, the large negative impact of secondary school concentration suggests that it would be advisable to group freshmen, so that students who attended the same secondary school are as spread as possible across class groups. Similarly, given the observed small but significant negative impact of sharing the classroom with a larger percentage of public or subsidized school students, it seems that it would also be advisable to spread this type of students across class groups. All this would be achievable by implementing targeted, multidimensional first semester classroom assignment policies.[28]

Second of all, the persistence of the observed impacts derived from first semester class group composition suggest that this is a very important period. Therefore, it may be advisable to even more so focus the transitional aid on the first semester, and/or potentially on the summer before starting college. Also, the detected negative impacts on the likelihood of graduation seem to be channeled through an increased probability of being dismissed due to poor academic performance. This suggests that, apart from facilitating the social adaptation of students to their new environment, special attention should still continue to be paid to academic training (remedial or otherwise).

Finally, although no clear pattern is observed, and results are therefore not presented on this paper, there seem to exist some differential impacts by degree and secondary school type. This suggests that one-size-fits-all transitional-aid programs may be less likely to succeed than programs tailored to the specific needs of each student profile in each degree. Also, students from public and subsidized secondary schools seem to be at a disadvantage, and may be negatively impacting their peers. This suggests that it would be advisable to put a special focus on helping this type of students to catch up (ideally with summer courses before starting college, in order to avoid a substitution effect between time devoted to regular subjects and remedial training). However, as the positive impact of subsidized secondary school student presence suggests, it seems that, without the formative shortcomings associated to the lower quality of their secondary education, public and subsidized secondary school students may instead potentially have a positive impact on their peers. Therefore, the first best solution to access to higher education barriers would be to address the quality gap in secondary education (between public and subsidized schools, and their private counterparts).

[28] Note however that as Carrell et al (2013) point out optimal assignment policies may be unsuccessful if students endogenously form sub-groups. Also, the impact of optimal assignment will be weakened if students prefer to interact with a particular set of students even when they are outside their assigned group

TABLE I
DISTRIBUTION OF FIRST SEMESTER COLLEGE STUDENTS

	Commercial Engineering Degree					Engineering Degree				
		Secondary School Type					Secondary School Type			
Year	Group	Public	Subsidized	Private	Total	Group	Public	Subsidized	Private	Total
2000	1	1	3	51	55	1	3	2	45	50
	2	4	7	41	52	2	3	2	43	48
	3	1	6	45	52	3	4	1	42	47
	4	1	9	43	53	4	3	7	40	50
	…	…	…	…	…	5	7	4	37	48
	…	…	…	…	…	6	1	3	44	48
	…	…	…	…	…	7	2	5	38	45
	…	…	…	…	…	8	1	5	39	45
	All	7	25	180	212	All	24	29	328	381
2001	1	6	3	45	54	1	5	4	41	50
	2	2	1	50	53	2	3	4	39	46
	3	2	3	49	54	3	3	5	38	46
	4	4	2	47	53	4	5	3	35	43
	…	…	…	…	…	5	7	2	41	50
	…	…	…	…	…	6	2	1	45	48
	All	14	9	191	214	All	25	19	239	283
2002	1	6	3	42	51	1	0	4	44	48
	2	2	12	38	52	2	4	6	39	49
	3	5	4	44	53	3	6	5	35	46
	4	3	3	51	57	4	4	5	40	49
	…	…	…	…	…	5	3	3	39	45
	…	…	…	…	…	6	1	2	47	50
	All	16	22	175	213	All	18	25	244	287
2003	1	4	4	43	51	1	4	3	42	49
	2	0	3	48	51	2	3	8	36	47
	3	1	7	45	53	3	5	4	37	46
	4	4	4	41	49	4	5	6	35	46
	…	…	…	…	…	5	6	3	36	45
	…	…	…	…	…	6	1	2	45	48
	All	9	18	177	204	All	24	26	231	281
2004	1	0	2	52	54	1	6	3	39	48
	2	1	6	49	56	2	9	4	32	45
	3	2	5	43	50	3	7	7	35	49
	4	2	3	53	58	4	4	5	39	48
	…	…	…	…	…	5	5	2	40	47
	…	…	…	…	…	6	4	4	41	49
	All	5	16	197	218	All	35	25	226	286
2005	1	3	3	50	56	1	1	8	41	50
	2	0	5	49	54	2	7	3	35	45
	3	3	6	45	54	3	3	5	41	49
	4	1	2	53	56	4	4	4	34	42
	…	…	…	…	…	5	3	4	40	47
	…	…	…	…	…	6	4	5	37	46
	All	7	16	197	220	All	22	29	228	279
2006	1	0	5	51	56	1	6	2	40	48
	2	2	3	47	52	2	4	6	36	46
	3	3	0	47	50	3	3	6	39	48
	4	2	4	48	54	4	8	6	35	49
	…	…	…	…	…	5	4	3	40	47
	…	…	…	…	…	6	7	4	34	45
	…	…	…	…	…	7	2	5	38	45
	…	…	…	…	…	8	7	3	35	45
	All	7	12	193	212	All	41	35	297	373
Total		123	224	2427	2774	Total	317	326	3142	3785

NOTES. Distribution of first semester college students in the Commercial Engineering and Engineering degrees at one of the leading Chilean universities. The data set has been constructed using the administrative data routinely gathered by the university from 2000 to 2012, and it includes all students who entered the Commercial Engineering and Engineering degrees at the university via ordinary admission process between 2000 and 2006.

TABLE II

BALANCE BY ADMISSION YEAR AND CLASS GROUP

II.A. Commercial Engineering Degree										
Year	Group	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	Obs.
2000	1	727.37	0.44	8.24	8.44	0.85	0.84	0.02	0.05	55
	2	726.47	0.58	7.69	8.17	0.77	0.73	0.08	0.13	52
	3	727.61	0.56	8.06	8.44	0.73	0.85	0.02	0.12	52
	4	726.02	0.66	8.19	8.58	0.77	0.83	0.02	0.17	53
	p-value	0.97	0.13	0.23	0.42	047	0.40	0.25	0.31	
2001	1	730.52	0.61	7.94	8.20	0.87	0.85	0.11	0.06	54
	2	731.72	0.62	7.77	8.60	0.87	0.92	0.04	0.02	53
	3	732.07	0.44	7.91	8.24	0.74	0.83	0.04	0.06	54
	4	729.24	0.58	7.96	8.23	0.73	0.85	0.08	0.04	52
	p-value	0.84	0.22	0.91	0.43	0.12	0.53	0.35	0.75	
2002	1	734.08	0.55	7.90	8.00	0.90	0.86	0.12	0.06	51
	2	732.70	0.50	8.04	8.17	0.77	0.73	0.04	0.23	52
	3	730.85	0.49	8.11	8.42	0.83	0.87	0.09	0.08	53
	4	731.82	0.40	8.10	8.33	0.83	0.84	0.05	0.05	58
	p-value	0.78	0.38	0.90	0.54	0.36	0.21	0.39	0.01	
2003	1	732.32	0.69	8.08	8.43	0.86	0.88	0.08	0.08	51
	2	732.57	0.39	8.06	8.49	0.78	0.92	0.00	0.06	51
	3	730.76	0.53	7.60	8.19	0.79	0.83	0.02	0.13	53
	4	730.08	0.57	7.96	8.35	0.84	0.86	0.08	0.08	49
	p-value	0.86	0.03	0.47	0.73	0.70	0.56	0.10	0.60	
2004	1	744.05	0.52	8.07	8.48	0.80	0.87	0.00	0.04	54
	2	744.76	0.52	7.89	8.25	0.73	0.86	0.02	0.11	56
	3	744.92	0.60	7.86	8.54	0.82	0.90	0.04	0.10	50
	4	744.53	0.57	7.76	8.29	0.79	0.84	0.03	0.05	58
	p-value	1.00	0.80	0.78	0.66	0.72	0.86	0.51	0.41	
2005	1	741.34	0.50	8.27	8.63	0.80	0.79	0.05	0.05	56
	2	742.86	0.54	8.17	8.44	0.87	0.80	0.00	0.09	54
	3	742.54	0.52	7.76	8.33	0.85	0.85	0.06	0.11	54
	4	739.62	0.59	8.50	8.64	0.71	0.80	0.02	0.04	56
	p-value	0.92	0.81	0.05	0.46	0.16	0.83	0.27	0.41	
2006	1	747.90	0.55	8.32	8.61	0.82	0.80	0.00	0.09	56
	2	746.31	0.48	7.69	8.48	0.73	0.88	0.04	0.06	52
	3	746.25	0.62	7.98	8.70	0.72	0.84	0.06	0.00	50
	4	746.67	0.54	8.09	8.74	0.81	0.89	0.04	0.07	54
	p-value	0.98	0.57	0.20	0.59	0.46	0.55	0.38	0.22	

NOTES. The data set has been constructed using the administrative data routinely gathered by the university from 2000 to 2012, and it includes all students who entered the Commercial Engineering degree at the university via ordinary admission process between 2000 and 2006. Assignment of students to their first semester college class group was random. Each cell presents the mean of the balance variable (column) in each class group (row). Balance variables are: (1) weighted admission score, (2) gender (1 = male), (3) mother's educational level, (4) father’s educational level, (5) housing status (1 = student lives with both parents), (6) region (1 = Santiago Metropolitan Region), (7) secondary school type (1 = public), (8) secondary school type (1 = subsidized). Reported p-values are for joint orthogonality test across class groups during the same admission year for each of the corresponding balance variables..

II.B. Engineering Degree										
Year	Group	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	Obs.
2000	2	739.56	0.86	8.28	8.32	0.70	0.72	0.06	0.04	50
	3	738.34	0.85	7.85	8.13	0.75	0.75	0.06	0.04	48
	4	740.70	0.83	8.26	8.38	0.74	0.85	0.09	0.02	47
	5	739.35	0.80	7.98	8.18	0.84	0.84	0.06	0.14	50
	6	739.01	0.81	8.17	8.50	0.79	0.81	0.15	0.08	48
	7	739.82	0.79	7.69	8.06	0.85	0.92	0.02	0.06	48
	8	738.85	0.76	7.78	8.11	0.78	0.80	0.04	0.11	45
	9	739.41	0.87	7.73	8.24	0.80	0.80	0.02	0.11	45
	p-value	1.00	0.86	0.40	0.83	0.64	0.32	0.26	0.30	
2001	1	753.33	0.92	7.72	7.82	0.86	0.80	0.10	0.08	50
	2	752.57	0.85	7.43	8.39	0.85	0.85	0.07	0.09	46
	3	751.14	0.83	8.07	8.26	0.78	0.85	0.07	0.11	46
	4	749.02	0.91	7.77	8.40	0.86	0.84	0.12	0.07	43
	5	750.31	0.88	7.52	7.84	0.86	0.86	0.14	0.04	50
	7	749.99	0.83	8.08	8.54	0.85	0.79	0.04	0.02	48
	p-value	0.92	0.67	0.32	0.07	0.90	0.93	0.54	0.57	
2002	1	738.03	0.90	7.63	8.13	0.77	0.73	0.00	0.08	48
	2	738.72	0.92	8.04	8.29	0.82	0.84	0.08	0.12	49
	3	738.20	0.87	7.87	8.24	0.76	0.72	0.13	0.11	46
	4	737.26	0.88	7.71	7.96	0.78	0.84	0.08	0.10	49
	5	740.09	0.80	7.69	8.53	0.73	0.78	0.07	0.07	45
	7	737.96	0.78	8.18	8.34	0.84	0.78	0.02	0.04	50
	p-value	0.99	0.32	0.49	0.51	0.84	0.61	0.11	0.73	
2003	1	738.23	0.88	7.84	8.16	0.76	0.82	0.08	0.06	49
	2	739.12	0.79	7.89	8.00	0.70	0.74	0.06	0.17	47
	3	736.76	0.65	8.00	8.30	0.78	0.80	0.11	0.09	46
	4	738.45	0.89	7.33	7.67	0.70	0.67	0.11	0.13	46
	5	738.15	0.87	7.53	8.36	0.76	0.64	0.13	0.07	45
	7	736.55	0.79	8.38	8.56	0.71	0.73	0.02	0.04	48
	p-value	0.99	0.03	0.08	0.24	0.91	0.35	0.44	0.26	
2004	1	757.16	0.88	8.00	8.52	0.83	0.85	0.13	0.06	48
	2	756.79	0.98	7.31	7.73	0.73	0.80	0.20	0.09	45
	3	757.44	0.80	7.67	8.31	0.80	0.76	0.14	0.14	49
	4	755.68	0.90	8.06	8.06	0.75	0.77	0.08	0.10	48
	5	757.35	0.83	8.06	8.28	0.79	0.77	0.11	0.04	47
	7	756.69	0.84	7.96	8.04	0.71	0.80	0.08	0.08	49
	p-value	1.00	0.14	0.24	0.24	0.76	0.87	0.52	0.61	
2005	1	767.66	0.92	7.92	7.96	0.76	0.84	0.02	0.16	50
	2	768.24	0.96	7.89	8.27	0.69	0.80	0.16	0.07	45
	3	766.14	0.88	7.61	7.82	0.80	0.78	0.06	0.10	49
	4	767.75	0.81	7.93	8.31	0.81	0.76	0.10	0.10	42
	5	765.61	0.74	7.87	8.26	0.91	0.74	0.06	0.09	47
	7	767.03	0.89	7.91	8.17	0.76	0.80	0.09	0.11	46
	p-value	0.99	0.04	0.94	0.64	0.17	0.90	0.26	0.77	
2006	1	774.80	0.85	8.10	8.38	0.67	0.85	0.13	0.04	48
	2	774.96	0.74	8.24	8.35	0.70	0.85	0.09	0.13	46
	3	772.46	0.79	7.88	8.58	0.83	0.77	0.06	0.13	48
	4	774.47	0.86	7.61	8.37	0.80	0.76	0.16	0.12	49
	5	774.14	0.83	8.00	8.17	0.79	0.79	0.09	0.06	47
	6	772.69	0.82	8.00	8.20	0.71	0.73	0.16	0.09	45
	7	773.30	0.84	8.07	8.24	0.73	0.73	0.04	0.11	45
	8	774.16	0.93	8.18	8.38	0.71	0.82	0.16	0.07	45
	p-value	1.00	0.41	0.66	0.89	0.57	0.72	0.43	0.74	

NOTES. The data set has been constructed using the administrative data routinely gathered by the university from 2000 to 2012, and it includes all students who entered the Engineering degree at the university via ordinary admission process between 2000 and 2006. Assignment of students to their first semester college class group was random. Each cell presents the mean of the balance variable (column) in each class group (row). Balance variables are: (1) weighted admission score, (2) gender (1 = male), (3) mother's educational level, (4) father's educational level, (5) housing status (1 = student lives with both parents), (6) region (1 = Santiago Metropolitan Region), (7) secondary school type (1 = public), (8) secondary school type (1 = subsidized). Reported p-values are for joint orthogonality test across class groups during the same admission year for each of the corresponding balance variables..

TABLE III

IMPACT ON ACADEMIC PERFORMANCE OF PRESENCE OF SECONDARY SCHOOL MATES IN FIRST SEMESTER COLLEGE CLASS GROUP

		(1)	(2)	(3)	(4)	(5)	(6)
		Graduation	Drop Out	Dismissal	1st Semester GPA	1st Year GPA	Final GPA
(III.1)	1 = Secondary School Mate(s) in Group	-0.027	0.009	0.015	-0.033	-0.039	-0.050
		(0.015)*	(0.012)	(0.009)*	(0.031)	(0.023)*	(0.021)**
	Other Student Characteristics	No	No	No	No	No	No
	R^2	0.04	0.03	0.04	0.07	0.05	0.05
	Observations	3,634	3,634	3,634	3,660	3,625	3,660
(III.2)	1 = Secondary School Mate(s) in Group	-0.025	0.009	0.014	-0.015	-0.026	-0.037
		(0.015)	(0.012)	(0.009)	(0.026)	(0.019)	(0.019)*
	Other Student Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
	R^2	0.07	0.04	0.07	0.31	0.30	0.23
	Observations	3,634	3,634	3,634	3,660	3,625	3,660

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

NOTES. This table analyzes the impact of the presence of secondary school mates in a student's first semester college class group in the Commercial Engineering and Engineering degrees at one of the leading Chilean universities. The assignment to these first semester college class groups is random, allowing to treat peer characteristics as exogenous. The data set has been constructed using the administrative data routinely gathered by the university from 2000 to 2012, and it includes all students who entered the Commercial Engineering and Engineering degrees at the university via ordinary admission process between 2000 and 2006. The impact of the presence of secondary school mates in the first semester college class group is evaluated on six academic performance measures, presented horizontally, in particular: (1) graduation likelihood, (2) drop out likelihood, (3) dismissal likelihood, (4) 1st semester GPA, (5) 1st year GPA and (6) final GPA. Two sets of specifications are presented stacked over each other, with the one above (III.1) including only the variable of interested and the one below (III.2) including other student characteristics as additional controls, namely: gender (1 = male), weighted admission score, mother's educational level, father's educational level, housing status (1 = student lives with both parents) and region (1 = Santiago Metropolitan Region). Both specifications include two sets of fixed effects: (i) admission year * first semester college class group * degree, (ii) number of same secondary school students admitted the same year to the same degree. The latter allows to increase precision by excluding secondary school fixed effects while still ensuring that the secondary school mate presence variable satisfies the exogeneity condition. Standard errors are clustered by admission year * first semester college class group * degree.

TABLE IV

IMPACT ON ACADEMIC PERFORMANCE OF AVERAGE WEIGHTED ADMISSION SCORE OF SECONDARY SCHOOL MATES IN FIRST SEMESTER COLLEGE CLASS GROUP

		(1)	(2)	(3)	(4)	(5)	(6)
		Graduation	Drop Out	Dismissal	1st Semester GPA	1st Year GPA	Final GPA
(IV.1)	Avg. Admission Score of Secondary School Mate(s) in Group (If Any)	0.000	-0.000	0.000	-0.003	-0.002	-0.002
		(0.001)	(0.000)	(0.000)	(0.001)**	(0.001)**	(0.001)*
	1 = Secondary School Mate(s) in Group	-0.210	0.314	-0.114	1.944	1.793	1.383
		(0.419)	(0.371)	(0.264)	(0.954)**	(0.781)**	(0.756)*
	Other Student Characteristics	No	No	No	No	No	No
	R^2	0.59	0.55	0.67	0.56	0.54	0.59
	Observations	3,634	3,634	3,634	3,660	3,625	3,660
(IV.2)	Avg. Admission Score of Secondary School Mate(s) in Group (If Any)	0.001	-0.001	-0.000	0.002	0.001	0.001
		(0.001)	(0.000)	(0.000)	(0.001)*	(0.001)	(0.001)
	1 = Secondary School Mate(s) in Group	-0.691	0.615	0.067	-1.460	-0.961	-0.853
		(0.402)*	(0.371)	(0.251)	(0.781)*	(0.592)	(0.559)
	Other Student Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
	R^2	0.61	0.56	0.67	0.68	0.68	0.68
	Observations	3,634	3,634	3,634	3,660	3,625	3,660

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

NOTES. This table analyzes the impact of the average weighted admission score of secondary school mates in a student's first semester college class group in the Commercial Engineering and Engineering degrees at one of the leading Chilean universities. The assignment to these first semester college class groups is random, allowing to treat peer characteristics as exogenous. The data set has been constructed using the administrative data routinely gathered by the university from 2000 to 2012, and it includes all students who entered the Commercial Engineering and Engineering degrees at the university via ordinary admission process between 2000 and 2006. The impact of the average weighted admission score of secondary school mates in the first semester college class group is evaluated on six academic performance measures, presented horizontally, in particular: (1) graduation likelihood, (2) drop out likelihood, (3) dismissal likelihood, (4) 1st semester GPA, (5) 1st year GPA and (6) final GPA. Two sets of specifications are presented stacked over each other, with the one above (IV.1) including only the variable of interested and the one below (IV.2) including other student characteristics as additional controls, namely: gender (1 = male), weighted admission score, mother's educational level, father's educational level, housing status (1 = student lives with both parents) and region (1 = Santiago Metropolitan Region). Both specifications include two sets of fixed effects: (i) admission year * first semester college class group * degree, (ii) admission year * secondary school * degree. Standard errors are clustered by admission year * first semester college class group * degree.

TABLE V

IMPACT ON ACADEMIC PERFORMANCE OF FIRST SEMESTER COLLEGE CLASS GROUP PEER CHARACTERISTICS

		(1)	(2)	(3)	(4)	(5)	(6)
		Graduation	Drop Out	Dismissal	1st Semester GPA	1st Year GPA	Final GPA
(V.1)	Avg. Admission Score of Other Students in Group	-0.003	0.001	0.002	-0.041	-0.026	-0.018
		(0.003)	(0.003)	(0.002)	(0.010)***	(0.008)***	(0.007)**
	Secondary School Concentration in Group (Herfindahl Index)	-1.255	-0.316	1.401	-9.774	-3.890	-7.973
		(1.156)	(1.156)	(0.796)*	(3.677)***	(3.003)	(2.329)***
	% Public School Students in Group	-0.297	0.074	0.218	-0.507	-0.570	-0.337
		(0.137)**	(0.146)	(0.084)**	(0.486)	(0.370)	(0.362)
	% Subsidized School Students in Group	-0.294	0.083	0.160	0.943	0.668	0.017
		(0.205)	(0.184)	(0.089)*	(0.484)*	(0.383)*	(0.341)
	Avg. Admission Score of Secondary School Mate(s) in Group (If Any)	0.000	-0.000	0.000	-0.002	-0.002	-0.001
		(0.000)	(0.000)	(0.000)	(0.001)	(0.001)**	(0.001)
	1 = Secondary School Mate(s) in Group	-0.320	0.355	-0.049	1.239	1.288	0.900
		(0.344)	(0.308)	(0.225)	(0.780)	(0.647)*	(0.624)
	Other Student Characteristics	No	No	No	No	No	No
	R^2	0.33	0.31	0.33	0.37	0.33	0.33
	Observations	2,677	2,677	2,677	2,690	2,671	2,690
(V.2)	Avg. Admission Score of Other Students in Group	0.002	-0.001	-0.000	-0.009	0.000	0.003
		(0.003)	(0.003)	(0.002)	(0.006)	(0.006)	(0.005)
	Secondary School Concentration in Group (Herfindahl Index)	-0.354	-0.843	1.026	-3.922	0.570	-3.972
		(1.232)	(1.220)	(0.791)	(2.440)	(2.211)	(1.834)**
	% Public School Students in Group	-0.274	0.058	0.211	-0.433	-0.501	-0.281
		(0.141)*	(0.152)	(0.078)***	(0.353)	(0.268)*	(0.273)
	% Subsidized School Students in Group	-0.341	0.117	0.173	0.634	0.393	-0.185
		(0.199)*	(0.184)	(0.086)**	(0.354)*	(0.288)	(0.266)
	Avg. Admission Score of Secondary School Mate(s) in Group (If Any)	0.001	-0.001	-0.000	0.002	0.001	0.001
		(0.000)**	(0.000)*	(0.000)	(0.001)**	(0.001)**	(0.001)**
	1 = Secondary School Mate(s) in Group	-0.720	0.593	0.113	-1.625	-1.061	-1.008
		(0.325)**	(0.306)*	(0.213)	(0.638)**	(0.499)**	(0.473)**
	Other Student Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
	R^2	0.35	0.32	0.34	0.54	0.53	0.47
	Observations	2,677	2,677	2,677	2,690	2,671	2,690

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

NOTES. This table analyzes the impact of first semester college class group peer characteristics on students in the Commercial Engineering and Engineering degrees at one of the leading Chilean universities. The assignment to these first semester college class groups is random, allowing to treat peer characteristics as exogenous. The data set has been constructed using the administrative data routinely gathered by the university from 2000 to 2012, and it includes all students who entered the Commercial Engineering and Engineering degrees at the university via ordinary admission process between 2000 and 2006. Four peer characteristics are studied: (a) average weighted admission score of other students in group, (b) secondary school concentration in the class group, measured as the sum of the square of the percentage of students from each secondary school in the class group, (c) percentage of public secondary school students in the class group, and (d) percentage of subsidized secondary school students in the classroom. The impact of these variables is evaluated on six academic performance measures, presented horizontally, in particular: (1) graduation likelihood, (2) drop out likelihood, (3) dismissal likelihood, (4) 1st semester GPA, (5) 1st year GPA and (6) final GPA. Two sets of specifications are presented stacked over each other, with the one above including only the variable of interested and the one below including other student characteristics as additional controls, namely: gender (1 = male), weighted admission score, mother's educational level, father's educational level, housing status (1 = student lives with both parents) and region (1 = Santiago Metropolitan Region). Both specifications include admission year * secondary school * degree fixed effects. Standard errors are clustered by admission year * first semester college class group * degree.

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