

The Effect of Social Networks on Students' Academic and Non-Cognitive Behavioral Outcomes:  
Evidence from Conditional Random Assignment of Friends in School\*

May 2015

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**Abstract**

In this paper, we estimate the influence of social networks on students' educational attainment in school. Specifically, we investigate the impacts and mechanisms of separating from pre-existing social relationships during the transition from elementary to middle school on students' academic progress. We define several types of friendships—identified by the students themselves in elementary school, as part of a unique aspect of the Tel Aviv school choice application process which allows sixth-grade students to designate their middle schools of choice and to list up to eight friends with whom they wish to attend that school. Our identification strategy is based on a conditional random assignment model: in Tel Aviv middle schools students are randomly assigned to classes within a given school. Therefore, conditional on the number of friends a student has at her school, the number of friends she attends class with should be random. Our results suggest that the number of friends ('quantity') and their socioeconomic background ('quality') have positive effects on educational outcomes of students, depending on the type of the relationship (reciprocal versus non-reciprocal), in the short term (on middle school national exam test scores) and in the long term (end of high school high stakes matriculation exams). We also find that the length of acquaintance does not factor in to the treatment effect of friendships. We find that these characteristics of students' social networks affect non-cognitive outcomes as well, suggesting that these educational gains might be partly mediated through greater cooperation, reduction in violent behavior and improvements in social satisfaction in class.

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\* We thank the Education Department of the Tel Aviv-Yafo Municipality and Yossef Shub, the CEO of Optimal Scheduling Systems, for making available the data for this study. Agnia Galesnik and Elior Cohen provided excellent research assistance. We also benefited from comments from Gigi Foster, Michael Friedman, James Heckman, Analia Schlosser, Tali Regev, Yona Rubinstein, Fabian Waldinger, four anonymous referees, and from participants in seminars at the Hebrew University, Higher School of Economics in Moscow, Tel Aviv University, University of Warwick, University of Haifa, Ben-Gurion University, Bank of Israel, at a conference in the Chinese University of Hong Kong, and at the Economic Workshop in IDC.

## I. Introduction

There are many educational programs and practices that separate students from their social network in school or class, from usual transitions of students between primary and middle/high school to more deliberate policies with different educational objectives. For example, school busing programs and policies that enhance school choice in order to increase school productivity (by introducing competition among schools) often detach students from their childhood social network.<sup>1</sup> Other policies that often lead to students being separated from their friends include educational reforms that redesign school zones or catchment areas<sup>2</sup>, closure of failing schools in high accountability settings<sup>3</sup>, the practice of reshuffling students among classes in every grade<sup>4</sup>, programs which expand student access to high-performing schools<sup>5</sup>, or reassigning students when they advance to a higher grade in school. Social and welfare programs, such as the US's Moving to Opportunity, also detach, though voluntarily, children from their childhood social environment.<sup>6</sup> The consequences of such social detachment are usually not taken into account in policy making circles<sup>7</sup>, even though it is well documented in social science literature that students' social networks are important for their academic performances and overall development.<sup>8</sup>

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<sup>1</sup> Many countries have pursued this type of policy—for example, the US (Cullen et al. 2005), (Angrist et al. 2013); UK (Gorad 2001); New Zealand (Fiske and Ladd 2001); and Colombia (Angrist et al. 2002).

<sup>2</sup> For example, the Wake County school district has moved up to 5 percent of the school population in any given year during the 1990s in order to balance schools' racial and income composition (Hoxby and Weingarth 2005).

<sup>3</sup> For example, a 2011 education bill in the UK allows the government to order closure of failing schools [<http://www.theguardian.com/education/2011/jan/27/education-bill-abolishes-four-quangos>].

<sup>4</sup> Classroom shuffles every September are common in many countries, including in the US in many school districts. [<http://www.nbcsandiego.com/news/local/Parents-Protest-Teacher-Shuffling-Combined-Classrooms-in-SDUSD-277828971.html>].

<sup>5</sup> For example, the METCO voluntary desegregation program that allows students from Boston public primary schools to attend public schools in other communities that have agreed to participate.

<sup>6</sup> For an analysis of the MTO Experiment, see Katz et al. (2001), Kling et al. (2007), and Kling et al. (2005).

<sup>7</sup> The recently approved Boston Public School's proposal to reallocate facilities in an effort to expand access to high performing schools has faced strong opposition from parents of children who under the new plan will be detached from their childhood environment [<http://www.change.org/petitions/mayor-thomas-menino-stop-bps-superintendent-johnson-s-plan-to-uproot-mission-hill-school-k-8-2>].

<sup>8</sup> In the next section we discuss the sociology literature on social capital and educational outcomes. In addition, the psychology literature also emphasizes the effect of children's peer relationships on multiple aspects of their emotional and cognitive development. It provides evidence linking children's social acceptance to self-perception which also motivates them to pursue academic goals and improve their educational outcomes. This literature also stresses the important role of friendships in the adjustment process of students during school transitions and even suggests that there are long run implications of adjustment difficulties in middle school to later educational attainments (Wentzel 1998, Wentzel et al. 2004, Nelson and Debacker 2008).

In this paper we investigate the influence of social networks on educational attainment of children in school. Our unique contribution is the analysis of the impact of students' social networks in class, both in the short and in the long run, while carefully addressing the identification and the causal nature of the relationship. We are able to examine several possible mechanisms through which social network affect students' educational outcomes, such as the 'quantity' and the 'quality' of friends in the network, where the 'quality' of friends is measured by the nature of reciprocity of friendships and by the mean socioeconomic background of each type of friends. Another mechanism that we examine is the non-cognitive aspects of memberships in a social network assessed by survey questionnaires on students' behavioral outcomes.

We base our analysis on a school choice program that started in Tel Aviv in 1994, which allowed students who completed primary school to choose their middle school.<sup>9</sup> The application process of this program allowed sixth-grade students to designate their middle schools of choice and to list up to eight friends with whom they wish to attend that school. The lists create natural "friendship hierarchies", identified by the students themselves, that we exploit in our analysis. We designate four categories of social networks of friends that stem from these lists as follows: reciprocal friends (students who list one another), followers (those who were listed by fellow students but did not reciprocate by including the same students on their own lists), rejecters (those who listed fellow students as friends but were not listed as friends by these same fellow students) and second circle of reciprocal friends (reciprocal friends of the student's reciprocal friends, excluding the first circle of reciprocal friends). We also measure, for each friendship type, the length of acquaintance among friends, being together in kindergarten or meeting later in primary school.

Using these data, we examine the consequences of the school transition on the size of a student's pre-existing (from elementary school) social network according to the different types of relationships defined. Then we estimate the effect of the students' new social networks in class after their assignments in middle schools on their educational outcomes in the short run (8<sup>th</sup> grade external exams) as well as in the long run (high stakes matriculation exams at the end of high school). This setting enables us to

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<sup>9</sup> See Lavy (2010) for a further analysis of the overall effect of the Tel Aviv choice program on student achievements and behavioral outcomes.

analyze several possible mechanisms through which these effects are mediated. We test the impact of both the ‘quantity’ and ‘quality’ of friends—where friends’ ‘quality’ is measured by the nature of reciprocity of friendships and by the mean socioeconomic background of each type of friend—on educational outcomes. We also examine as a mechanism the sensitivity of the effect of each type of friendship to the length of acquaintance among friends. In addition, since according to the social capital literature, these features of social networks are said to be correlated with the degree of social capital within networks, we test whether these features of social networks indeed have an effect on several non-cognitive outcomes, such as cooperation, violent behavior and social satisfaction in class.

Our identification strategy is a conditional random assignment model: in Tel Aviv middle schools, students are randomly assigned to classes within a given school; therefore, conditional on the school and on the number of friends a student has at her/his school, the number of friends she/he attends class with should be random. Since we estimate the impact of friends by type in class, we control for the number of friends by type in school; the school (and in a variation, the class) fixed effect enables us to eliminate all school (class)-level unobservables and compare the impact of friends in class among students who attend the same class, and have the same number of friends in school. To support our identification assumption, we also provide evidence for the practice of random assignment of students to classes within schools, and show balancing tests which demonstrate that, conditional on the school and on the number of friends in school, student’s background characteristics are not correlated with the number of friends in class.

Our results highlight the importance of students’ social networks in class to their educational outcomes in middle school, and its prolonged effect until the end of high school. Simulating how students’ academic success would have changed if the transition to middle school would not entail changing their social network in class, we find a large overall positive increase in academic achievements, as test scores in math, English and Hebrew would rise by about 0.12 standard deviations. This effect persists until the end of high school, leading to gains in several matriculation outcomes, such as the average matriculation scores in the three subjects above, the total number of credit units in matriculation certificates, and the probability of receiving a matriculation certificate.

Furthermore, we are able to test how these educational gains depend on two dimensions of ‘quality’ of friends. The first dimension of friendships’ ‘quality’ suggests that relationships which are of reciprocal nature have the highest positive impact on educational performances. The presence of reciprocal friends in class has a large positive effect on middle school test scores—adding one reciprocal friend in class raises the student's average test scores by 0.098 standard deviation of the test scores distribution. The impacts of non-reciprocal relationships are lower and depend on the asymmetry of the relation—while the presence of a follower has a positive effect on test scores, the effect of rejecters is negative. The impact of indirect links, as measured by the second circle of reciprocal friends, is small and not significantly different from zero. We also test the effect of length of acquaintance, by comparing the effect of friends from kindergarten to those of friends who meet in later years, which reveals that the length of acquaintance does not affect the treatment effect of each type of friendship.

The effect of the second dimension of ‘quality’, which is measured by the mean socioeconomic background of friends, allows us to distinguish between the effects of ‘quality’ versus ‘quantity’ of friends. We find that both of these effects are important for students’ achievements. Moreover, the mean socioeconomic background of friends has a positive effect on students' educational outcomes, though this effect is significantly different from zero only in the case of reciprocal friends. In addition, we find that the effects of both ‘quality’ and ‘quantity’ of friends have interesting patterns of heterogeneity by gender, parental education and age of students.

The effects of these different aspects of social networks may indicate, as suggested in the social capital literature, that trust and cooperation among members of the social networks are important, and facilitate the effects on educational outcomes. We are able to test this channel by observing the impacts of these features of social networks on several non-cognitive outcomes. We show that classes that are characterized by more reciprocal friends (especially if these relations are supported, meaning that reciprocal friends have a mutual reciprocal friend<sup>10</sup>) are also characterized by more cooperative behavior of students toward each other in class. In addition, we find that having more reciprocal friends and followers lowers violent behavior and improves social satisfaction in class.

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<sup>10</sup> See Jackson et al. (2012) for a theoretical and empirical discussion of the concept of ‘supported’ friendship.

From a policy perspective, our research highlights the possible negative consequences for educational and behavioral outcomes of detaching students from their social environment. The literature on housing mobility or school choice based on randomized vouchers programs has shown mixed results, perhaps because their overall effect may reflect detachment of students from their childhood social environment. While some school choice programs have been shown to have positive effects on test scores, mainly of students from low socioeconomic backgrounds, housing mobility programs, such as Moving to Opportunity in the US, had no significant impacts on standardized test scores.<sup>11</sup> Some have argued, for example Blume et al. (2011), that these programs might have disrupted participants' social ties and as a result have harmed their educational achievements, offsetting to some extent the potential gain from exposure to better schools and communities.<sup>12</sup> In this paper, we are able to isolate the effect of social relationship detachment on student educational outcomes from other environmental changes and highlight the importance of maintaining one's social network throughout middle/high school. The policy implications are that taking students' social networks into account can create a better assignment of students between and within schools in general, and improve the design of these social and welfare programs in particular.<sup>13</sup>

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<sup>11</sup> See, for example, reports of the US Department of Education on “The Evaluation of Charter School Impact” (2010) and of the US Department of Housing and Urban Development on “Moving to Opportunity for Fair Housing Demonstration Program—Final Impact Evaluation” (2011).

<sup>12</sup> Testing the degree of social isolation as one of the possible outcomes of housing vouchers programs, by comparing the amount of social interactions of lottery winners to losers, suggests mixed evidence: while Katz et al. (2001) report a similar number of social visits (of friends and family members) for both groups, and Kling et al. (2006) finds that job-related social networks improved labor market outcome of lottery winners by a small amount according to the MTO program, other papers have found negative effects of MTO and other programs (e.g., the Gautreaux program and HOPE VI program) on the social relations of lottery winners. Turney et al. (2006) found that transportation difficulties and disrupted social networks were barriers to employment in the treatment group. Other papers have reported that lottery winners have fewer close relationships (Kissane and Campet-Lundquist (2012)), fewer neighborhood social ties (Greenbaum et al. (2008)) and reported experiencing lower emotional support in general (Curley (2009)). An additional recent paper, which address a similar housing voucher program in India (Barnhardt, Field and Pande (2014)), finds that lottery winners reported facing increased isolation from family and caste networks and lower access to informal insurance. Low level of social integration of lottery winners in schools was also suggested as affecting school vouchers' programs (Blume et al. 2011, DeLuca and Dayton 2009). For example, Angrist and Lang (2004) show that there is little evidence of socially or statistically significant effects of lottery-winning students on their classmates.

<sup>13</sup> The optimal design of school choice programs is the focus of much recent research. For example, in a recent series of studies, Abdulkadiro et al. (2003), (2005), (2011) and Pathak and Sönmez (2013), analyze the optimal design of admission rules in school choice programs where students take into account strategic considerations when submitting their preferences for schools.

The rest of the paper is organized as follows. Section II surveys the literature. In Section III, we present our data. Section IV explains the identification and estimation methodologies. We detail our results in Section V and offer conclusions and policy implications in Section VI.

## **II. Relevant Literature**

This paper is related to a growing body of research on the role of social capital in shaping economic outcomes. Social capital can be generally described as circumstances in which individuals can use membership in groups and networks to secure benefits.<sup>14</sup> The extent to which an individual has access to resources through social networks is said to depend on the person's number of connections, the strength of those connections, and the resources available to their connections (Sobel 2002). Recent empirical evidence suggests that certain characteristics of a network are correlated with higher degree of trust and cooperation, with more informal favor transactions, and higher degree of risk sharing among network members. Risk sharing models and related empirical evidence suggest that the number of direct links (the number of members with whom the individual interact directly); the quality of these links (whether these relationships are interpersonal such as close friends and relatives groups); the amount of endowments embodied in the network; and the degree of correlation between incomes of members in the network, are all associated with more access to credit, better risk sharing and higher amount of network's informal favor transactions (Attanasio et al. (2012), Fafchamps and Lund (2003), De Weerd and Dercon (2006), and Fafchamps and Gubert (2007)). Other papers that are based on strategic network formation models, have additionally presented evidence that the number of indirect links between members and the degree of closure among direct links foster social pressure that helps sustain favor

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<sup>14</sup> The concept of social capital is relatively new in social sciences, and was only developed formally in the sociology literature about three decades ago. Bourdieu (1986) defined social capital as "an attribute of an individual in a social context. One can acquire social capital through purposeful actions and can transform social capital into conventional economic gains. The ability to do so, however, depends on the nature of the social obligations, connections, and networks available to you." Putnam (1993) defines it as "features of social organization, such as networks, norms and social trust that facilitate coordination and cooperation". Lin (1999) goes even further and states that "similarly to other form of capital, social capital can be referred to as investment in social relations with expected returns". Despite these differences, a consensus is emerging that "social capital stands for the ability of actors to secure benefits by virtue of membership in social networks or other social structures" (Portes 1998).

exchange between group members (Karlan et al. (2009), Ambrus et al. (2014), Jackson et al. (2012), and Allcott et al. (2007), Krishnan and Sciubba (2009)).<sup>15</sup>

Coleman (1988) introduced the link between social capital and human capital, suggesting that students' social capital is embodied in peer relationships, relations between the parents, parents' relations with community institutions, and the degree of closure of these social structures. He argued that strong relations improve students' educational attainments in school by reinforcing the trustworthiness and cooperation within the network, and by facilitating the imposition of effective norms by the parents. In support of his premise, Coleman first showed that there is a significant correlation between students' dropout rates and the number of times students changed school because the family moved, which he used as a proxy for students' social capital. In addition, Coleman finds further support for his premise, by showing that religious schools have lower dropout rates relative to public schools, and arguing that it is caused by higher provision of intergenerational closure (i.e., connections between the parents of students) by religious communities.<sup>16</sup>

Our paper is also related to the literature on peer effects in education, which highlights the important role of students' peers' 'quality', often measured by their characteristics or/and schooling outcomes. Recent studies estimated the effect of 'quality' friends, where friendships are identified by the students themselves.<sup>17</sup> Bramoullé et al. (2009) and Lin (2010) show that both friends' mean school grades and friends' mean characteristics have significant effects on a student's educational attainments,

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<sup>15</sup> Macro studies have shown significant correlations between social capital, measured by the degree of social trust, and several economic outcomes, such as government quality (Putnam 1993), judicial efficiency (LaPorta et al. 1997), financial development (Guiso et al. 2004), private investment (Bohnet, Herrman, and Zeckhauser 2008) and economic growth (Knack and Keefer 1997).

<sup>16</sup> Morgen and Sorensen (1999) tested Colman's intergenerational closure in religious schools premise, by analyzing parents' survey questionnaires from the National Education Longitude Study (NELS 1988). They conclude that the degree of intergenerational closure cannot explain the educational gap between Catholic and public schools, even though they find that within Catholic schools, parental connections are positively correlated with students' educational value added. See also Hallinan and Kubitschek (1999) and Carbonaro (1999).

<sup>17</sup> These papers address the reflection problem raised by Manski (1993), i.e., the difficulty of separating the endogenous effects (the influence of peer outcomes) from the exogenous/contextual effects (the influence of peer characteristics) in the context of a linear-in-means model. Bramoullé et al. (2009) develop the empirical conditions for identifying both endogenous and contextual social effect under full knowledge of the social structures. A paper by Blume et al. (forthcoming) integrates the theoretical, econometric, and empirical sides of the social interactions literature through a systematic investigation of linear social interaction models. In addition, they present alternative conditions to those introduced in Bramoullé et al. (2009), which enables the identification of both endogenous and contextual social effect under partial knowledge of the social structure, and present the conditions for identification of endogenous network formation as well.



using the Add Health data. Using the same data and empirical identification strategy, Patacchini et al. (2011) present evidence regarding the persistency of these effects ten years after the friendships' nomination took place. Lam (2014) addresses the peer selection problem based on unique data from a survey he conducted in Chinese schools and estimates the impact of several peer-attributes (cognitive ability, personal traits and behavioral traits) on student's cognitive outcomes. He distinguishes between friends, study mates, emotional supporters, and seatmates, and finds that both the mean cognitive abilities and the mean personal traits of peers (of all types except seatmates) have significant effect on students' achievements. Calvo-Armengol et al. (2009) show in a theoretical model that when agents choose their peer effort simultaneously and their payoffs are complementary, the game has a unique Nash equilibrium where each agent's strategy is proportional to his/her Katz-Bonacich centrality measure. Developing the condition for the model's identification, they are able to test its prediction regarding the dependency of students' educational outcomes on their position in the network empirically using the Add Health data.

Our paper contributes to the social capital and peer effect literatures in four dimensions. First, it provides estimates of the impact of the 'quantity' of friendships (number of friends) on students' educational outcomes, while carefully addressing the causal nature of the relation. Second, it estimates the respective effect of 'quality' of friendships based on two different aspects of relationship quality: friends by friendship type based on the relationship reciprocity and the average socioeconomic background of friends by type. Third, using a unique dataset on non-cognitive outcomes, it measures the effects of these social networks' characteristics on several behavioral outcomes, which proxy the impact of trust and cooperation within social networks. Fourth, our finding regarding the negative consequences of detaching students from their childhood social environment allows better understanding of puzzling evidence of small or no effect of school choice or housing programs for the poor on educational outcomes of children. Clearly, taking these consequences into account can improve the design of these and related social and welfare programs.

### III. Data

#### A. Data Sets

In this paper we use a unique database of friendship networks of students that participated in the Tel Aviv school choice program in 2000–2003. A new school choice program started in Tel Aviv in September 1994. It replaced a busing integration program that assigned some students to schools in the city, but out of their school district. The choice program allowed students who completed primary school a choice of a middle school. Each student could choose from a set of five schools, three of which were outside his/her school district. The school choice program opened the possibility for a better match between students and schools, and the system had the potential to increase school productivity by introducing competition among schools.

Within this framework, each student, at the end of sixth grade, was asked to rank their preferred five middle schools, and to list up to eight peers with whom they would like to be assigned with in middle school. In case of excess demand for enrollment in one school, students were assigned with one or more of their nominated friends to a subsequent school, so as to maintain a balanced enrollment across schools based on socioeconomic level, educational achievement, gender, and disciplinary record.<sup>18</sup> On average, 93 percent of the students received their first school choice and most of the remaining 7 percent received their second choice.

The empirical analysis presented in this paper is based on the Tel Aviv municipality's administrative records of sixth-grade students in schools that participated in the Tel Aviv school choice program, for the years 2000, 2002, and 2003. The cohort of 2001 is not included in this study because the essential data on school choice and friendships are not available.<sup>19</sup> In addition, Tel Aviv municipality's administrative records also include the assignment of these students in kindergarten for the years 1994, 1996, and 1997. Each record contains an individual identifier, a kindergarten identifier,

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<sup>18</sup> Because the system guaranteed that each student would attend school with at least one of his or her nominated friends (if the student nominated eight friends), a strategy that guaranteed getting the first chosen school was to form a group of friends that all chose the same school as first choice but each chose different schools as their other choices. This strategy will work perfectly for all group members if there are only four or five students in the group but it might be less than perfect for some members of the group when the group size is increased beyond five because there are only 13 relevant secondary schools.

<sup>19</sup> We obtained the data from the School Authority of Tel Aviv and the files for the 2001 cohorts were erased from their archive by mistake.

a school and class identifier in the sixth grade and student preferences for middle school enrollment and friend assignments.

In order to test the effect of students' separation from pre-existing social networks during the transition from elementary to middle school on their behavioral and education outcomes in middle school and high school, we combine this dataset with data from two additional sources:

1) The first is GEMS records (Growth and Effectiveness Measures for Schools - *Meitzav* in Hebrew) for the three cohorts that we study. The GEMS is collected by the Division of Evaluation and Measurement of the Ministry of Education.<sup>20</sup> The GEMS is administered at the midterm of each school year to a representative 1-in-2 sample of all elementary and middle schools in Israel, so that each school participates in GEMS once every two years. This dataset includes test scores of eighth graders from a series of tests (in math, Hebrew and English), which were transformed into z-scores for each year and for each subject to facilitate interpretation of the results, as well as responses of seventh- through eighth-grade students to a questionnaire. The proportion of students tested is above 90 percent, and the rate of questionnaire completion is roughly 91 percent. The GEMS questionnaire records include seventh and eighth graders' responses addressing various aspects of the school and learning environment. We select a section that focuses on student social behavior and satisfaction from school environment. In this section, students are asked to rate in a 6-point scale—ranging from 1 (strongly disagree) to 6 (strongly agree)—the extent to which they agree with a series of statements. We also examine a set of items in the questionnaire where students report the amount of time allocated to homework in math, Hebrew, English, and science and technology. Each record contains, additionally, the student's class identifier, school identifier, and demographic information (gender, ethnicity, number of siblings and level of parental education).

2) The second is high school matriculation test scores and credit units from the Israel Ministry of Education<sup>21</sup> for the three cohorts that we study. Matriculation exams are a series of national exams in core and elective subjects taken by the students between tenth and twelfth grade. Students choose to be

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<sup>20</sup> The GEMS is not administered for school accountability purposes, and only aggregated results at the district level are published. For more information on the GEMS, see the Division of Evaluation and Measurement website (in Hebrew): <http://cms.education.gov.il/educationcms/units/rama/odotrama/odot.htm>.

<sup>21</sup> The matriculation test scores are available at the Ministry of Education lab.

tested at various levels of proficiency, with each test awarding from one to five credit units per subject, depending on difficulty. Some subjects are mandatory, and, for many, the most basic level is three credit units. Advanced level subjects are those subjects taken at four or five credit units. A minimum of 20 credit units is required to qualify for a matriculation certificate, which is a prerequisite for university admission. The average scores in the matriculation certificate, which are calculated by the higher education Council, are weighted based on the number of credit units taken (advanced level subjects are also given bonuses: four credit units are awarded a bonus of 12.5 points, and five credit units 25 points). All schools in the sample are schools with an academic track leading to a matriculation certificate. We focus on the following matriculation outcomes that are available for all the years: test scores in math, English and Hebrew which were transformed into z-scores for each year and for each subject<sup>22</sup>, matriculation status (=1 if awarded with the matriculation diploma and 0 otherwise) and total number of credit units in the matriculation certificate. The final merged panel dataset consists of data for three cohorts of students: 1994–2006, 1996–2008 and 1997–2009. The dataset includes students' social networks in the sixth-grade, their placement in kindergarten and in eighth grade, eighth-grade student GEMS test scores, seventh-grade and eighth-grade student GEMS questionnaires, high school matriculation exams and student characteristics.

Table 1 presents descriptive statistics, for the sample size, number of schools, and number of classes for the Panel data set. We use data for the three sixth grade cohorts: 2000, 2002 and 2003. The school choice program included 47 secular primary schools and 13 secular middle schools.<sup>23</sup> Nearly every primary-school student (about 97 percent) in those schools took part in the program and listed at least one of the two preferences—the preferred schools or peers.<sup>24</sup> The sample included 1037 students

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<sup>22</sup> These three subjects are compulsory: the number of credits units required in Hebrew is two credit units, and in math and English students have to choose between the most basic level (three credit units) and the advanced level (four or five credit units). Additionally, students got zero values in matriculation exams scores if they did not take the exam, but did take exams in other subjects (in about 10 percent of cases).

<sup>23</sup> The middle schools included in the sample are only those that participated in the GEMS testing in the given year. We note that these schools are both middle schools and high schools, and that most students stay in the same school from 7<sup>th</sup> grade to 12<sup>th</sup> grade (above 80 percent of the students).

<sup>24</sup> If a student listed his or her preferred school but not his or her preferred peers (about 6 percent of the students), we assume that he did not have friends with whom he or she wanted to be with in middle school.

from the 2000 cohort, 960 from the 2002 cohort, and 1012 in the 2003 cohort. The table indicates that the cohorts are similar across a host of variables: parental education, average family size, and ethnicity.

## **B. Definition and measurement of friendship types**

We are able to distinguish in this study between different types of social networks, such as reciprocal friendships versus non-reciprocal. In particular, our database allows us to map students' social networks in elementary schools and in middle schools (according to their sixth grade social networks and after their new school and class assignments).<sup>25</sup> By using the students' friendship nominations we are able to define four different types of students' social networks: (1) reciprocal friends—the nominated friends who reciprocated with friendship nominations; (2) followers—students nominated by individual *i* but who did not reciprocate with friendship nominations of student *i*; (3) rejecters—students who nominated individual *i* but were not reciprocally nominated as friends by *i* and (4) second circle of reciprocal friends—which includes the reciprocal friends of the reciprocal friends of individual *i* (excluding the first circle of reciprocal friends of individual *i*).

Table 2 lists the descriptive statistics of these social networks at the classroom level (columns 1-3) and at the school level (columns 4-6). The table indicates that on average, students have more reciprocal friends than either followers or rejecters across almost all groups. For example, the number of reciprocal friends in class is 3.07 in 6<sup>th</sup> grade while the number of followers is 2.44 and the number of rejecters is 2.41. The range of followers is nevertheless wider (from zero to 13 in class in the sixth grade) than the range of reciprocal friends and rejecters, since students were allowed to list just up to eight peers. The second circle of reciprocal friends in class includes on average more students (3.65 students in class in the sixth grade) than any other form of first circle friendships, and has also the widest range, from zero to 18 students.

Note that since we measure the students' social networks in the 6<sup>th</sup> grade, the table indicates that all types of friendships decline between sixth and eighth grade during the transition from elementary to middle school. For example, the number of reciprocal friends in school drops from 3.46 to 2.7 in the

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<sup>25</sup> It should be noted that our definition of friendships (based on students' nominations of friends with whom they wish to attend school) differs from the one usually used in the literature, which relies mainly on more direct questionnaires regarding students' social networks.

eighth grade and a sharper decline is observed in the count of various friends at the class level. The decline in the number of friends at the school level is due to the fact that the city authority tried to meet students' school preferences, rather than assigning them to school based on friendships' requests. This decline is even sharper at the class level (from 3.07 to 1.48) since classes were formed randomly. We will rely on this significant variation in number of friendships by types in class, which is random once we control for the number of friendships by type in school, when we estimate the impact of the number of friends by type on students test scores.<sup>26</sup>

We also present in Table A1 a comparison of social networks by subgroups. For example, the table indicates that girls have larger social networks of all kinds, except for second circle of reciprocal friends, than boys. Younger students have fewer friends by type, except for rejecters, than students who are in the same grade but older. Students of highly educated parents have more friends from all types than students of low-skilled parents. These patterns are consistent at the class level as well as at the school level.

#### **IV. Identification and Estimation**

The main goal of this paper is to estimate the effects of social networks on students' academic progress in middle school and in high school, while examining several possible mechanisms through which these effects are mediated. Our main identification strategy relies on the conditional random assignments of students and teachers in classes within a school.

The randomness of class composition results from the fact that students' assignments into class based on ability, family background or any other characteristics of the students are forbidden by law in Israel and this law is strictly enforced.<sup>27</sup> In order to explicitly test for the randomness of class composition in our sample, we performed a series of Pearson Chi-Square tests ( $\chi^2$ ) that check whether

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<sup>26</sup> We note that middle schools' curriculum in Israel does not include any elective courses and therefore students are with the same classroom peers at all courses.

<sup>27</sup> Numerous publications of the Director General's Circulars at the Ministry of Education note that a specific committee at the Ministry is responsible for the implementation of the integration policy. This committee monitors periodically the integration process between and within schools. (see for example the Director General's Circular publication regarding the integration policy of Ethiopian students: [http://cms.education.gov.il/EducationCMS/applications/mankal/arc/sd9ak3\\_7\\_47.htm](http://cms.education.gov.il/EducationCMS/applications/mankal/arc/sd9ak3_7_47.htm)). See also the Bank of Israel Report No. 2014.07 which examined whether the allocation of students to classes by socio-demographic characteristics was random during the years 2001-2010 and found very little segregation within schools in Israel.

the student's characteristics and the class the student are assigned to, are statistically independent. Based on 13 middle schools (with two or more classes) and nine characteristics (gender, several ethnicity groups, number of siblings, and level of parents' education), 12 p values were equal or lower than 5 percent out of 117 p values. Therefore, in 10 percent of the cases, we cannot reject that there is non-random assignment. In addition only in one of 13 middle schools, up to three p values were equal or lower than 5 percent. Overall, we conclude that there is no evidence of systematic formation of classrooms with respect to students' characteristics. Similar evidence is presented in Lavy (forthcoming) who shows that there is no evidence of systematic non-random formation of classrooms in all primary and middle schools in Israel. We also note that the process of assigning students to classes within school is done independently of their assignment to school which is based on peers' and schools' preferences and is administered by the Tel Aviv municipality. The assignment of students to classes within school is managed by school administrators who do not receive students' peers' preferences.

Since students are randomly assigned to classes within schools, then conditional on school and on the number of friends a student has at her school, the number of friends she attends class with should be random. This motivates the following estimation strategy:

$$y_{icjt} = \alpha + \beta_s + \delta_j + \gamma_t + \sum_n \beta_n FC_{nicjt} + \sum_n \mu_n FS_{nicjt} + u_c + \varepsilon_{icjt}$$

where  $y_{icjt}$  denotes the outcome of student  $i$ , from class  $c$ , subject  $j$  and year  $t$ ;  $\beta_s$  is the class/school fixed effects;  $\delta_j$  is the subject fixed effect;  $\gamma_t$  is the year fixed effect;  $X_{icjt}$  are student characteristics;  $\sum_n FC_{nicjt}$  are the size of the social network of type  $n$  in class, where the types are: first and second circles of reciprocal friends, followers and non-reciprocal friends; and  $\sum_n FS_{nicjt}$  are the number of friends of type  $n$  in school. The error term in the equation includes a class-specific random element,  $\varepsilon_{icjt}$ , that allows for any type of correlation within observations of the same school across classes and an individual random element  $u_c$ . The coefficients of interest are  $\beta_n$ , which capture the effects of the different types of friendships in class.

For the purpose of comparison, we will first present estimates based on a regression specification that includes only year and subject dummies as controls, and then we will present estimates

that include additionally a school fixed effect and number of friends by type in school. With students randomly assigned to classes within schools, any additional controls should not affect the Plim of the estimate of  $\beta$ . However, we also estimate a model that includes a class fixed effect  $\beta_c$  instead of a school fixed effect and also student characteristics,  $X_{icjt}$  (including the mother's and father's years of schooling, number of siblings, immigration status, and ethnic origin). We note that the sensitivity of the treatment estimates to these additional controls will provide indirect evidence about whether the size of the different types of social networks is correlated with a student's predetermined characteristics, which we will also test directly by running standard balancing test regressions as done in a randomized experiment.

## **V. Results: Effect and Mechanisms of Number of Friends by Types on Academic Outcomes**

### **A. Main Results**

In this section, we present evidence regarding the effect of number of friends in class by type of friendship on educational outcomes. First, we show the impact of the size of friendship networks in middle school class on 8<sup>th</sup> grade GEMS test scores in math, Hebrew and English. Secondly, we estimate its impact on longer term educational outcomes in the end of high school, in particular test scores in matriculation exams in these three subjects, obtaining a matriculation diploma and total number of credit units in matriculation exams.

#### ***Short Term Effect on Academic Outcomes***

Table 3 reports the estimated effect of friendship networks, measured by number of friends by type of friendship in class, on pupils' GEMS test scores. The GEMS test scores in all three subjects (math, English, and Hebrew) are stacked together. We report results for four different specifications: the first is a simple OLS regression with subject and year fixed effects; the second is based on the conditional random assignment model and it includes as controls middle school fixed effects and the number of friends by type in school; the third specification includes middle school class fixed effects instead of middle school fixed effects and the fourth specification includes pupil characteristics as well. Each estimate presented in the first four columns comes from a separate regression. We estimate the impact of reciprocal friends (column 1), followers (column 2), rejecters (column 3), and second circle of



reciprocal friends (column 4) on 8<sup>th</sup> grade academic outcomes. The next four columns (columns 5-8) show the estimated coefficients from one joint regression that includes the number of reciprocal friends, followers, rejecters, and second circle of reciprocal friends in class together.

The simple OLS estimates in columns 1–4 are significant for the four types of friendships, indicating that reciprocal friends (in the first and second circles) and followers have a positive effect on pupil academic performance and rejecters have the opposite (negative) effect. The treatment estimates of most types of friends decline in the conditional random assignment specification. The estimate for reciprocal friends declines marginally while the estimate for followers drops by half but remains statistically significant. The estimates for rejecters and second circle of reciprocal friends, in contrast, become not significantly different from zero. We note, however, that these estimates are robust to adding students' characteristics and including class fixed effects instead of school fixed effects to the regression. The positive estimates of reciprocal friends and followers remain almost identical, while the estimates of rejecters and second circle of reciprocal friends are still not significantly different from zero. The fact that the estimates remain stable when adding pupil's characteristic implies that the number of friends by type is not correlated with student's observed characteristics, once we control for the number of friends by type in school and class unobserved characteristics.

In columns 5–8 of Table 3, we report estimates from regressions that include all four types of friends jointly in the regression. The table indicates that the estimates for the four types of friendships in columns 5–8 are only marginally lower than the respective estimates in columns 1-4, despite some degree of collinearity between the four friendship types. These estimates follows a similar pattern to the estimates in columns 1–4, when adding the number of friends by type in school and school/class fixed effect and are also robust to pupil's characteristic. The estimate of reciprocal friends declines marginally to 0.098 (se= 0.013) and the estimate of followers drops to 0.035 (se= 0.018). The estimates of rejecters and of the second circle of reciprocal friends are now both negative and remain not significantly different from zero. We view this result as evidence supporting our identification strategy.

In Appendix Table A2, we present the results from an alternative specification. The estimates presented are from a joint regression that includes the number of the four types of friendships in class on GEMS test scores, while controlling for the sum of these four types of friendships at school level

instead of four separate controls, since it is less correlated with the coefficients of interest. The estimates in the last specification are, in most cases, similar to those in Table 3: The estimate of reciprocal friends resembles the estimate in the previous specification, 0.083 (se=0.009), and the estimate of followers is higher 0.049 (se=0.015). The estimate of rejecters is also negative, as in the previous specification, but is now statistically significant, -0.041 (se=0.017), whereas the estimate of the second circle of reciprocal friends remains small and is not significantly different from zero.<sup>28</sup>

The signs and magnitude of these coefficients are consistent with the social network literature, which predicts positive effects of social membership in networks, depending on the nature of the relationships. For example, the more ‘intense’ and ‘positive’ the friendship, the higher the trust and cooperation between networks’ members (see, for example, Attanasio et al. (2012) and Fafchamps and Lund (2003)). Psychology literature offers further supporting evidence, suggesting that friendship ties of reciprocal nature have positive effects on emotional and educational outcomes of students, while negative peers’ experiences (for example, students who reject their friendship offer) have a negative effect on educational outcomes.<sup>29</sup>

The estimates of the second circle of reciprocal friends are small and not significantly different from zero in both specifications. This result suggests that, in contrast to some recent empirical findings,

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<sup>28</sup> In Appendix Table A3 and Table A4 we test two additional alternative specifications: in Table A3, we present the effect of the number of friends by type on each subject separately, and in Table A4 we test for the existence of non-linear effects of the four types of friendships. The estimates in Appendix Table A3 show that the effects across subjects are remarkably similar: while the subject-specific estimates are naturally less precise than our pooled estimates, each of these three estimates is close to the average estimate obtained in Table 3 (column 5–8, third row) when all the subjects were pooled together. Appendix Table A4 tests for the degree of linearity of the effects of the four types of friendships, by a regression that includes dummy variables for the four types of friendships and controls for their respective number in school. The estimates indicate that the influences of reciprocal friends and followers are only partly linear, while the coefficients of all dummy variables of other types of friendships are not significantly different from zero.

<sup>29</sup> Some studies in this literature distinguish between the impact of different kind of relationships, similar to the groups that we are defining: 1) friendships ties among children, especially of reciprocal nature, are said to be a source of emotional support (Crosnoe et al. 2003, Vaquera and Kao 2008); increase self-esteem (Gifford-Smith and Brownell (2003); help to deal with problems (Azmitia and Montgomery 1993); and can also function as academic resources (Cauce 1986). 2) The effect of popularity and social status on educational outcomes is more ambiguous. While most of the literature emphasizes the fact that centrality in a peer group is usually associated with promoting students' self-esteem, since aggressive children often holds central position within their peer group, it can also promote aggression and decrease children's academic outcomes (Salmivalli et al. 1997). 3) Research examining the different types of rejected children suggests that negative peer experiences may exacerbate academic difficulties by undermining motivation to attend school or by increasing the exposure to other marginalized peers who de-value academic success (Buhs and Ladd 2001).

the number of indirect links, as measured by the second circle of reciprocal friends, has no impact on educational outcomes, once we account for the effect of the most ‘intimate’ social network, namely the size of the direct links network (the first circle of reciprocal friends). Nevertheless, addressing another aspect of indirect links which refers to the degree of closure of social relation reveals that they do matter to some extent for students’ educational outcomes. Following Jackson et al. (2012) we measure the closure of social relation<sup>30</sup> by testing whether reciprocal friends are supported (meaning that reciprocal friends have a mutual reciprocal friend) or not. By including the two separated groups of reciprocal friends (supported and not supported reciprocal friends) in a regression that includes all other types of friends jointly in the regression, their respective number in school, and class, year and subject fixed effect, we find that the effect of number of reciprocal friends that are supported is higher than those who are not (0.103, se=0.014 versus 0.058, se=0.04) though the estimates are not statistically different between the two groups.

The results we presented in this section imply a relatively large impact of social relationships, especially of reciprocal nature. The effect of reciprocal friends is statistically higher than that of other friendship types. The addition of one reciprocal friend raises average GEMS test scores by 0.098 standard deviations of the test scores distribution (based on the preferred specification, presented in Table 3, columns 5–8, last row). Another way of assessing the magnitude of the effect size is by computing the effect of the decline of 1.6 reciprocal friends in the transition from primary to middle school (based on the summary statistics in Table 2). This change leads to a decline in the average GEMS test scores of 0.16 of a standard deviation. The effect of follower is also statistically higher than the effects of both non-reciprocal friends and second circle of reciprocal friends. The treatment estimate of followers is 0.035 of a standard deviation. Therefore, the decline of 1.8 in the mean number of followers in middle school relative to primary school lowered the average GEMS test scores by 0.06 standard deviations according to the preferred specification. The impact of rejecters is not significant in the preferred specification, but it is more precisely measured in the specification presented in Appendix

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<sup>30</sup> Jackson et al. (2012) show in a theoretical model that patterns of exchange that are locally enforceable require all links within the network to be supported. They also provide empirical evidence from rural villages in India regarding the correlation between patterns of favor exchange and the levels of support.

Table A2. Here, a reduction of 1.7 in the mean number of rejecters in middle school relative to primary school increases the average GEMS test scores by 0.07 standard deviations. The estimated impacts of the second circle of reciprocal friends are not significantly different from zero in all specifications.

A complementary way of assessing the overall magnitude of these estimates is by simulating how one's academic success would change if the transition to middle school did not entail changing the size of the social networks in class, further to the change occurring due to middle school transition. In other words, we model the dynamics of the circumstances as if students were able to stay with all of their childhood friends in a class that moved with them to middle school. Based on the summary statistics in Table 2, we assume the students would have on average an additional 0.91 reciprocal friends and 0.87 followers (referring to the respective number of friends in middle school multiplied by the ratio of number of friends in primary class to number of friends in primary school). Based on the estimates from the preferred specification with class fixed effects (columns 5–6), this scenario increases their GEMS score by 0.12 standard deviations. If we instead use the alternative specification, where the impact of rejecters is also taken into account, and assuming that a student has on average an additional 0.87 rejecters as well), it would increase their GEMS score by 0.08 standard deviation.

In Appendix Table A5 and Table A6, we test for the effect of the length of friends' acquaintance. This dimension of friendship ties is presumed to reflect the probability of parents knowing each other, which is said to affect the degree of intergenerational closure and facilitate the imposition of effective norms by the parents (Coleman 1988). Using data on kindergarten assignments of these students enables us to examine whether friends by type in primary school class attended the same kindergarten. We show that although longer length of acquaintance increases the likelihood of reciprocity of friendship ties, friendships based on new acquaintance during primary schools have the same effect on educational outcomes as friendships that are based on acquaintance since kindergarten. Appendix Table A5 reports the effect of the length of acquaintance of two primary class friends (=1 if two class peers came from the same kindergarten and 0 otherwise) on the likelihood of friendship nomination by type, based on separate logistic regressions for each friendship type and includes subject, year and primary school class fixed effects as controls. The estimated effect of length of acquaintance is positive and significant only in the case of reciprocal friends (0.027, se = 0.03), while negative and only partly significant for other

friendship types. Appendix Table A6 reports the estimated effect of the number of relationships based on acquaintance since primary school versus relationships based on acquaintance since kindergarten, for all four types of friendships in class, on GEMS test scores. As in the last specification of Table 3, we report results based on one joint regression that includes the number of friends by type of friendship nomination and by friendship length in class together, controlling for the number of friends by type of friendship nomination in school, and including year, subject and middle school class fixed effects. Comparing the estimated effect by friendship length, reveals that the differences between the estimates are not statistically different between the two groups: while the estimates of reciprocal friends who knew each other since kindergarten are higher than primary school acquaintance based relationships (0.111  $se=0.019$  versus 0.093,  $se=0.014$ ); the estimates of rejecters have the opposite pattern, those based on primary school acquaintance are more negative (-0.075,  $se=0.035$  versus -0.011,  $se=0.024$ ); and the estimates of follower and second circle of reciprocal friends are almost identical for both types of acquaintance length.

### *Long Term Effect on Academic Outcomes*

Using administrative data, we are able to track students from the end of primary school, through middle school, to the end of high school. In Table 4, we present evidence of the longer term effect of number of friends by type on very economically important end of high school educational outcomes. Panel A reports the estimated effect on high school exit exams (matriculation) test scores in math, Hebrew and English, which are stacked together; Panel B reports the estimated effect on the probability of receiving a matriculation diploma based on a linear probability regression.<sup>31</sup> Panel C reports the estimated effect on the total number of successfully completed matriculation exams' units.<sup>32</sup> We report estimates from a regression that includes all four types of friendships jointly in the regression, controlling for subject, year and middle school class fixed effects, pupil characteristics and number of friends by type in school. The estimated effects of each type of friendship are presented in columns 1–4.

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<sup>31</sup> Appendix Table A7 reports the respective coefficients and standard errors from a logistic regression. The marginal effects at the means are very similar to the coefficients of the linear probability regression in Table 4.

<sup>32</sup> We note here that all these high school outcomes are very good predictors of post-secondary schooling attainment and quality and also of earnings at adulthood (Lavy 2014).

Comparing the estimates in Panel A of Table 4 to those in Table 3 (last specification) reveals that the effects of the number of friends by type persist to a large extent through high school. Furthermore, most of the point estimates for high school outcomes are very similar to the estimated effect in middle school. For example, the effect of reciprocal friends on GEMS test scores (0.098,  $se=0.013$ ) is only somewhat higher than its effect on matriculation test scores in same subjects (0.071,  $se=0.016$ ); the effect of followers is almost the same (0.035 ( $se=0.018$ ) in Table 3 versus 0.043 ( $se=0.022$ ) in Table 4, Panel A). Both effects are statistically higher than the effects of rejecters and second circle of reciprocal friends, which in both cases are negative and not significantly different from zero.

Panel B and Panel C of Table 4 report similar estimated effects of the different friendship types on obtaining a matriculation diploma and on total number of successfully completed matriculation exams' units. Reciprocal friends have the statistically largest effect on this outcome (0.025,  $se=0.008$ , and 0.771,  $se=0.210$  respectively), while the respective estimated effect of followers is positive and the estimated effects of the other two types of friendship ties are negative, but none of them are significantly different from zero.

As shown earlier, we can simulate how one's academic success would change if the transition to middle school did not entail changing the size of the social networks in class, further to the change occurring due to middle school transition. This analysis highlights the importance of the friendship network and its prolonged influence on students' chances of receiving matriculation certificates. Assuming as before that students would have, on average, an additional 0.91 reciprocal friends and 0.87 followers, will increase their matriculation scores (in math, English and Hebrew) by 0.102 standard deviations; their probability of receiving a matriculation diploma by 2 percentage point (from 76 percent to 78 percent); and their total number of successfully completed matriculation exams' units by 0.7 (from 19.5 to 20.2).

As discussed in Table 3, the estimates of the effect of all types of social relationships are robust to adding pupil's characteristics to the regression, once we control for the number of friends by type in school and add class fixed effects to the regression. The fact that the estimates remain stable when adding pupil's characteristics implies that, conditional on number of friends in school and a middle school class

fixed effect, the number of friends of different types is not correlated with students' observed characteristics. In Table 5, we present additional evidence regarding this important result in the form of "balancing tests" for the number and different types of friends in class. We regresses directly student characteristics on the treatment measures, focusing on the following background variables: gender, number of siblings, father's years of education, mother's years of education, new immigrant and four ethnicity indicators (child or parents born in Asia/Africa, Europe/America, Former Soviet Union or in Israel). The estimates presented in the table are the regression coefficients of each of these student characteristics on the number of friends of a given type in class. We include as controls the number of friends by type in school (same type as in class), and year and middle school class fixed effects. Each column presents estimates for one of the four types of social networks.

Overall, the table indicates that there is no evidence of systematic relationship between these characteristics and the change in number of friends of each type. First, there are 36 estimates presented in Table 5 and only 3 are significant. Taken in combination with our Table 3 results, the overall evidence suggests that there is no systematic imbalance in the relationship between student characteristics and the number of friends by type in class after controlling for the number of friends by type in school. Secondly, some of the characteristics switch sign. For example, parental education is positively correlated with reciprocal friends but negatively correlated with followers. We would expect, however, that these two types of friendship would have the same correlation sign with parental schooling.<sup>33</sup>

## **B. Mechanisms of Effects of Friendships on Cognitive Achievements**

The large and persistent effect of social networks on educational outcomes presented in Table 3 and Table 4 could be partly mediated through the 'quality' of friends and higher cooperative behavior and trust among students in class. In this section, we test how these educational gains from social networks in school depend on 'quality' of friends that we measure by their socioeconomic background

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<sup>33</sup> In Appendix Table A8, we present additional robustness tests: we report the estimated effect of the number of friends by type on students' GEMS test scores, when including also an elementary school/class fixed effect. The coefficients presented are remarkably similar to those in Table 3, which implies that the results are not sensitive to these additional controls.

and how they partly result from higher cooperation between student and improved social atmosphere in class.

### ***‘Quality’ of Friends and ‘Quantity-Quality’ Tradeoff***

Peer effect studies in economics focus largely on the effect of a peer’s ‘quality’. Few studies have documented that peers from a higher socioeconomic background improve classmates’ educational outcomes. In this section, we test whether the effect of the size of a student’s friendship network changes once we take into account the ‘quality’ of friends in this social network, and whether the impact of the size of the network varies with the ‘quality’ of friends. In other words, we test for ‘quantity-quality’ tradeoff in the effect of social network on educational outcomes. Additionally, we explore the heterogeneous effects of friendships ‘quality’ and ‘quantity’ across different dimensions of students’ characteristics.

In Table 6, we present evidence on the effect of both the ‘quantity’ and ‘quality’ of friends by types on educational outcomes. We use an index of friends’ ‘quality’ that we constructed based on socioeconomic background characteristics of students, in particular parental schooling, Asia/Africa ethnicity and number of siblings.<sup>34</sup> For students with no friends of a given type, the ‘quality’ of friends was set to zero, and a dummy variable that equals one for such a case (and zero otherwise) was included in the regressions.

We report the estimated effect of the number and average ‘quality’ of friends by type in class from one joint regression that includes the number of friends by type in school, dummy variables for having no friends by type in class, pupil characteristics, and middle school class fixed effects as controls (columns 1–4).<sup>35</sup> The next four columns (columns 5–8) show the estimated coefficients from one joint regression that includes, additionally, an interaction term between the number and the ‘quality’ index of

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<sup>34</sup> The ‘quality’ index of friends by type in class is equal to the sum of the mean education of the friends’ fathers and the mean education of the friends’ mothers less the proportion of friends from Asia/Africa ethnicity and the mean number of siblings of friends. In Appendix Table A9 we present the estimated effect of each of these characteristics of friends on GEMS tests scores separately: the estimated effect of friends’ ‘quality’ and ‘quantity’ is presented in columns 1-4, and columns 5-8 present their interaction as well. The results of the effects of each category of socioeconomic background of friends are similar to the index of friends ‘quality’: in most cases only the ‘quantity’ and ‘quality’ of reciprocal friends are significantly different from zero. We note that the interaction term of reciprocal friends is significantly different from zero only in the case of number of siblings.

<sup>35</sup> We note that the ‘quality’ of friends by type in school was not included as an additional control due to the high correlation between the ‘quality’ of friends by type in school and the ‘quality’ of friends by type in class.



friends for each type of friendship nomination. In Panel A and Panel B, we present the estimated effects on tests scores in math, English and Hebrew, where the test scores in all three subjects are stacked together: Panel A presents short run effects on GEMS test scores, whereas Panel B presents long run effects on matriculation exams test scores; Panel C reports the estimated effects on the probability of receiving a matriculation certificate based on a linear probability regression;<sup>36</sup> and Panel D report the estimated effects on the number of successfully completed matriculation exams' units.

The results in almost all panels indicate that the estimated effects of the number of friends by type (columns 1–4) is not very sensitive to adding the ‘quality’ of friends variable by type of friendship to the regressions. Namely, the estimates presented in Table 6 are relatively similar to the respective estimates presented in Table 3 and Table 4. Thus, despite some degree of collinearity between the number and ‘quality’ of friends, the number of friends remains an important factor in students’ achievements when adding the ‘quality’ of friends by type: The estimated effect of the number of reciprocal friends is positive and significantly higher than other friendship types for all educational outcomes. The estimated effect of number of followers is also positive and marginally significant for average matriculation test scores in math, Hebrew and English (0.04,  $se=0.025$ ), but ceases to be significantly different from zero in the case of average GEMS test outcomes; The effects of rejecters and of the second circle of reciprocal friends are still negative and not significantly different from zero in all educational outcomes regressions.

Similar to the peer effect literature, we present evidence on the positive effect of ‘quality’ of friends, especially that of reciprocal friends, on educational performances.<sup>37</sup> The impacts of reciprocal friends’ ‘quality’ on short term as well as long term educational outcomes are positive and significantly different from zero. Moreover, the impacts of reciprocal friends on both GEMS test scores and matriculation exam test scores (0.016  $se=0.004$  and 0.01,  $se=0.003$  respectively), as well as on the likelihood of

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<sup>36</sup> Appendix Table A7 reports the respective coefficients and standard errors from a logistic regression. The marginal effects at the means (in italics) resemble the coefficients of the linear probability regression in Table 6.

<sup>37</sup> The peer effect literature focuses mostly on the impact of both endogenous and contextual effect of reciprocal friends. A recent paper by Lam (2014) considers several additional friendship types, such as seatmates, emotional supporters and study mates. He finds that several friendship types improve educational performances through different attributes. While the degree of self-discipline is found to be the most important attribute of friends and emotional supporters, mental ability is found to be the main channel through which study mates influence students’ performances.

obtaining a matriculation diploma and on the total number of matriculation exams' units (0.006,  $se=0.002$  and 0.196,  $se=0.047$ ) are all significantly higher than that of other friendship types. The impacts of other friendship types' 'quality' are also positive (except for the second circle of reciprocal friends) but not significantly different from zero. Comparing the elasticity of the 'quality' of reciprocal friends to that of their 'quantity' at their mean values (the mean value of the 'quality' of reciprocal friends is 16.2, while the mean value of the non-zero number of reciprocal friends is 1.5) reveals that the elasticity of the 'quality' of reciprocal friends is about twice higher than the elasticity of the 'quantity' of reciprocal friends in all Panels.

Further insights regarding the impact of both friends 'quality' and 'quantity' can be derived from the analysis in Appendix Table A10, which tests the effect of the number of friends with lower/higher socioeconomic background of the student in class, while controlling for their respective number in school (and it includes middle school class, year and subject fixed effects). The table presents evidence on higher positive impact of reciprocal friends and followers with higher socioeconomic background than those with lower socioeconomic background (though the effects are statistically higher only in part of them). Interestingly, in the case of rejecters, those who have lower socioeconomic background are the most influential and are found to decrease the student's educational performances.

These findings seem to suggest that both friends' 'quantity' and 'quality' are important channels of influence on educational performance. While the 'quality' of friends, especially the 'quality' of reciprocal friends, has a positive effect on student test scores, as the evidence of the peer effect literature seems to suggest, controlling for it does not affect the 'quantity' channel considerably. Adding an interaction term between the 'quantity' and the 'quality' of friends by type reveals that to some extent a tradeoff exists between the 'quantity' and the 'quality' of reciprocal friends. The estimated effect of the interaction term is negative for all educational outcomes, though significant only for GEMS test scores ( $-0.004$ ,  $se=0.002$ ). This tradeoff stresses the importance of the previously overlooked effect of the size of friendship networks on educational outcomes in the economic literature, since it reveals that the effect of the mean socioeconomic background of reciprocal friends depends on their number, and declines with the total numbers of reciprocal friends.

In order to gain more insight into the effects of social networks on students' test scores, we explore in this section the heterogeneous effects of 'quality' and 'quantity' of friends.

In Table 7 we present estimates based on three different stratifications of the full sample.<sup>38</sup> Panel A reports the effects of friendship types by gender. Panel B presents evidence separately for young and older children of a given cohort. Panel C reports results separately by parental years of schooling (=1 if both parents' years of schooling is above the median – 12 years, and zero otherwise).<sup>39</sup> We report estimates from regressions that include the number and the average 'quality' of friends by type in class, all types included jointly in the regression, and we control for the number of friends by type in school as well as for having no friends by type in class, students' characteristics, class and year fixed effects.

Panel A suggests that the effects of 'quality' versus 'quantity' of friends by type differ by gender. Recent related studies suggest that a higher proportion of girls in class improves educational outcomes (Hoxby (2000), Lavy and Schlosser (2011)) by decreasing the level of violence in the classroom and improving inter-student relationships. Since friendship networks are mostly composed of students from the same gender (around 80 percent of friendships' nomination are of the same gender), we posit that gender peer effects, as discussed in the literature, characterize small friendship groups as well, and therefore the impact of network would be more pronounced on girls. We nevertheless find the opposite, that social network have stronger effects on boys: We do find that the effects of both the number of reciprocal friends are positive and significant for both gender but they are statistically higher for boys (0.12, se=0.023 versus 0.052, se=0.022). Similarly, the effects of mean 'quality' of reciprocal friends are positive and significant for both gender (0.013, se=0.007 for boys , and 0.017, se=0.06 for girls), but the mean 'quality' of other types of friendships (except for the second circle of reciprocal friends) are positive and significant only for boys: the 'quality' of followers is positive and significant for boys

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<sup>38</sup> It should be noted that an alternative way to measure heterogeneous effects would have been to use interaction terms for these subgroups. However, in this type of approach, the treatment-interaction terms may pick up variations by gender or parental schooling in the effects of other covariates included in the regressions. For this reason, we choose to stratify our sample, although this means our estimates are based on a smaller sample.

<sup>39</sup> Students with missing values in parental education (4 percent of the total sample) are excluded from this analysis. The results are not sensitive to the inclusion of these students in the low or high education group. Results based on stratifying the sample by mother's schooling are very similar to those based on father's schooling. These results are available from the authors upon request.

(0.015, se=0.007), and in the case of rejecters it is also statistically higher than that of girls (0.02, se=0.007 for boys and -0.002, se=0.006 for girls).

Panel B of Table 7 presents the estimates for the heterogeneity of effect of social networks of friends by age of pupils. Empirical evidence suggest that “young” students of each cohort have lower scores than “oldest” students throughout their school years, are less likely to attend university (Bedard and Dhuey 2006), and are more often victims of violence and bullying (Mühlenweg 2010). Since “young” students relative to their cohort are characterized by lower cognitive as well as non-cognitive outcomes than “old” students, we postulate that both ‘quality’ and ‘quantity’ channels would have stronger impacts on younger students. In order to be consistent with the literature, we stratify the sample so as to include in the “young” group students who are substantially younger than the others. Therefore, the “young” group includes pupils born in the later part of the cohort year (from September to December) while the “old” group includes pupils born in the earlier part of the cohort year (from January to August). However, the table indicates that younger and older students are similarly affected by both number of reciprocal friends (0.067, se=0.024 and 0.089, se=0.019, respectively) and their ‘quality’ (0.018, se=0.005 and 0.016, se=0.005 respectively). These two groups are being similarly affected by other friendship types as well.

Earlier peer effect studies suggest that students from low socioeconomic backgrounds are more affected by their peers’ ‘quality’ (Hanushek et al. 2003, Gould et al. 2009, Lavy et al. 2012). The results presented in Panel C of Table 7 suggest that both the ‘quality’ and ‘quantity’ of reciprocal friends have indeed a higher effect on students of low parental schooling than on students of high parental schooling. While this difference is marginally significant in the case of reciprocal friends ‘quality’ (0.022, se=0.005 versus 0.008, se=0.007), the difference between the effect of the number of reciprocal friends for the students with low levels of parental education and those with high levels of parental education is statistically significant (0.113, se=0.021 versus 0.042, se=0.020). The ‘quality’ and ‘quantity’ of other types of friendship have no significant effects for both groups (except for the ‘quality’ of rejecters for student of low parental schooling).

## ***Behavioral Outcomes***

The role of social networks in promoting trust and cooperation between individuals has been the focus of many recent papers on social capital.<sup>40</sup> We are able to test this channel by observing the impacts of social network characteristics on several non-cognitive outcomes. Moreover, we view these non-cognitive outcomes as channels through which trust and cooperation affect students' medium and longer term educational outcomes.

Using GEMS questionnaires in the 7<sup>th</sup> and 8<sup>th</sup> grades enable us to broaden the scope of the discussion of social networks effects, by examining the effects of friendship on behavioral outcomes as well. The analysis is based on the following five questionnaire items<sup>41</sup>: (1) "Students in class help each other"; (2) "I was involved in violence (physical fights) in school many times this year"; (3) "Sometimes I'm scared to go to school because there are violent students"; (4) "I feel well-adjusted socially in my class"; (5) "I am satisfied in school". We note that while the first question addresses the overall social atmosphere in class, the other questions relate to students' personal feelings and attitudes in the classroom. The students also report the time spent (in weekly hours) doing homework in each of the four subjects, and we use the reported total number of weekly hours spent on homework in all subjects as an additional behavioral outcome.

The first survey question addresses the mutual support of all students in the class ("Students in class help each other"). Since this question refers to the overall behavior of students in class, we built aggregate measures of mutual support and social network density in class. We focus on several measures of social network density in class: the average number of direct links (reciprocal friends) in class, the average number of indirect links (non-reciprocal friends) in class and the average number of direct links (reciprocal friends) that are supported. We refer to two additional measures which we view as further reflecting the proximity of social relation in class: the proportion of indirect versus direct links in class and the proportion of supported direct links versus overall direct links in class. In Table 8 we report

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<sup>40</sup> The literature on social capital is discussed in Section II. Psychology literature has also documented considerable influence of students' social network on their psychological well-being which presumably affects their academic performances.

<sup>41</sup> In these questions, students are asked about the extent to which they agree with a series of statements by using a six-point scale ranging from 1 (strongly disagree) to 6 (strongly agree).

estimates of the effects of these social network measures on the average amount of mutual support reported in class. We present estimates from separate regressions for each social network measure, which includes year and school fixed effects and students' average characteristics in class. The table indicates that the estimated effect of the average number of direct links, indirect links and direct links which are supported are all positive, but not statistically different from zero. Nevertheless, the estimated effects of the proportion of indirect links to direct links and the proportion of supported direct links to overall direct links are positive and statistically significant (0.203,  $se=0.098$  and 0.354,  $se=0.214$  respectively). These estimates indicate that classes which are characterized by more 'intense' and 'positive' friendship ties have a higher degree of trust and cooperation in class.

Further support regarding the impact of friendship ties on behavioral outcomes can be found at the student level. In Table 9, we report estimates of the effect of friends by type on each of the five additional outcomes. We report estimates from a regression that includes the four types of friendships jointly in the regression, controlling for the number of friends by type in school. The regression also includes students' characteristics, class and year fixed effects. The estimates in Table 9 suggest that the presence of more reciprocal friends in the classroom reduces personal involvement in violence in school ( $-0.091$ ,  $se=0.018$ ) and improves school satisfaction (though this latter affect is only marginally significant,  $0.033$ ,  $se=0.021$ ); while the presence of followers improves social satisfaction in class ( $0.043$ ,  $se=0.023$ ). In contrast, the presence of rejecters and second circle of reciprocal friends do not have significant effect on these behavioral outcomes. We note also that all types of friendships do not affect the time dedicated to doing homework. Comparing the effect of social networks types on behavioral outcomes by gender in Appendix Table A11 suggests that boys tend to be more affected by both the number of reciprocal friends and followers whereas girls are generally more affected by the number of reciprocal friends and rejecters. For example, the table suggests that followers sharply improve boys' social and school satisfaction and reciprocal friends reduces their violent behavior. In the case of girls, both reciprocal friends and rejecters, reduce girls' fear of school violence and reciprocal friends marginally increase their social satisfaction in class.

In Appendix Table A12 we report the estimated effect of both 'quality' and 'quantity' of friends by type. The regression includes the four types of 'quality' and 'quantity' of friends jointly in the

regression, while controlling for the number of friends by type in school, as well as having no friends by type in class, and students' characteristics, class and year fixed effects. The effect of friends by type remains to a large extent very similar when controlling for friends' 'quality'. As before, the presence of more reciprocal friends in the classroom reduces personal involvement in violence in school (-0.07, se=0.02), while the presence of more followers improve school satisfaction (0.048, se=0.028). The 'quality' of reciprocal friends and followers affects positively the overall satisfaction from school and social satisfaction in class but these effects are not significantly different from zero. These results highlight the importance of membership in social networks and its positive impact on students' educational outcomes, and suggest that this positive effect could be partly mediated through higher cooperation, reduction of violent behavior and overall improvement in student social satisfaction in class.

## **VI. Conclusions**

In this paper we study how separating from pre-existing social networks during the transition from elementary to middle school affect students' educational achievement in the short term and in the longer term. For our research, we exploit a unique free school choice framework that also allows students to maintain, in their new school, some of their pre-existing social ties. These unique features of the Tel Aviv school choice program permit an identification strategy that relies on a conditional random assignment model: since students are randomly assigned to classes within a given school, conditional on the number of friends a student has at her school, the number of friends she attends class with should be random. Thus, we estimate the impact of friends by type in class while controlling for the number of friends by type in school. This strategy allows us to contrast the impact of friends by type among students that have the same number of friends by type in school. We further add school/class fixed effects which enable us to eliminate all school/class-level unobservables.

Our results highlight the important effect of students' social networks in class on their educational outcomes in middle school and its prolonged effect in the long run, as well, affecting several important educational outcomes in high school. To assess the overall magnitude of the effect size of these estimates we simulate how students' academic success would change if the transition to middle

school did not entail changing their social circle in class, beyond the change occurring due to middle school transition. We find that if students kept their childhood friends in a class that moved with them to middle school it would have increased their score in middle school by around 0.1 of a standard deviation. In addition, it would have improved several human capital outcomes by the end of high school (i.e., matriculation exam scores, the probability of receiving a matriculation diploma and the total number of successfully completed matriculation exams' units) that have meaningful economic consequences for quantity and quality of post-secondary schooling and on earnings in adulthood.

These educational gains are affected by the 'quality' of friends as measured by the nature of friendship ties and by the mean socioeconomic backgrounds of friends. Focusing on the first measure of 'quality' of friends, we show that the presence of reciprocal friends and followers in class has a positive and significant effect on test scores in English, math and Hebrew, while the presence of rejecters has an opposite (negative) effect. However, beyond the first circle of reciprocal friends, the effect of the rest of the social network has no effect on students' academic performance. Addressing the second measure of 'quality' of friends, we find that both 'quantity' and 'quality' of friends are important for students' educational outcomes and that, similar to the peer effect literature, reciprocal friends from higher socioeconomic background improve student's educational outcomes. In addition, we find that these characteristics of the social network affect also several non-cognitive outcomes, implying that the impact of social networks on students' medium and longer term educational outcomes is partly mediated through higher cooperation, reduction in violent behavior and the improvements in social satisfaction in class.

The evidence we present is relevant for education and welfare policy makers, in particular with regard to the design of school choice programs, and for programs that may lead to relocation of children from their childhood environment. Since our study addresses the importance of students' social networks on academic achievements and general wellbeing, the research has the potential to improve the way students are assigned among and within schools, and to advance our understanding of the social dynamics implicit in school choice programs and welfare programs such as the MTO in the US or immigrant absorption programs in Europe.



## VI. References

- Abdulkadiroglu, A., Parag A.P., Roth, A.E. and T. Söonmez (2005). "The Boston Public Schools Match." *American Economic Review, Papers and Proceedings*, 96, 368-371.
- Abdulkadiroglu, A. and T. Söonmez (2003). "School Choice: A Mechanism Design Approach." *American Economic Review*, 93(3), 729-747.
- Abdulkadiroğlu, A., Yeon-Koo, C. and Yosuke Y. (2011). "Resolving Conflicting Preferences in School Choice: the Boston Mechanism Reconsidered." *American Economic Review*, 101(1), 399-410.
- Allcott, H., D. Karlan, M.M., Möbius, T.S., Rosenblat, and A., Szeidl (2007). "Community Size and Network Closure." *American Economic Review*, 97(2): 80-85.
- Ambrus, Attila, Markus Mobius, and Adam Szeidl. 2014. "Consumption Risk-Sharing in Social Networks." *American Economic Review*, 104(1), 149-182.
- Ammermueller, A. and J.S. Pischke (2009). "Peer Effects in European Primary Schools: Evidence from PIRLS." *Journal of Labor Economics*, 27(3), 315-348.
- Angrist, J.D., Bettinger, E., King, E. and M. Kremer (2002): "Vouchers for Private Schooling in Colombia: Evidence from a Randomized Natural Experiment," *American Economic Review*, 92, 1535–1558.
- Angrist, J.D. and K. Lang (2004). "Does School Integration Generate Peer Effects? Evidence from Boston's Metco Program." *American Economic Review*, 94 (5), 16213-1634.
- Angrist, J.D., Pathak, P.A. and C.R. Walters (2013). "Explaining Charter School Effectiveness." *American Economic Journal: Applied Economics*, 5(4): 1-27.
- Attanasio, O., A. Barr, J.C, Cardenas, G. Genicot, and C. Meghir. (2012). "Risk Pooling, Risk Preferences, and Social Networks." *American Economic Journal: Applied Economics*, 4(2), 134-67.
- Azmitia, M. and R. Montgomery (1993). "Friendship, Transactive Dialogues and the Development of Scientific Reasoning." *Social Development*, 2, 202-221.
- Bourdieu P. (1985). "The Forms of Capital". in *Handbook of Theory and Research for the Sociology of Education*, ed. J.G. Richardson, 241–258. New York: Greenwood.
- Barnhardt, S., Field, E. and R. Pande (2014), "Moving to Opportunity or Isolation? Network Effects of a Slum Relocation Program in India", Ahmedabad : IIMA working paper
- Bedard, K. and E. Dhuey, (2006). "The Persistence of Early Childhood Maturity: International Evidence of Long-Run Age Effects," *The Quarterly Journal of Economics*,. 121(4), 1437-1472.
- Blass, N., Tsur, S. and N. Zussman (2014). "Segregation of Students in Primary and Middle Schools", Bank of Israel Discussion Paper No. 2014.07.

- Blume, L., W. Brock, S. Durlauf, and Y. Ioannides (2011). "Identification of Social Interactions." In *Handbook of Social Economics*, vol. 1B, edited by J. Benhabib, A. Bisin, and M. Jackson. Amsterdam: North Holland, 853–964.
- Blume, L., W.A., Brock, S. N., Durlauf and R. Jayaraman (Forthcoming). "Linear Social Interactions Models", *Journal of Political Economy*.
- Bohnet, I., Herrmann, B., and R., Zeckhauser (2009). "Trust and Reference Point for Trustworthiness in Gulf and Western Countries", *The Quarterly Journal of Economics*, 125(2), 811-828.
- Bourdieu, P., (1986). "The Forms of Capital", in: John C. Richardson (Ed.), *Handbook of Theory and Research for the Sociology of Education*, Greenwood Press, pp. 241 – 258
- Bramoullé, Y., Djebbari, H. and B. Fortin (2009). "Identification of Peer Effects through Social Networks." *Journal of Econometrics*, 150(1), 41-55.
- Buhs, E. and G. Ladd (2001). "Peer Rejection as Antecedent of Young Children's School Adjustment: An Examination of Mediating Processes." *Developmental Psychology*, 37, 550-560.
- Calvo Armengol, A., Patacchini E. and Y. Zenou (2009). "Peer Effects and Social Networks in Education." *Review of Economic Studies*, 76(4), 1239-1267.
- Carbonaro, W. J. (1999). "Opening the Debate on Closure and Schooling Outcomes: Comments on Morgen and Sorensen." *American Sociological Review*, 64, 682-686.
- Cauce, A. (1986). "Social Networks and Social Competence: Exploring the Effects of Early Adolescent Friendships." *American Journal of Community Psychology*, 14, 607–628.
- Coleman J.C. (1988). "Social Capital in the Creation of Human Capital". *American Journal of Sociology*, 94, 95–120.
- Conley, T.G. and C.R. Udry (2010). "Learning about a New Technology: Pineapple in Ghana". *American Economic Review*, 100(1), 35-69.
- Crosnoe, R., Cavanagh S. and G.H. Elder (2003). "Adolescent Friendships as Academic Resources: The Intersection of Friendship, Race, and School Disadvantage." *Sociological Perspectives*, 46, 331–352.
- Cullen, J., Jacob, B. and S. Levitt (2005). "The Impact of School Choice on Student Outcomes: An Analysis of the Chicago Public Schools," *Journal of Public Economics*, 89, 729–760.
- Curley, A. (2009). "Draining or Gaining? The Social Networks of Public Housing Movers in Boston." *Journal of Social and Personal Relationships*, 26, 227-247.
- De Giorgi, G., Pellizzari, M. and S. Redaelli (2010). "Identification of Social Interactions through Partially Overlapping Peer Groups." *American Economic Journal: Applied Economics*, 2(2), 241-275.
- DeLuca, S. and E. Dayto (2009), "Switching Social Contexts: The Effects of Housing Mobility and School Choice Programs on Youth Outcomes", *Annual Review of Sociology*, 35, 457–491.

- De Weerd, J. and S. Dercon (2006). "Risk-Sharing Networks and Insurance against Illness". *Journal of Development Economics*, 81(2), 337–356.
- Fafchamps, M. and F. Gubert (2007), "The Formation of Risk Sharing Networks," *Journal of Development Economics*, 83(2), 326-350.
- Fafchamps, M. and S. Lund (2003). "Risk Sharing Networks in Rural Philippines." *Journal of Development Economics*, 71(2), 261-287.
- Fiske, E. B. and H. F. Ladd (2001). "When Schools Compete: A Cautionary Tale." Washington, DC: Brookings Institution Press.
- Gifford-Smith, M. E. and C.A. Brownell (2003). "Childhood Peer Relationships: Social Acceptance, Friendships and Peer Networks." *Journal of School Psychology*, 41, 235-284.
- Gleason, Philip, Melissa Clark, Christina Tuttle, and Emily Dwoyer. 2010. The Evaluation of Charter School Impacts: Final Report. U.S. Department of Education National Center for Education Evaluation and Regional Assistance (NCEE) 2010-4029. Washington, DC, June.
- Gorad, S. (2001). "The Long Term Impact of School Choice in the United Kingdom," Occasional Paper 13, National Center for the Study of Privatization in Education, Columbia University, New York.
- Gould, E.D., Lavy, V. and M.D., Paserman, (2009). "Does Immigration Affect the Long-Term Educational Outcomes of Natives? Quasi-experimental Evidence". *Economic Journal*, 119(540), 1243–69.
- Guiso, L., Sapienza, P., and L., Zingales (2004). "The Role of Social Capital in Financial Development." *American Economic Review*, 94(3): 526-556.
- Granovetter, M. (1973). "The Strength of Weak Ties." *American Journal of Sociology*. 78(6), 1360-1380.
- Greenbaum, S., Hathaway, W., Rodriguez, C., Spalding, A., and Ward, B. (2008). "Deconcentration and Social Capital: Contradictions of a Poverty Alleviation Policy". *Journal of Poverty*, 12(2), 201-228.
- Hallinan, M.T. and W.N., Kubitschek (1999). "Conceptualizing and Measuring School Social Networks: Comments on Morgen and Sorensen." *American Sociological Review*, 64, 687-693.
- Hanushek, E.A., Kain, J.F. and S.G. Rivkin (2003). "Does Peer Ability Affect Student Achievement?" *Journal of Applied Econometrics*, 18(5), 527-544.
- Hoxby, C. and G. Weingarth Salyer, "School Reassignment and the Structure of Peer Effects," NBER Conference Paper, 2005.
- Imberman, S.A. (2011). "Achievement and Behavior in Charter Schools: Drawing a More Complete Picture." *Review of Economics and Statistics*, 93(2), 416–35.
- Jackson, M.O. (2011). "An Overview of Social Networks and Economic Applications", in Jess Benhabib, Alberto Bisin and Matthew O. Jackson (Eds.), *Handbook of Social Economics*, North Holland Press.

- Jackson, M.O., Rodriguez-Barraquer, T. and X. Tan (2012). "Social Capital and Social Quilts: Network Patterns of Favor Exchange." *American Economic Review*, 102(5): 1857-97.
- Karlan, D., Mobius, M., Rosenblat, T. and A. Szeidl (2009). "Trust and Social Collateral", *The Quarterly Journal of Economics*, 124 (3), 1307-1361.
- Katz, L.F., Kling, J.R. and J.B. Liebman (2001). "Moving to Opportunity in Boston: Early Results from a Randomized Mobility Experiment," *Quarterly Journal of Economics*, 116(2), 607-654.
- Kissane, R.J. and S. Clampet-Lundquist" (2012). "Social Ties, Social Support, and Collective Efficacy among Families from Public Housing in Chicago and Baltimore" (2012), *Journal of Sociology & Social Welfare*, 39(4), 157-181.
- Kling, J.R., Liebman, J.B. and L.F. Katz (2007). "Experimental Analysis of Neighborhood Effects." *Econometrica*, 75(1), 83-119.
- Kling, J.R., Ludwig, J. and L.F. Katz (2005). "Neighborhood Effects on Crime for Female and Male Youth: Evidence from a Randomized Housing Voucher Experiment." *Quarterly Journal of Economics*. 120(1), 87-130.
- Knack, S., and P., Keefer (1996), "Does Social Capital Have an Economic Payoff? A Cross-country Investigation." *The Quarterly Journal of Economics*, 112(4),1251.
- Krishnan, P. and E. Sciubba (2009). "Links and Architecture in Village Networks". *The Economic Journal*, 119, 917-949.
- Lam, C.T., (2012). "Estimating Various Kinds of Peer Effects on Academic Performance", Clemson Department of Economics, working paper.
- La Porta, R., Lopez De Silanes, F., Shleifer, A., and R., Vishiny (1997). "Trust in Large Organizations". *American Economic Review*, 87(2): 333-338.
- Lavy, V. (2010). "Effects of Free Choice among Public Schools". *Review of Economic Studies*. 77(3), 1164-91.
- Lavy, V. and A. Schlosser (2011). "Mechanisms and Impacts of Gender Peer Effects at School." *American Economic Journal: Applied Economics*, 3(2), 1-33.
- Lavy, V., Silva, O. and F. Weinhardt (2012a). "The Good, The Bad and The Average: Evidence on Ability Peer Effects in Schools." *Journal of Labor Economics*, 30(2), 367-414.
- Lavy, V., Paserman, D. and A. Schlosser (2012b). "Inside the Black Box of Ability Peer Effects: Evidence from Variation in Low Achievers in the Classroom." *Economic Journal*, 122, 208-237.
- Lavy, V. (2011) "What Makes an Effective Teacher? Quasi-Experimental Evidence" forthcoming, *CESifo Economic Papers*.
- Lee, L. (2007). "Identification and Estimation of Spatial Econometric Models with Group Interactions, Contextual Factors and Fixed Effects" *Journal of Econometrics* 140(2), 333-374.
- Lin, N. (1999). "Building a Network Theory of Social Capital." *Connections*, 22(1), 28-51.

- Lin, X. (2010). "Identifying Peer Effects in Student Academic Achievement by Spatial Autoregressive Models with Group Unobservables." *Journal of Labor Economics*, 28(4), 825-860.
- Manski, C.F. (1993). "Identification of Endogenous Effects: The Reflection Problem." *Review of Economic Studies*, 60, 531-542.
- Morgan, S.L. and A.B. Sorensen (1999). "Parental Networks, Social Closure, and Mathematics Learning: A Test of Coleman's social Capital Explanation of School Effects." *American Sociological Review*, 64, 661-681.
- Mühlenweg, A. (2010). "Young and Innocent: International Evidence on Age Effects within Grades on Victimization in Elementary School", *Economics Letters*, 109(3), 157-160.
- Nelson, R. M. and T. K. Debacker (2008). "Achievement Motivation in Adolescents: The Role of Peer Climate and Best Friends." *The Journal of Experimental Education*, 76(2), 170-189.
- Patacchini, E., Rainone, E. and Y. Zenou (2011), "Dynamic Aspects of Teenage Friendships and Educational Attainment." *CEPR Discussion Papers* 8223.
- Pathak, A.P. and T. Sönmez. (2013) "School Admissions Reform in Chicago and England: Comparing Mechanisms by their Vulnerability to Manipulation", *American Economic Review*. 103 (1), 80–106.
- Portes A. (1998). "Social Capital: Its Origins and Applications in Modern Sociology." *Annual Review of Sociology*, 24, 1-24.
- Putnam, R.D. (1993). "The Prosperous Community: Social Capital and Public Life." *American Prospect*, 13, 35–42.
- Sacerdote, B. (2001). "Peer Effects with Random Assignment: Results from Dartmouth Roommates." *Quarterly Journal of Economics*, 116, 681-704.
- Salmivalli, C., Huttunen, A., and K.M.J. Lagerspetz (1997). "Peer Networks and Bullying in Schools." *Scandinavian Journal of Psychology*, 38, 305-312.
- Sanbonmatsu, L., Kling, J.R., Duncan, G.J., and Brooks-Gunn, J. (2006). Neighborhoods and Academic Achievement: Results from the Moving to Opportunity Experiment." *Journal of Human Resources*. 41(4), 649-691.
- Sanbonmatsu, L., Ludwig, J., Katz, L.F., Genntian, L.A., Duncan, G.J., Kessler, R.C., Adam, A., McDade, T.W., and S.T., Lindau (2011), "Moving to Opportunity for Fair Housing Demonstration Program, Final Impacts Evaluation", Prepared for U.S. Department of Housing and Urban Development Office of Policy Development & Research.
- Sobel, J., (2002). "Can We Trust Social Capital", *Journal of Economic Literature*, 40(1): 139-154.
- Turney, K., S. Clampet-Lundquist, K. Edin, J. R. Kling, and G. J. Duncan (2006). "Neighborhood Effects on Barriers to Employment: Results from a Randomized Housing Mobility Experiment." *Brookings-Wharton Papers on Urban Affairs*, 137-187.
- Vaquera, E. and G. Kao (2008). "Do You Like Me as Much as I Like You? Friendship Reciprocity and Its Effects on School Outcomes among Adolescents." *Social Science Research*, 37(1), 55–72.

- Wentzel, K.R. (1998). "Social Relationships and Motivation in Middle School: The Role of Parents, Teachers and Peers." *Journal of Educational Psychology*, 90(2), 202-209.
- Wentzel, K.R., McNamara, B.E. and K.A. Caldwell (2004). "Friendships in Middle School: Influences on Motivation and School Adjustment." *Journal of Educational Psychology*, 96(2), 195-203.
- Zimmerman, D. (2003). "Peer Effects in Academic Outcomes: Evidence from a Natural Experiment." *Review of Economics and Statistics*, 85, 9-23.

**Table 1: Summary Statistics of Students' Characteristics by Cohort**

	<b>2000</b>	<b>2002</b>	<b>2003</b>
	(1)	(2)	(3)
Mean Father's Education	13.36 (3.58)	13.35 (3.43)	12.73 (3.51)
Mean Mother's Education	13.70 (3.16)	13.69 (3.15)	13.08 (3.07)
Mean Number of Siblings	2.06 (1.18)	2.05 (1.05)	2.30 (1.15)
Proportion of Asia/Africa Ethnicity	0.13 (0.34)	0.11 (0.31)	0.10 (0.31)
Proportion of Europe/America Ethnicity	0.19 (0.39)	0.20 (0.40)	0.18 (0.38)
Proportion of Israel Ethnicity	0.57 (0.49)	0.57 (0.50)	0.62 (0.48)
Number of Students	1037	960	1012
Number of Elementary Schools	42	37	43
Number of Elementary Classes	83	69	80
Number of Middle Schools	6	6	7
Number of Middle School Classes	34	30	36

Notes: Each column is based on a different cohort. Standard deviations are reported in parentheses.

**Table 2: Descriptive Statistics of the Social Network: Number of Friends by Type in Class and in School**

	In Class			In School		
	Mean	Min	Max	Mean	Min	Max
	(1)	(2)	(3)	(4)	(5)	(6)
<b><u>Sixth Grade</u></b>						
A. Reciprocal friends	3.07 (2.23)	0	8	3.46 (2.34)	0	8
B. Followers	2.44 (2.33)	0	13	3.08 (2.90)	0	20
C. Non-reciprocal friends	2.41 (2.14)	0	8	3.02 (2.30)	0	8
D. Second Circle of Reciprocal Friends	3.65 (3.10)	0	18	4.89 (3.99)	0	26
Number of Students	3009					
<b><u>Eighth Grade</u></b>						
A. Reciprocal friends	1.48 (1.52)	0	8	2.70 (2.21)	0	8
B. Followers	0.66 (1.04)	0	8	1.93 (2.38)	0	17
C. Non-reciprocal friends	0.67 (1.07)	0	7	1.94 (2.00)	0	8
D. Second Circle of Reciprocal Friends	1.08 (1.39)	0	9	3.46 (3.50)	0	21
Number of Students	3009					

Notes: The figures in the table denote the number of friends in each category. Reciprocal friends (group A) includes students who listed one another. Followers (group B) includes students who were listed by fellow students but did not list them as friends. Non-reciprocal friends (group C) includes students who listed fellow students as friends but were not listed as friends by these same fellow students. Second Circle of Reciprocal Friends (group D) includes only the second circle of reciprocal friends (namely, reciprocal friends of reciprocal friends, excluding the student's reciprocal friends). Standard deviations are reported in parentheses.



**Table 3: Estimated Effect of Number of Reciprocal Friends, Followers, Rejecters and Second Circle of Reciprocal Friends in Class on GEMS Test Scores in Math, English, and Hebrew**

	Treatments included separately				Treatments included Jointly			
	Reciprocal Friends	Followers	Rejecters	Second Circle of Reciprocal Friends	Reciprocal Friends	Followers	Rejecters	Second Circle of Reciprocal Friends
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OLS	0.117*** (0.012)	0.094*** (0.015)	-0.035* (0.018)	0.047** (0.015)	0.109*** (0.013)	0.061*** (0.017)	-0.014 (0.018)	-0.008 (0.016)
Friends in School and School Fixed Effects	0.107*** (0.014)	0.049** (0.018)	-0.001 (0.022)	0.009 (0.014)	0.112*** (0.015)	0.040* (0.020)	0.005 (0.021)	-0.019 (0.015)
Friends in School and Class Fixed Effects	0.118*** (0.013)	0.049** (0.019)	-0.020 (0.021)	0.008 (0.014)	0.121*** (0.014)	0.034 (0.021)	-0.012 (0.022)	-0.010 (0.016)
Friends in School, Class Fixed Effects and students' Characteristics	0.098*** (0.012)	0.050** (0.016)	-0.028 (0.020)	0.007 (0.013)	0.098*** (0.013)	0.035* (0.018)	-0.022 (0.021)	-0.005 (0.015)
Number of Students	7760							

Notes: The GEMS test scores in all three subjects (math, English, and Hebrew) are pooled together. These test scores are standardized scores, by year and subject. The first specification is a simple OLS regression with subject and year fixed effects; the second specification includes in addition middle school fixed effects and the number of friends by type in school (Friends in school) as controls; the third specification includes middle school class fixed effect instead of middle school fixed effects; and the fourth specification includes in addition students' characteristics (gender, parental education, number of siblings, immigration status and dummies for four ethnicity groups). The estimates in each row in columns 1-4 are each from a separate regression. The estimates in each row in columns 5-8 are from the same regression. Standard errors are clustered by class and are reported in parentheses. Significance level of regressions are reported as follows: "\*\*\*\*"=1% level, "\*\*\*"=5% level, and "\*"=10% level.

**Table 4: Estimated Effect of Number of Reciprocal Friends, Followers, Rejecters and Second Circle of Reciprocal Friends in Class on Long Term Educational Outcomes**

	<b>Reciprocal Friends</b>	<b>Followers</b>	<b>Rejecters</b>	<b>Second Circle of Reciprocal Friends</b>
	(1)	(2)	(3)	(4)
<b>A. Matriculation Test Scores in Math, English, and Hebrew</b>				
Regression Estimates	0.071*** (0.016)	0.043** (0.022)	-0.030 (0.022)	-0.010 (0.017)
Number of Students	7599	0.102		
<b>B. Probability of Receiving a Matriculation Diploma</b>				
Regression Estimates	0.025*** (0.008)	0.015 (0.010)	-0.008 (0.011)	-0.003 (0.009)
The Outcome Mean	<i>0.76</i>			
Number of Students	2609			
<b>C. Total Number of Successfully Completed Matriculation Exams' Unit</b>				
Regression Estimates	0.771*** (0.210)	0.386 (0.268)	-0.380 (0.297)	0.030 (0.228)
The Outcome Mean	<i>19.5</i>			
Number of Students	2609			

Notes: The estimates in each row in columns 1-4 are from the same regression. Each regression controls for the number of friends by type in school and includes students' characteristics, class and year fixed effects. Long term educational outcomes are: A) Matriculation test scores in math, English and Hebrew, which are pooled together. These test scores are standardized scores, by year and subject; B) The probability of receiving a matriculation diploma according to a linear probability regression; C) The total number of successfully completed matriculation exams' units. Standard errors are clustered by class and are reported in parentheses. Outcome means are reported in italics. Significance level of regressions are reported as follows: "\*\*\*"=1% level, "\*\*"=5% level, and "\*"=10% level.

**Table 5: Balancing Estimates of Student Characteristics of the Number of Friends (By Type) in Class**

	<b>Reciprocal Friends</b>	<b>Followers</b>	<b>Rejecters</b>	<b>Second Circle of Reciprocal Friends</b>
	(1)	(2)	(3)	(4)
Gender (Boy = 1)	-0.090 (0.057)	-0.055 (0.037)	-0.056 (0.045)	-0.051 (0.063)
Number of siblings	-0.026 (0.019)	0.006 (0.012)	-0.008 (0.017)	0.004 (0.027)
Father's years of schooling	0.016** (0.006)	-0.005 (0.003)	-0.001 (0.005)	-0.002 (0.005)
Mother's years of schooling	0.018** (0.006)	-0.007 (0.005)	0.006 (0.006)	-0.001 (0.007)
Ethnicity Asia/Africa	-0.040 (0.059)	-0.019 (0.045)	0.028 (0.048)	0.069 (0.055)
Ethnicity Europe/America	0.010 (0.040)	0.006 (0.035)	0.024 (0.046)	-0.025 (0.050)
Ethnicity Israel	0.025 (0.036)	0.015 (0.028)	-0.056* (0.032)	0.003 (0.041)
Ethnicity Former Soviet Union	-0.035 (0.068)	-0.021 (0.035)	0.053 (0.063)	-0.046 (0.068)
Recent Immigrant	-0.025 (0.059)	-0.028 (0.035)	0.093 (0.059)	-0.037 (0.062)
Number of Students	3005			

Notes: Each regression controls for the number of friends by type in school and includes year fixed effects and class fixed effects. Standard errors are clustered at the class level and reported in parentheses. Significance level of regressions are reported as follows: “\*\*\*”=1% level, “\*\*”=5% level, and “\*”=10% level

**Table 6: Estimated Effect of 'Quality' and 'Quantity' of Reciprocal Friends, Followers, Rejecters and Second Circle of Reciprocal Friends in Class on Several Educational Outcomes**

	Without Interaction				With Interaction			
	Reciprocal Friends	Followers	Rejecters	Second Circle of Reciprocal Friends	Reciprocal Friends	Followers	Rejecters	Second Circle of Reciprocal Friends
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>A. GEMS Test Scores</b>								
Regression Estimates of Friends' 'Quantity'	0.085*** (0.014)	0.016 (0.022)	-0.030 (0.027)	-0.019 (0.016)	0.200*** (0.058)	0.046 (0.112)	-0.042 (0.112)	-0.038 (0.069)
Regression Estimates of Friends' 'Quality'	0.016*** (0.004)	0.006 (0.005)	0.010* (0.005)	-0.005 (0.005)	0.025*** (0.006)	0.008 (0.007)	0.009 (0.008)	-0.006 (0.006)
Regression Estimates of the Interaction between 'Quality' and 'Quantity' of Friends					-0.004** (0.002)	-0.001 (0.004)	0.000 (0.004)	0.001 (0.002)
Number of Students	7394							
<b>B. Matriculation Test Scores</b>								
Regression Estimates of Friends' 'Quantity'	0.062*** (0.018)	0.040 (0.025)	-0.025 (0.024)	-0.014 (0.021)	0.068 (0.061)	0.115 (0.100)	0.036 (0.087)	-0.076 (0.076)
Regression Estimates of Friends' 'Quality'	0.010*** (0.003)	0.005* (0.003)	0.005 (0.004)	-0.005 (0.003)	0.010* (0.005)	0.008* (0.005)	0.007 (0.005)	-0.008 (0.005)
Regression Estimates of the Interaction between 'Quality' and 'Quantity' of Friends					0.000 (0.002)	-0.003 (0.004)	-0.003 (0.002)	0.002 (0.003)
Number of Students	7404							

Table 6: continued

	Without Interaction				With Interaction			
	Reciprocal Friends	Followers	Rejecters	Second Circle of Reciprocal Friends	Reciprocal Friends	Followers	Rejecters	Second Circle of Reciprocal Friends
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>C. Probability of Receiving a Matriculation Diploma</b>								
Regression Estimates of Friends 'Quantity'	0.029*** (0.009)	0.001 (0.012)	-0.016 (0.013)	-0.003 (0.010)	0.048 (0.041)	-0.028 (0.060)	-0.064 (0.070)	0.051 (0.052)
Regression Estimates of Friends 'Quality'	0.006*** (0.002)	0.001 (0.002)	0.003 (0.003)	0.001 (0.002)	0.007** (0.003)	0.000 (0.003)	0.001 (0.004)	0.004 (0.003)
Regression Estimates of the Interaction between 'Quality' and 'Quantity' of Friends					-0.001 (0.001)	0.001 (0.002)	0.002 (0.003)	-0.002 (0.002)
Number of Students	2519							
<b>D. Total Number of Successfully Completed Matriculation Exams' Unit</b>								
Regression Estimates of Friends 'Quantity'	0.821*** (0.243)	0.107 (0.334)	-0.518 (0.315)	0.062 (0.270)	1.300 (1.097)	-0.394 (1.636)	-1.751 (1.709)	0.734 (1.312)
Regression Estimates of Friends 'Quality'	0.196*** (0.047)	0.062 (0.048)	0.096 (0.071)	-0.003 (0.063)	0.230*** (0.077)	0.042 (0.093)	0.035 (0.100)	0.035 (0.090)
Regression Estimates of the Interaction between 'Quality' and 'Quantity' of Friends					-0.019 (0.038)	0.019 (0.059)	0.047 (0.065)	-0.026 (0.046)
Number of Students	2519							
Treatment Means of Friends 'Quality'	<i>16.162</i>	<i>9.642</i>	<i>9.248</i>	<i>12.580</i>				

**Notes:** The treatments are the number of friends by type in class, the 'quality' of friends by type (set to zero if the student has no friends in class) in class and their interaction. The estimates in columns 1-4 are from the same regression that includes as treatments the number of friends by type in class and the 'quality' of friends by type in class; the estimates in columns 5-8 of each part are from the same regression that includes as treatments the number of friends by type in class, the 'quality' of friends by type in class and their interaction. Each regression includes as controls the number of friends by type in school; a dummy variable that equals one if the student has no friends in class by type; students' characteristics (gender, parental education, number of siblings, immigration status and dummies for four ethnicity groups) and middle school class and year fixed effects. The 'quality' index of friends by type in class is the sum of the mean education of the friends' fathers and the mean education of the friends' mothers less the proportion of friends from Asia/Africa ethnicity and the mean number of siblings of friends. Standard errors are clustered by class and are reported in parentheses. Treatment means of friends 'Quantity' are reported in italics (the means differ by friendship types because the 'quality' of friends by type was set to zero if the student has no friends in class). Significance level of regressions are reported as follows: "\*\*\*"=1% level, "\*\*"=5% level, and "\*"=10% level.

**Table 7: Estimated Effect of 'Quality' and 'Quantity' of Reciprocal Friends, Followers, Rejecters and Second Circle of Reciprocal Friends in Class on GEMS Test Scores, By Sub-Groups**

	Reciprocal Friends	Followers	Rejecters	Second Circle of Reciprocal Friends	Reciprocal Friends	Followers	Rejecters	Second Circle of Reciprocal Friends
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>A. By Gender</b>								
	<b>Boys</b>				<b>Girls</b>			
Regression Estimates of Friends' 'Quantity'	0.120*** (0.023)	-0.009 (0.034)	-0.035 (0.038)	-0.016 (0.023)	0.052** (0.022)	0.036 (0.028)	-0.025 (0.034)	-0.031 (0.028)
Regression Estimates of Friends' 'Quality'	0.013** (0.007)	0.015** (0.007)	0.020** (0.007)	-0.011 (0.007)	0.017*** (0.006)	0.001 (0.007)	0.002 (0.006)	0.000 (0.007)
Treatment Means of Friends 'Quality'	<i>16.204</i>	<i>9.647</i>	<i>9.027</i>	<i>13.126</i>	<i>16.850</i>	<i>10.333</i>	<i>9.554</i>	<i>12.545</i>
Outcome Means	<i>-0.110</i>				<i>0.120</i>			
Number of Students	3818				3576			
<b>B. By Student's Age</b>								
	<b>Young</b>				<b>Old</b>			
Regression Estimates of Friends' 'Quantity'	0.067** (0.024)	0.026 (0.038)	-0.042 (0.039)	-0.016 (0.028)	0.089*** 0.019	0.008 0.029	-0.020 0.038	-0.026 0.022
Regression Estimates of Friends' 'Quality'	0.018*** 0.005	0.014* 0.008	0.004 0.008	-0.012 0.008	0.016** 0.005	0.000 0.006	0.013** 0.006	-0.001 0.006
Treatment Means of Friends 'Quality'	<i>15.910</i>	<i>9.577</i>	<i>9.221</i>	<i>12.040</i>	<i>16.338</i>	<i>9.938</i>	<i>9.015</i>	<i>12.961</i>
Outcome Means	<i>0.063</i>				<i>-0.035</i>			
Number of Students	2793				4601			
<b>C. By Parental Education</b>								
	<b>High Parental Education</b>				<b>Low Parental Education</b>			
Regression Estimates of Friends' 'Quantity'	0.042** 0.020	0.038 0.034	-0.056 0.039	-0.008 0.027	0.113*** 0.021	0.005 0.033	-0.015 0.029	-0.022 0.023
Regression Estimates of Friends' 'Quality'	0.008 0.007	0.011 0.007	0.012 0.008	-0.009 0.007	0.022*** 0.005	0.006 0.006	0.013** 0.006	-0.011 0.007
Treatment Means of Friends' 'Quality'	<i>20.243</i>	<i>11.742</i>	<i>10.655</i>	<i>15.435</i>	<i>14.133</i>	<i>8.600</i>	<i>8.552</i>	<i>11.174</i>
Outcome Means	<i>0.408</i>				<i>-0.227</i>			
Number of Students	2629				4765			

Notes: The estimates of each part in columns 1-4 are from the same regression and so are the estimates of each part in columns 5-8. Each regression controls for the number of friends by type in school and includes a dummy variable that equals one if the student has no friends in class by type, students' characteristics, class and year fixed effects. The quality index of friends by type is as defined in Table 6. High parental education is defined as more than 12 years of schooling for both parents. The "Young" group includes pupils born in September-December in the cohort year or later. The "Old" group includes pupils born in January-August in the cohort year or earlier. Standard errors are clustered by class and reported in parentheses. Treatment and Outcome means are reported in italics. Significance level of regressions are reported as follows: "\*\*\*"=1% level, "\*\*"=5% level, and "\*"=10% level.

**Table 8: Estimated Effect of Network Characteristics in Class on the Level of Mutual Help Reported in Class**

	Average Number of Direct Links	Average Number of Indirect Links	Average Number of Direct Links Supported	Ratio of Indirect to Direct Links	Ratio of Supported Direct Links to Overall Direct Links
	(1)	(2)	(3)	(4)	(5)
Regression Estimates	0.014	0.118	0.051	0.203**	0.354*
	(0.057)	(0.111)	(0.056)	(0.098)	(0.214)
Treatment Means	<i>1.365</i>	<i>0.637</i>	<i>1.116</i>	<i>0.535</i>	<i>0.778</i>
Outcome Mean	<i>4.121</i>				
Number of Classes	171				

Notes: The table report estimates of the effects of social network measures on the average amount of mutual support reported in class. The social network measures are: (1) the average number of direct links (reciprocal friends) in class; (2) the average number of indirect links (non-reciprocal friends) in class; (3) the average number of direct links which are supported in class; (4) the ratio of number of indirect to direct links in class; (5) the ratio of number of supported direct links to overall direct links in class. The estimates in each row in columns 1-5 are from the separated regression. Each regression includes students' characteristics, school and year fixed effects. Standard errors are clustered by class and reported in parentheses. Treatment and Outcome means are reported in italics. Significance level of regressions are reported as follows: “\*\*\*”=1% level, “\*\*”=5% level, and “\*”=10% level.

**Table 9: Estimated Effect of Number of Reciprocal Friends, Followers, Rejecters and Second Circle of Reciprocal Friends in Class on Behavioral Outcomes**

	<b>Reciprocal Friends</b>	<b>Followers</b>	<b>Rejecters</b>	<b>Second Circle of Reciprocal Friends</b>
	(1)	(2)	(3)	(4)
<b>A. Involvement in School Fights</b>				
Regression Estimates	-0.091*** (0.018)	-0.019 (0.025)	-0.012 (0.022)	-0.017 (0.020)
Outcome Mean	<i>1.730</i>			
<b>B. Fear from School Violence</b>				
Regression Estimates	-0.018 (0.019)	-0.003 (0.025)	0.028 (0.025)	-0.006 (0.018)
Outcome Mean	<i>1.604</i>			
<b>C. Social Satisfaction in Class</b>				
Regression Estimates	0.025 (0.020)	0.043* (0.023)	0.009 (0.021)	0.019 (0.021)
Outcome Mean	<i>5.184</i>			
<b>D. Overall Satisfaction from School</b>				
Regression Estimates	0.033 (0.021)	0.033 (0.025)	0.004 (0.022)	-0.003 (0.022)
Outcome Mean	<i>5.008</i>			
<b>E. Time Doing Homework</b>				
Regression Estimates	0.036 (0.085)	0.022 (0.092)	0.066 (0.095)	-0.064 (0.080)
Outcome Mean	<i>9.137</i>			
<b>F. Behavioral Outcome Index</b>				
Regression Estimates	0.163*** (0.053)	0.089 (0.065)	0.011 (0.059)	0.035 (0.056)
Outcome Mean	<i>20.878</i>			
Number of Students	<i>4529</i>			

Notes: The estimates in each row in columns 1-4 are from the same regression. Each regression controls for the number of friends by type in school and includes students' characteristics, class and year fixed effects. The behavioral outcomes index summarizes the answers of the previous parts (C + D - A - B). Standard errors are clustered by class and reported in parentheses. Outcome means are reported in italics. Significance level of regressions are reported as follows: "\*\*\*"=1% level, "\*\*"=5% level, and "\*"=10% level.