Peer effects and academic achievement: a regression discontinuity approach

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ABSTRACT

In this paper, I study ability peer effects among teenagers. The identification relies on a fuzzy regression discontinuity approach where assignment into high-ability classes constitutes the source of identifying information. An important feature of this system is that both types of classes are taught by the same teachers, they follow a common curriculum and take the same exams. Students are in general unaware of the system prior to school start as it is unofficial. In cases where they are informed of the system's existence, they do not know where the threshold lies and school switching possibilities are limited. I find significant and sizable effect on the academic achievement of students around the assignment threshold. Being assigned to a high-ability class increases academic achievement, measured by year grade and spring exam results, by 0.47 and 0.32 standard deviations, respectively.

1. Introduction

The effects of social interactions on individual behavior enthuses economists and policymakers alike. One question of particular interest is how peers enter the educational production. There is no general consensus on this though. Different theories attempt to explain this and according to some of them the average ability of classmates has detrimental effect on one's schooling outcomes while others imply that it enhances one's achievements (Marsh, 2005).

The exact causal mechanism of peer effects in education is also ambiguous. One possible, and most direct, channel for peer effects is that students instruct each other. Other possible channels are, for instance, classroom disruption and classroom atmosphere. Students could also be indirectly affected by their peers. This can for instance come about through the way teachers react to different groups of students. Another possibility is that if students are sorted into classes based on their ability, it might allow teachers to match instructions more closely to students' needs because of more homogenous group, which would benefit all students. However, my primary purpose with this paper is to establish empirically the existence and direction of peer effects but not to distinguish the channels by which peer effects operate.

In recent years the estimation of peer effects in schools has received much attention. Several studies have provided important findings about these effects in different circumstances. Among the studies finding that students benefit from being around high-achieving peers are Ammermueller and Pischke (2009), Goux and Maurin (2007), Graham (2008), Hoxby and Weingarth (2007), Sacerdote (2001), Sund (2009), and Carrell, Fullerton, and West (2009). The experimental literature provides complementary evidence on the importance of peers in learning processes (Eisenkopf, 2010).

In this paper I examine the effects of the ability of a student's classmates on her academic success in her first year of college, i.e., I explore whether better academic qualifications of a student's classmates can cause an effect on achievement. The problem one faces when estimating

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peer effect is that, as the saying goes, birds of feather flock together,[1] and the same applies to students. College students self-select their friends and they are likely to select friends whose unobservable characteristics are systematically related to theirs.

Even when students do not select their peers entirely voluntary there can be a relation between their characteristics. If a student decides, for instance, to enroll in a demanding course that is non-compulsory his classmates will probably have similar characteristics. As most high-school and college students choose their peers, it is usually difficult to estimate peer-effects in higher-education settings. In these cases and other situations where students choose their own peers we are subject to the reflection problem, i.e., if a student's peers have unobserved characteristics that are systematically related to her own, estimation of peer effects cannot be given a causal interpretation. If, for instance, a smart student tends to choose smart peers then it is not feasible to statistically distinguish between the effects of the her own intelligence and the effect of peer?s intelligence.

In this paper, I address this problem by employing a regression discontinuity (RD) design where student assignment into high-ability (HA) classes constitutes the source of identifying information. The basic intuition behind this approach is that, in the absence of program manipulation, students just below the treatment-determining grade cutoff should provide valid counterfactual outcomes for students just above the cutoff, who were assigned to HA classes.

I use data on 5 years of entering students at an Icelandic high school to test for peer effects among classmates. The outcome variable of interest is the academic achievement measured by the end of their first year. There are approximately 270 incoming students each year that are divided into 10 classes out of which 3–4 classes are HA classes but the rest of the students are randomly assigned to normal classes. The system is not official so prior to enrollment students and their parents are, in most cases, not aware of the fact that streaming into classes will take place.

Once students learn whether they are in a normal or HA class their outside options are rather limited if they decide to drop out. They will most likely have to wait at least one semester to get into another high school and for a whole year in order to get into those that are most sought-after. Also, the school under consideration has for long been a favorite among Icelandic student and it is believed to be a good signal of high-academic ability to have graduated from there. Since it will be hard for students to get as good a signal of their academic ability at another high school at this point in time it is difficult to see why students would be willing to drop out and thereby let go of this signal because they did not get into a HA class.

The same teachers are assigned to normal and HA classes, they cover the same material and all students take

the same exams. Selection into classes is mostly based on students' assignment grades, defined as the average of their results in Mathematics, Icelandic, English and Danish on the standardized tests for 10th grade and their school grades in these subjects. The probability of being assigned to a HA class therefore jumps at the 60th or 70th percentile of the assignment grade, depending on which year we consider. This discontinuity in the probability of being assigned to a HA class therefore allows me to use a fuzzy RD design to capture the effect the ability of class peers have on one's own school achievement.

Using a RD approach I restrict the estimation to the discontinuity in the assignment probability for a HA class since this will essentially result in a randomized experiment, i.e., I compare outcomes for the students whose grades are just below and just above this 60th or 70th percentile threshold since they on average will have similar characteristics except for the treatment. Students just above and just below the threshold are therefore treated as the treatment and control group, respectively. Those students slightly below the threshold provide the counterfactual outcomes for the students slightly above since the treatment status is randomized in a neighborhood of the threshold. Jumps in the relationship between assignment grade and grades by the end of the first year in the neighborhood of the HA class threshold can therefore be taken as evidence of a treatment effect.

The contribution of this paper is twofold. First, the way I measure peer ability is an improvement over existing studies. The majority of previous empirical evidence on ability peer effects in education comes from studies that are either based on data that does not include class identifiers or they examine the effect of academic ability of peers without having direct measures of their academic ability but rely instead on background characteristics as proxies for this (see, for instance, Hoxby (2000) for the US and Ammermueller and Pischke (2009) for several European countries). Since students spend a relatively big part of their time in class they are very likely to be significantly influenced by their classmates. It is therefore very important to be able to identify this group. To the best of my knowledge, this is the first paper that is both able to identify classmates and measure peer ability directly using their test scores from standardized national exams and school exams.

Second, I am not aware of other papers that employ a fuzzy regression discontinuity strategy to extract the causal impacts of peers ability on achievement. However, Bui, Craig, and Imberman (2011) have applied the same method to estimate the effects of gifted and talented services on students, i.e., they estimate combined effect of better peers, higher quality teachers and a change in curriculum. The advantage of the setting of this paper over their setting is how clean the treatment is, the only difference between the normal and HA classes is the quality of peers since they are taught by the same teachers, they follow a common curriculum and take the same exams.

I find that assigning students to a class with students that are on average of higher ability, holding everything else constant, has a positive and significant effect on their

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[1] The saying describes the tendency of individuals to associate with others who are similar to themselves, a phenomenon known as homophily.