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Do selective high schools improve student achievement? Effects of exam schools in China☆

Kathryn Anderson [a], Xue Gong [b], Kai Hong [a,*], Xi Zhang [b]

[a] Vanderbilt University, VU Station B#351819, 2301 Vanderbilt Place, Nashville, TN 37235, USA
[b] Beijing Academy of Educational Sciences, 95 Beisihuandonglu, Chaoyang District, Beijing 100101, China

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ABSTRACT

We use regression discontinuity design to examine the effect of a system of public exam high schools, which admit students solely by pre-existing achievement, on student college entrance exam scores in Beijing, China. More selective exam schools may have higher peer quality and sometimes are equipped with more experienced teachers and better facilities. We find, however, that elite exam high schools, which are the most selective, have no effects on student test scores. We find that on average the system of exam schools improves student performance on the exam, which indicates that students benefit from attending more selective *non-elite* schools. The results on qualifying for college admission are consistent with our findings about test scores. Differences among schools in peer achievement, student/teacher ratio and the percentage of certificated and experienced teachers partially explain our findings; self-choices of track and exam participation do not explain test scores or college admission.

1. Introduction

More than 80,000 ninth grade students took the high school entrance exam on June 26, 2014 in Beijing; the exam was given in about 3000 classrooms and lasted for three days. Performance on the exam would decide which middle school students would attend high school in the fall semester. High schools vary in quality, and the competition to get into elite schools is severe; the minimum requirement for admission to some elite schools is to score as high as 95% on the entrance exam. College admission is also based on an exam taken after high school, and graduation from a higher-ranked college usually indicates that the student will obtain a good job with a higher salary and better working conditions. Parents and students think that graduation from an elite high school with high quality teachers and high-ability peers increases the probability that the student is admitted to a good college; graduation from an elite high school can be the ticket to a student's successful future career.

The exam school system is one of the most important parts of Chinese education; many public resources are involved, but its effectiveness in improving student achievement remains unclear. The evidence on the effectiveness of elite schools which admit students by exam score is under debate in the United States. A recent article in *Slate* magazine advocates that "super-elite public

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* Corresponding author at: Robert F. Wagner Graduate School of Public Service, New York University, 295 Lafayette Street, New York, NY 10012.
E-mail addresses: kathryn.anderson@vanderbilt.edu (K. Anderson), gong.sophie@gmail.com (X. Gong), kai.hong@nyu.edu (K. Hong), zhangxi87@gmail.com (X. Zhang).

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schools aren't necessary any more" (Salam, 2014). The author of the article looks at Stuyvesant High School in New York City and describes several potential problems at elite high schools like Stuyvesant; most of these problems are associated with the fierce competition at the schools which encourages languishing among lower-ranked students and cheating on exams. Salam's solution is to close such one-size-fits-all elite schools and spread gifted students across a wide range of high schools.

The elite school model is found in countries other than China and the United States. Romania, Trinidad and Tobago, and the United Kingdom have elite schools that admit students based on an admission test score, especially at the high school level, and the majority of public high schools in Singapore are exam schools. Evaluations of student performance in exam schools produce mixed results. The positive effect of elite schools on the final year test scores is found in studies by Pop-Eleches and Urquiola (2013) in Romania, Jackson (2010) in Trinidad and Tobago and Park, Shi, Hsien, and An (2015) in rural China. Other studies show little to no effect of exam schools on student outcomes, including Abdulkadiroglu, Angrist, and Pathak (2014) in Boston and New York City, Dobbie and Fryer (2014) in New York City, Clark (2010) in the United Kingdom, Lucas and Mbiti (2014) in Kenya and Ajayi (2014) in Ghana. The studies of elite schools which admit students by lottery also show no consensus. The positive effect on test scores is found by Hastings and Weinstein (2008) in Charlotte-Mecklenburg, North Carolina, but little evidence of a positive effect on student achievement is found by Zhang (2014) in urban China and Cullen, Jacob, and Levitt (2006) in Chicago.[1]

One possible reason for the mixed results is that the elite school is not a homogenous educational experience; many characteristics related to achievement can affect academic outcomes. In most cases elite schools admit higher ability students. Students are influenced by their peers, and students may learn more if they interact with smarter peers (Hoxby & Weingarth, 2006). However, studies of exam schools find positive peer effects in some cases (Jackson, 2013, in Trinidad and Tobago) and no peer effects in others (Abdulkadiroglu et al., 2014, in Boston and New York City). Higher school quality is another expected characteristic of elite schools, although it is difficult to precisely measure quality. Some literature shows that school quality and teacher qualification have positive effects on student performance (Lai, Sadouolet, & de Janvry, 2011, in China). Since school quality is multidimensional, elite schools do not necessarily outperform other schools in all school quality measures which have significant impacts on student exam performance.

Another possible explanation for the mixed results concerns differences in samples across school settings (Park et al., 2015). An RDD study compares students near the cutoff, and the result of this comparison may depend on the school setting. If the studied system of schools is in a rich metropolitan area and the elite schools are extremely selective, a significant positive effect of the elite school is less likely. The students who fail to enter an elite school in this setting may still get admitted to a high-quality school. Their families may also have sufficient resources that are used to complement school quality. On the flip side, if the studied system of schools is in a poor rural area, the potential gap in quality between elite schools and other schools can be very large. Families also lack resources to fill the quality gap between schools, and we may observe significant effects of elite schools on academic performance. In an extreme case where the educational system is inefficient, even elite schools cannot effectively improve student performance.

One difficulty in measuring the effect of exam schools is the admission rule itself. Students admitted by higher-ranked schools perform better than other students on the admission test. Performance on the test reflects how well students did in school before the test and is positively correlated with student ability and parental resources. Students in higher-ranked schools are more likely to obtain higher scores on exams even if they are enrolled in a lower-ranked school because these students, on average, are more able and have more parental resources. The crucial empirical problem in the evaluation of the effectiveness of elite exam schools is modelling this selection by ability. Several recent studies implement regression discontinuity design (RDD) to solve the selection problem (Hahn, Todd, & van der Klaauw, 2001; Imbens & Lemieux, 2008; Lee & Lemieux, 2010).

Our paper evaluates the effect of exam schools in Beijing on academic performance using the RDD strategy. Each school has a minimum test score for admission. None of the individual school cutoffs are deterministic; students can attend an exam school with scores below the relative cutoff, and students with scores above the cutoff can attend another lower-ranked school. The structure for admission into high schools fits the fuzzy RDD setting.[2] The forcing variable by which students are assigned to schools is their score on the entrance exam to high school (SEEH); the main outcome of high school selection is the score on the entrance exam to college (SEEC).

Our study contributes to the existing literatures in several ways. First, we examine the effect of a couple of elite schools and all of the other non-elite exam schools in a large metropolitan area of China. All of these schools follow the same student admission rules but with different admission cutoff points. We have multiple settings for these schools and are able to examine whether the sample differences across settings explain the mixed findings in literature. Second, the distribution of student achievement is broad across the exam schools in our study. With RDD we can only identify the effect at the cutoff, but our study provides stronger external validity by identifying the effects of elite schools at multiple cutoffs. Finally, our paper examines whether there are heterogeneous effects by gender and parental education and occupation, and we provide insight into whether selective exam schools in Beijing decrease the gender gap in achievement and variation in achievement by parental background.

[1] Zhang (2014) studies the effect of elite middle schools that admit students by lottery in a provincial capital city in China. He finds that attending elite middle schools has no significant impact on high school entrance exam scores.

[2] Students can attend a higher-ranked school because they are able to obtain extra scores if certain requirements are satisfied, such as being of minority race or the child of a martyr. Students choose a lower-ranked school rather than higher-ranked schools for which they are eligible because, when students report their school preferences, they do not rank those higher-ranked schools above the school they actually attend.