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Is Reputational Pressure Enough to Create Competitive School Choice Effects? Evidence from Seoul's School Choice Policy

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During the pandemic, a number of states instituted hold-harmless funding policies to protect school district financially from declining enrollments (Center for Public Education, 2021). In addition, some school choice policies have protected traditional public schools financially from declining enrollments. Together, these policies raise the question of whether competitive effects can exist in a policy environment of reduced financial pressure. Theoretically, despite the lack of financial pressure, schools could feel competitive pressure in other ways including a loss of reputation as students move to schools of choice (Epple, Romono, & Urquiola, 2017; Friedman, 1962; MacLeod & Urquiola, 2009; Urquiola, 2016). To provide insights on whether schools can improve without the threat of financial loss, we examine the Seoul school choice program which introduced autonomous private high schools (APHSs) in the context in which there is equalized funding across schools. More specifically, we examine whether competition induced by APHSs affects the achievement of students attending traditional public and private schools. The effect of APHSs is identified by exploiting plausible exogenous APHSs' entry through the random assignment of students. We find a small and positive effect of APHS penetration on the Korean and English achievement of private school students while finding no effects for traditional public schools, which have limited ability to respond.

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Abstract

During the pandemic, a number of states instituted hold-harmless funding policies to protect school district financially from declining enrollments (Center for Public Education, 2021). In addition, some school choice policies have protected traditional public schools financially from declining enrollments. Together, these policies raise the question of whether competitive effects can exist in a policy environment of reduced financial pressure. Theoretically, despite the lack of financial pressure, schools could feel competitive pressure in other ways including a loss of reputation as students move to schools of choice (Epple, Romono, & Urquiola, 2017; Friedman, 1962; MacLeod & Urquiola, 2009; Urquiola, 2016). To provide insights on whether schools can improve without the threat of financial loss, we examine the Seoul school choice program which introduced autonomous private high schools (APHSs) in the context in which there is equalized funding across schools. More specifically, we examine whether competition induced by APHSs affects the achievement of students attending traditional public and private schools. The effect of APHSs is identified by exploiting plausible exogenous APHSs' entry through the random assignment of students. We find a small and positive effect of APHS penetration on the Korean and English achievement of private school students while finding no effects for traditional public schools, which have limited ability to respond.

1. **Introduction**

As school districts experienced declining enrollment during the pandemic, at least 14 states implemented hold-harmless policies to protect school districts financially.[1] [2] In addition, in some cases, policies have been put into place to protect traditional public schools financially from losing students to schools of choice (Atherton & Rubado, 2014; Hess, 2010; Roza & Fullerton, 2013). For instance, as part of the compromise of initiating the Washington, D.C. voucher program, Congress provided traditional public schools with more money, which muted any financial pressure that came from losing students to the voucher program (Hess, 2010). Additionally, as the Milwaukee voucher program grew over time, the school district substantially increased per pupil funding for traditional public schools, even as district enrollment declined (Hess, 2010). Similarly, in Chile, public schools experienced a substantial drop in student enrollments after the introduction of a voucher program but did not experience a similar drop in school resources as revenue losses from the central government were covered by municipal offices (Hsieh & Urquiola, 2006). While the hold-harmless policies put into place during the pandemic were meant to be temporary, it is it is possible that these policies may persist in the future.[3] Given this, along with the fact that policymakers in some cases have financially protected traditional public schools from the loss of students to schools of choice, there is a question of whether school of choice programs can create competitive effects in an environment without the financial pressure that comes from a loss of revenue associated with a loss of enrollment.

Advocates for school choice argue that creating greater enrollment choices for families leads to healthy competitive pressure resulting in a "rising tide" of improved quality for all schools

[1] https://www.nsba.org/-/media/NSBA/File/cpe-hold-harmless-research-brief-2021.pdf
[2] https://reason.org/commentary/how-should-states-count-students-to-calculate-school-funding/
[3] www.the74million.org/article/smith-some-clues-to-what-states-will-do-when-school-covid-funding-runs-out/

(Chaubb & Moe, 1990; Hoxby, 2003). These advocates argue that competition encourages a variety of school options (Friedman, 1962), which allows parents to choose educational programs that better address their child's needs and interests. In this competitive environment, schools may have an incentive to make improvements, especially in ways valued by families. If families put a high value on academic quality, school leaders may channel their resources into activities that are more directly related to raising student achievement (Hoxby, 2003; Rouse & Barrow, 2009). Theoretically, the most prominent means of creating competitive pressure is through financial pressure as government funding is often allocated to schools based on student enrollment. However, there could be other means of creating competitive pressure including reputational pressure (Epple, Romono, & Urquiola, 2017; Friedman, 1962; MacLeod & Urquiola, 2009; Urquiola, 2016). If a school has a loss of reputation, it could affect the peer groups within schools and working conditions of teachers. One could argue that reputational pressure could be more acute than financial pressure because, in a traditional public-school setting, school districts rather than schools hold the "purse strings" and teachers (who are the main conduit for learning) are likely to be more worried about the school's working conditions than the district's financial budget. In this paper, we investigate whether competitive effects can exist in an environment of reduced financial pressure by examining the introduction of a Seoul school choice policy that holds schools financially "harmless" as students switch to schools of choice.

Seoul's school choice policy was adopted in 2010, which was a significant departure from its prior High School Equalization Policy (HSEP). HSEP was adopted in 1974 to ameliorate excessive competition for elite high schools by introducing uniformed and centralized policies for school curriculum, finance, operation, student admission, and tuition. In addition, HSEP randomly assigned students to public and private schools within school districts, which deprived families of

the right to choose a school and eliminated competition for students across public and private schools. With the introduction of school choice policy in 2010, the Seoul local education agency (LEA) abolished random assignment of students and introduced greater enrollment choice for families by authorizing some private schools to convert into autonomous private high schools (APHSs) and became "schools of choice". APHSs are different from traditional public and other private schools (TPPSs) in that they have more freedom from government regulation and have greater autonomy over decision-making in school operation and curriculum in exchange for financial independence from the government (see Table 1 for comparison across different types of schools). Because Seoul's school choice program holds TPPSs harmless from financial pressure, Seoul's school choice program can be used to study whether schools show any student achievement improvement without financial pressure that comes from a loss of student enrollment.

The remaining portion of the paper proceeds as follows. The first section describes how reputational pressure may manifest in the Korean context. The second section outlines the previous studies on the effects of school choice on student achievement. The third section explains the school system in Korea and the Seoul school choice policy. The fourth discusses data used in this study and methodological strategies. The fifth section reports the main results, and the sixth section concludes.

2. School Choice Policy and Reputational Pressure

Before empirically examining whether competitive effects can exist without financial pressure, it is important to describe how competitive effects can theoretically manifest in general. We should make clear that the mechanism of how a school could respond to competitive pressure would not necessarily vary whether it is from financial or reputational pressure. For instance, regardless of whether schools feel financial or reputational pressure, competition may increase school

productivity by pushing schools to improve practices (Chubb & Moe, 1990; Hoxby, 2002, 2003; Nathan, 1996). To the degree that reputational pressure manifests differently, it could manifest in a number of ways. For instance, schools will want to maintain their reputation because a loss of reptation could lead to a loss of quality students, which could reduce positive peer influences (Zimmer & Toma, 2000). Furthermore, the loss of quality students could reduce teachers' working conditions as these teachers will have to educate a more challenging set of students. As a result, teachers may be less inclined to work at schools with a weak reputation for quality. Evidence to support these hypotheses comes from management literature which suggests that a decline in an organization's reputation can lead to a loss of customers (Fombrun, & Shanley, 1990) or their ability to attract high quality employees (Cable & Turban, 2001), which, together, can affect the organization's success (Deephouse & Carter, 2005). To avoid these consequences, schools and their teachers may try to work smarter and harder to retain the reputation of their schools.

In the context of South Korea, if a school experiences a loss of reputation, high-achieving students may apply to APHSs. Their departure will increase the proportion of academically low performing students in TPPSs reducing positive peer effects which could affect teachers' pedagogical practices and classroom management (Lavy, Paserman, & Schlosser, 2011), making a teacher's job more difficult. As the job becomes more challenging, some teachers may look for other opportunities, including at APHSs, to improve working conditions. Also, poor reputation can lead to distrust of the public school system among parents and students, which is important for a supportive environment. Results of a survey and an interview conducted among TPPSs teachers show that teachers think the introduction of APHSs significantly increased distrust of the public school system as well as the percentage of low-achieving students among TPPSs,

which, they believe, reduced the quality of their school and instruction (Kim, 2013; Kim 2014).[4] Thus, schools and teachers could feel pressure to maximize their reputation by improving their students' academic performance.

In this paper, we attempt to investigate whether schools can improve performance without the threat of financial pressure by examining the impact the introduction of APHSs on the performance of students attending TPPS. To answer this question, we must address the endogeneity of school location and student sorting. If, for example, private schools are more likely to be located in areas with a high percentage of low-achieving public schools, a negative association between increased competition and public-school achievement could be found. Likewise, if private schools attract low-achieving students from public schools, the average achievement of public-school students could artificially improve. If unaddressed, the endogeneity of school location and student sorting may lead to biased estimates.

To address the potential endogeneity of school location and student sorting, we draw upon two features of the Korean education system. First, to address the issue of student sorting, we utilize data from high school seniors who were randomly assigned to their schools in 2008 and 2009 (i.e., the 2008 and 2009 cohorts) but attended school while their school faced competition induced by APHSs in 2010 and 2011. Because they entered high school before the introduction of the school choice policy, they were randomly assigned to schools. These randomly assigned cohorts of students allow us to measure the impacts of competition without concerns of endogenous student

[4] Amid criticisms that autonomous private high schools have detrimental impacts on regular public and private schools, as well as concerns about growing inequality and achievement gaps induced by the introduction of APHSs, the Ministry of Education and the Seoul Metropolitan Office introduced several policies aimed at removing the special status of APHSs (Kim 2021; Ock, 2019; Yu, 2013). These policies included transitioning them into regular schools and allowing any students to apply to APHSs regardless of their achievement level. However, some of these attempts were met with staunch resistance and legal challenges from autonomous private schools and parents who chose to send their children to these schools.

sorting, as these students will be the focus of any possible change in student achievement. Second, we take advantage of the equalized school system to address the endogeneity of school location. APHSs were introduced in a school system where school resources and (within-district) student body compositions had been equalized across the schools due to the HSEP. This means that the level of APHS competition is not associated with school and student characteristics for the 2008 and 2009 cohorts. Based on the plausible assumption of exogenous competition, we examine whether cross-sectional and cross-time variation in the level of APHS competition is associated with changes in TPPSs' achievement. Overall, we find evidence suggesting that APHSs generate small and positive competitive impacts on Korean and English achievement of students attending non-APHS private schools but have no effect on traditional public schools.

3. Previous empirical research

In recent years, researchers have synthesized the literature on U.S. voucher and charter programs, including the competitive effects. Zimmer and colleagues (2021) found mixed evidence of the competitive effects of charter schools while Epple and colleagues (2017) and Jabbar and colleagues (2022) concluded that the results for competitive effect for voucher programs have been more positive, even if they are generally small. These researchers have also noted that not all of the previous research has entirely addressed the two sources of endogeneity of non-random sorting of students and school locations. Focusing on previous studies of charter competition in the U.S., which is most analogous to the possible competitive effects of APHS, most of the early research used panel data sets with a combination of student and school fixed effects to address the non-random sorting of school locations and student sorting (Bifulco & Ladd, 2006; Booker, Gilpatric, Gronberg, & Jansen, 2008; Sass, 2006; Zimmer & Buddin, 2009). However, estimates from these fixed effects models can be biased if there are time-varying school and student-level characteristics

that affect students' outcomes. Because of concerns that the initial set of studies did not fully address the sources of endogeneity, subsequent studies adopted more causal approaches, such as instrument variables (e.g., Imberman, 2011), difference-in-differences (Bukowski & Kobus 2018; Mumma, 2022), and regression discontinuity (e.g., Clark, 2009), to address the issues of student sorting and school location.

For example, Imberman (2011) used an instrumental variable approach where building stock near traditional public schools is the instrument. Cordes (2018) controlled for schools' achievement trends prior to charter school entry to address concerns that charter school entry might be associated with pre-existing achievement trends and, to address the issue of student sorting, Cordes conducted an intent-to-treat analysis that fixes students in their original schools of attendance regardless of whether they transferred. As another alternative, Mumma (2022) employed a difference-in-differences (DiD) approach and compared performance of students in public schools near actual charter schools with those near sites which were proposed by a charter school but were never occupied.[5]

Among these quasi-experimental studies, results of Cordes (2018) and Mumma (2022) bolster findings of previous studies in that they found null- or positive impact of competition. However, Mumma also found evidence suggesting that the characteristics of schools located near charter schools are significantly different from those located farther away in terms of levels and trends. Additionally, Imberman (2011) found negative impacts of charter schools in his analysis based on an IV approach. These findings suggest that fixed-effect models might not be able to

[5] In related research, Gilraine, Petronijevic, and Singleton (2021) examined whether a horizontally or a non-horizontally charter can create competitive effects, In their analysis, the authors exploited a policy change in which the cap in the number of charter schools was lifted in North Carolina, which allowed the authors to use a difference-in-differences approach by comparing test score changes for students who lived near entering charter schools with test score changes for students who lived farther away.

fully remove biases induced from by systematic differences that vary over time between schools exposed to high-level competition and those introduced to lower levels of competition.

A small number of studies have examined this topic using data from other countries such as Nepal (Thapa, 2013), Poland (Bukowski & Kobus 2018), Sweden (Bohlmark & Lindahl, 2007) and the United Kingdom (Clark, 2009). Clark (2009) evaluated a U.K. reform that allows high schools to become autonomous schools (i.e., Grant-Maintained schools). Clark did not find evidence that Grant-Maintained schools have any significant impacts on the achievement of neighborhood public schools. Using data from Poland, Bukowski and Kobus (2018) investigated the impact of autonomous schools on public school achievement. The authors employed a DiD approach and compared achievement of schools that were exposed to a higher level of competition with that of schools that experienced a smaller increase in the level of competition before and after the reform. For the total sample the authors did not find any significant competitive effects of autonomous schools, but, for more competitive urban educational markets, they found a drop in public schools' test scores following the increased competition. Similarly, Bohlmark and Lindahl (2007) found that an increase in enrollment share in publicly funded but privately operated schools raise the average achievement of all pupils in Sweden. Finally, Thapa (2013) examined private school competition in Nepal. Of note, when examining competitive effects using an OLS model, he found no competitive effects. However, when employing an instrumental variable approach to address endogenous school locations, the results are positive.

Across both domestic and international studies, studies have not isolated reputational pressure as a source of competitive effects, which is the purpose of this current study.

4. Background of the Korean School System

The school system in Korea consists of six years of elementary school, three years of middle school, and three years of high school. Due to a law passed in 1974, Korea has a highly centralized school system. The 1974 law eliminated school choice in favor of random student assignment, standardized school curriculum, operations, and financing of private and public schools. Prior to 1974, when a universal school choice program was in place, there was fierce competition among middle-school students for prestigious high schools. Admission criteria based on academic achievement increased students' dependency on the use of tutors (Sorensen, 1994). Additionally, low-secondary schooling was geared toward preparing students for high school entrance examinations. Out of concerns about excessive exam pressure and fierce competition, the High School Equalization Policy (HSEP) of 1974 was passed in Pusan and Seoul, the two largest metropolitan areas in Korea, and were eventually adopted in other major metropolitan areas (Kim, Lee, & Lee, 2008). The HSEP banned entrance exams for most high schools and opened up secondary education to the wider public. Also, under the HSEP, the government regulated private and public schools by adopting uniform and centralized policies for tuition, curriculum, finance, and teachers. Due to the HSEP, few differences between public and private schools exist in Korea as shown in Table 1. Additionally, school choice policies were eliminated in favor or within-district random assignment of students, which equalized the compositions of schools' student bodies across public and private schools within the same districts (Hahn, Wang, &Yang, 2018; Kang, 2007). Student enrollment sizes at these schools were and continue to be decided and managed by 17 metropolitan or provincial offices of education.

In 2010, Seoul's High School Choice Policy substantially modified the student assignment of the HSEP by adopting a universal high school choice policy (Kim, 2018).[6] The school choice

[6] Since the Seoul Metropolitan Office of Education has jurisdiction over 11 school districts and the public and private schools located in them, school districts are equivalent to catchment areas in the U.S (Oh & Sohn, 2021).

policy has two main components. First, the introduction of autonomous private schools. More specifically, the policy allowed private high schools to convert into autonomous private high schools by giving these schools autonomy over personnel, operational, and curricula decisions. Table 2 provides an overview of the types and number of high schools from 2009 to 2014. In 2010, 14 APHSs opened with an additional 13 opening in 2011 across 11 school districts in Seoul. Any private schools can apply for conversion to an autonomous one. Among applicants, the LEA and the Ministry of Education authorized conversion into APHSs for private schools whose finances were considered to be stable and strong enough to be independent from the government. At least one APHS opened in every school district (see Table A1).

The policy also introduced autonomous public high schools. They have greater autonomy in school curriculum and operations but to a lesser degree compared to APHSs because autonomous public high schools are still public institutions that are publicly financed. Autonomous public high schools differ from APHSs in that their creation was initiated by the LEA's effort to improve the productivity of low-performing high schools, especially those located in disadvantaged areas, through increased financial support and autonomy in curriculum. However, they are still public institutions that are publicly financed and are subjected to governmental regulations in many aspects of school operation including teacher salary or tuition levels.[7]

Seoul comprises 605. 25 km2 (233.69 square miles), and there are 11 school districts in Seoul. That means the average district size is 55.02 km2 (21.24 square miles). In 2011, the average school district in Seoul had about 22 academic high schools and about 28,890 students.

[7] Compared to traditional public schools, autonomous public schools have greater autonomy in certain aspects of school operation. For example, autonomous public schools located in non-high school equalization policy regions can selectively admit students based on their academic achievements when these schools are oversubscribed (autonomous public schools located in HSEP regions still use a lottery system to admit students). Additionally, autonomous public schools are allowed to hire a certain percentage of their teachers among those who submit their applications to their schools. However, only those who were already employed by metropolitan or provincial offices of education can apply to these schools, and their teacher salary follows the same salary level as that of traditional public-school teachers. Furthermore, they have greater freedom in making curriculum decisions, similar to autonomous private schools.

Second, the policy significantly expanded school choice by allowing middle school graduates to apply to any high school of their choice regardless of school type. However, to admit students, schools must follow common admission rules. First, students who want to apply to APHSs or special purpose schools[8], such as science or foreign language schools, must submit their application to these types of schools. In order to apply to APHSs, students' middle school GPA should be above the median score. These two types of schools use their own criteria to select students, but they are not allowed to set a separate test. Then, those who did not get admission in the first stage and the rest of the students who did not apply to APHSs or special purpose apply to the other types of high schools that include public, non-APHS private, and autonomous public high schools. These schools admit 20 percent of their students in this stage. When public, non-APHS private, and autonomous public high schools are oversubscribed, admissions are determined by a random lottery selection process. Students who are not assigned to any school are considered for their next preferred schools located in their own school districts. Forty percent of the public, non-APHS private, and autonomous public schools' spots are filled in this stage. Students who have not been assigned to any school of their choice through these stages are randomly assigned to open seats in schools within their own or adjoining school districts, which means that all public and non-APHS private schools are guaranteed to have nearly all their seats filled, reducing any financial pressure.

It is important to note that the Seoul LEA expands school choice while maintaining features of the HSEP for TPPSs. In Table 1, we show differences existing between private and public schools before and after the introduction of the school choice policy. Due to HSEP, private schools are publicly operated in Korea. In exchange for this high level of control, the government provides

[8] Special purpose high schools are public and private schools that provide specialized education in a particular area such as science or foreign language.

financial subsidies to private schools for teacher salaries and school operating expenditures. Government funding of private schools in Korea is similar to voucher programs in the United States, in that public money is used for students to attend private schools. However, there are important differences between these two. For instance, in the U.S., voucher programs are generally means tested while Korean programs are not. In addition, U.S. voucher programs may not cover the full cost of private school, while students in Korea are allowed to go to any school at the same cost because the Korean government maintains the same tuition rates for private and public high schools, which are generally very low.[9] Additionally, while voucher programs in the U.S. do not limit private schools' autonomy, government funding of private schools in Korea puts restrictions on private schools' autonomy in school operation and curriculum, including their student selection. Private schools in the United States are closer to APHSs than Korea's traditional private schools in that they have great autonomy in curriculum, personnel decisions, school operation, and student admission in exchange for financial independence from the government.

As shown in Table 1, the school choice policy brought no change in autonomy of operation, curriculum, funding, teacher hiring, and student selection for TPPSs. The only notable difference between these two periods for TPPSs is that the policy has introduced freedom for students to choose a school. Also of note, the school choice program was designed so it does not affect total enrollment in TPPSs as APHSs are not allowed to expand their student enrollment beyond their initial share of the total enrollment among public and private schools in Seoul. Additionally, students attending a TPPS are allowed to transfer to a APHS only when there are open seats in APHSs. Furthermore, as explained above, students who are not admitted to any school through the

[9] In 2010, the annual tuition fee for public and private high schools was about 1,300 USD. The tuition was waived for students from low-income families. The Korean government started to provide free education to all high school students from 2021.

admission procedures are randomly assigned to open seats in TPPSs, which minimizes any financial competitive pressure for these schools. This is in contrast to school choice programs in other countries in which a loss of enrollment often leads to reduced funding for traditional public schools. This policy feature makes Korea an interesting location to examine competitive effects, as it allows us to examine whether competitive effects through reputational pressure can exist without financial pressure.

Finally, and importantly, in Korea, only private schools have autonomy over personnel decisions (Hahn et al., 2018; Kim, 2017). In private schools, the school board appoints a school principal and determines their term. Teachers are also directly hired by private schools.[10] Principals or school boards decide who they will hire with or without tenure and who will get promoted to a tenured position or a more senior position. Private schools tend to hire a higher proportion of teachers with a fixed-term contract compared to public schools (Hahn et al., 2018; Kim, 2017). Due to these conditions, private school principals and teachers face job security issues compared to their public counterparts (Hahn et al, 2018), and are likely more susceptible to students' and parents' evaluation for their teaching, which could manifest through their school choice. Because school boards and principals can take evaluations from students and their families into consideration in their hiring or promotion decisions, private school teachers may be more likely to respond to newly imposed reputational pressure by improving their teaching. Additionally, autonomy may allow the flexibility to reorganize their workforces to address newly induced competition for private schools, which is not the case for public schools. That means autonomy over personnel decisions makes it possible for private schools to better address newly introduced

[10] Even though private schools have autonomy in teacher hiring, they still are required to hire individuals who earned a teaching certificate by completing the required number of credit hours at an accredited teacher education institution.

reputational pressure by taking student learning outcomes into account in their teacher promotion and hiring decisions.

In contrast, Korean public schools have little autonomy over their staffing decisions including hiring and promotion. Public school teachers are employed by metropolitan or provincial offices of education. To work in a tenured position in a public high school, one must pass a test administered by metropolitan and provincial offices of education. Once hired, teachers are assigned to positions within the city or province by the local educational authority. Teachers' promotion to a senior administrative position is largely determined by their years of teaching and participation in performance development training. Due to these institutional differences between public and private schools, we would expect to see a higher reputational effect in private schools.

5. Data and estimation strategies

5.1. CSAT data

In order to measure the competitive effects of APHSs on the achievement of students attending TPPSs, we utilize the Ministry of Education data. We obtained the data from the EduData Service System (EDSS). The EDSS randomly selects 70 percent of the schools located in Seoul and provides detailed data on school administration, including school budget, curriculum, and test scores for the 70 percent of randomly chosen students from each school. The EDSS data are available from 2009, which is one year before the implementation of Seoul's school choice policy.

The EDSS does not provide information on school name and school location. However, the EDSS data have detailed school-level information, such as the number of teachers or students who dropped or transferred out. Using school-level information, we successfully linked the EDSS data with the Seoul school data which are publicly available on the Seoul LEA's website. Because

the Seoul LEA Seoul data include school name and location, merging these datasets allowed us to identify the name and location of the schools in our data sample.

Our analysis includes data from 2009 and 2011. The school choice policy was officially announced on August 30, 2009 and was enacted at the start of the 2010 school year. The main outcomes are the College Scholastic Aptitude Test (CSAT) English, Korean, and math scores of twelfth graders who entered higher school between 2007 and 2009 and took the CSAT between 2009 and 2011. Twelfth graders take the CSAT at the end of their third year of high school. The CSAT aims to measure knowledge and skills that are assumed to be important for academic success in college and is used for college admission in Korea. Scores from the CSAT are nationally standardized at a mean of 100 with a standard deviation of 20 in each year. We rescaled the CSTA scores to have a mean of zero and a standard deviation of one.

The 2009 data include the CSAT scores of the 2007 cohort who entered (in 2007 school year) and graduated high school before the implementation of the school choice policy in 2009 school year. In contrast, the 2010 and 2011 data include the records of the 2008 and 2009 cohorts who were randomly assigned to their school in the 2008 and 2009 school years but attended school under the school choice program during the 2010 and 2011 school years. We excluded students who graduated in the previous years and retook the exam because we cannot identify when they attended high school. After dropping these students, we aggregated student-level scores into school-level scores. We dropped schools that have a missing value in CSAT scores in any of the years of our study.

Table 3 provides descriptive information for schools in our data sample. Column 1 reports school characteristics and CSAT scores during the pre-policy period (i.e., 2009). The other columns of Table 2 show the CSAT scores and school characteristics during the post-policy period

(i.e., 2010 and 2011). There are 116 schools in our sample and 74 of them are non-APHS private schools. The average CSAT scores of these schools rarely changed across the years of study. Spending per student and the student-teacher ratio rarely changed in TPPSs after the implementation of the school choice policy compared to their levels in the pre-policy period.

In addition, we do not observe measurable changes in student characteristics. The only exception is the percentage of free lunch (FL) students[11]; between 2009 and 2011 the percentage of FL students increased from 10% to 16.6%. This is probably because APHSs attracted high-income students among incoming cohorts (i.e., the 2010 and the 2011 cohorts), which might have increased the percentage of FL students in TPPSs among these cohorts of school choice. It is important to note that this change in student composition among incoming school-choice cohorts did not affect the composition of the 2007, 2008, and 2009 cohort of students (i.e., the sample of our study) who were admitted before the school choice policy as we show in Table 4. Another notable change is the number of APHSs within 5 *km*. The table shows that the opening of APHSs in 2010 and 2011 significantly increased the average number of APSHs within 5 *km* between 2009 and 2011.

5.2. Estimation strategies

To estimate the competitive effect, we take advantage of two features of the school choice program. First, APHSs were introduced in the school system where school resources and (within-district) student body compositions across schools were equalized due to the HSEP and random student assignment. This means that school and student characteristics should not be associated

[11] Only low-income students were eligible for free lunch in high schools before the Seoul Metropolitan Office of Education started a free lunch program for all high school students in 2021. To be certificated as eligible for free lunch, students were required to submit documentation proving their households belong to the lowest income group registered in the Korean National Basic Livelihood Security System or their household income belongs to the bottom 11% in the income distribution. For example, in 2010, about 0.9 million students (in total about 13% of the elementary, middle, high school students) received free lunch across the nation.

with levels of AHPSs competition for the 2008 and 2009 cohorts, which mitigates concerns over endogenous location. Second, we address the issue of student sorting by exploiting data from high school seniors who were randomly assigned to their school in 2008 and 2009 (i.e., the 2008 and 2009 cohorts) but received schooling while their school faced competition induced by the new school choice policy in 2010 and 2011. Even though they attended high school during the time that the school choice policy was in place in 2010 and 2011, they were still subject to the previous random assignment policy. This means that these students did not choose their schools, rather they were randomly assigned by the previous policy. When they transferred to another school district, they were randomly assigned to a school within the district. Furthermore, as we can see in Table 4, only a small percentage of this cohort transferred out of their school in 2010 and 2011. Because of the random assignment of student cohorts prior to the introduction of the school choice policy, we can measure the impacts of competition without student sorting.

Based on this assumption of exogenous competition and student random assignment, we estimate the following OLS specification to measure the impact of competition based on reputational pressure:

$$CSAT_{it} = \beta_0 + \beta_1 C_{it} + X_{it}\zeta + D\eta + Y_t + \varepsilon_{it} \quad (1)$$

where $CSAT_{it}$ is the average math, Korean, and English CSAT scores of school i in year t. This model utilizes 2010 and 2011 CSAT scores of high school seniors who were randomly assigned to their high school in 2008 and 2009 in order to address the issue of student sorting. $C_{it,}$ the variable of interest, represents the measures of competition faced by school i. X_{it} is a vector of school characteristics that include the percentage of free lunch students and the percentage of male students. We also include $Y_{t,}$ a year dummy to control for the citywide trends that are common across schools. D refers to district fixed effects which allows us to compare schools within the

same district and, therefore, account for any unobserved district factors. β_0 is the intercept, and ε_{it} is the idiosyncratic error term. Robust standard errors are clustered at the school district level because students were randomly assigned within districts.

Following an approach taken in the literature (e.g., Booker et al., 2008; Bifulco & Ladd, 2006; Jinnai, 2014; Sass, 2006; Zimmer & Buddin, 2009), we use the number of APHSs within a given radius (i.e., 5 *km*) as our measure of competition. This approach assumes that schools that have more APHSs within a given distance are likely to face more threat to lose high achieving students to APHSs than schools that have lesser APHSs (Bifulco & Ladd, 2006). We also report the results of a model in which we measure competition by the actual number of students lost to APHSs (Booker et al, 2008). This approach counts the number of new students APHSs successfully attracted in each school year rather than just counting the number of schools without considering their size.

We also employ a school-fixed effects model using cross-time variation existing in the level of competition that the introduction of APHSs created. While we think it is unlikely that school characteristics is associated with APHS school locations because of the equalization of resources and random assignment created under the previous HSEP policy, we do include school-fixed effects to account for time-invariant school characteristics that might lead to the non-random sorting of APHS schools. This model utilizes the 2009, 2010, and 2011 CSAT scores of high school seniors who were randomly assigned to their high school in 2007, 2008, and 2009. The 2007 cohort entered and graduated high school before competition from APHSs was introduced. In contrast, the 2008 and 2009 cohorts received schooling when their high schools faced competitive pressure exerted from APHSs. Using their scores, this model examines whether

varying levels of APHS competition existing across years leads to achievement gains in these cohorts' high schools.

$$CSAT_{it} = \beta_0 + \beta_1 C_{it} + X_{it}\zeta + Y_t + \theta_i + \varepsilon_{it} \quad (2)$$

where $CSAT_{it}$ is the average math, Korean, and English CSAT scores of school i in year t. $C_{it,}$ the variable of interest, represents the measures of competition faced by school i. X_{it} is a vector of time-varying school characteristics that include the percentage of free lunch students and the percentage of male students. $Y_{t,}$ is a year dummy, and θ_i refers to unobserved school fixed effects that account for all the unobserved school characteristics that are stable over time. ε_{it} is the idiosyncratic error term. Robust standard errors are clustered at the school district level.

6. Results

6.1. Verifications of exogenous competition

The validity of the results depends on the assumption that the school choice policy introduced exogenous competition when measured within each school district. Fig 1 shows the distribution of students' 2009 CSAT English, Korean, and math scores (pre-policy outcomes) for schools exposed to different levels of competition. A high-level competition is defined as having three or more APHSs within 5 *km* in 2011 while a low-level competition is defined as having two or lesser APHSs within 5 *km* in 2011. We do not see measurable differences in the distribution of pre-policy period CSAT English, Korean, and math scores.

We also test whether there is any significant relationship between the level of competition a school is exposed to and its base-line characteristics (i.e., pre-treatment) using i) the number of APHSs within 5 *km* radius (Table 5A) and ii) the number of new incoming students that APHSs successfully recruited within 5 *km* radius (Table 5B) as measures of competition. We regress these two measures of competition on school-level average 2009 CSAT scores and school characteristics

including the percentage of FL students, spending per pupil, teacher student ratio, a private school indicator, and the percentage of teachers with an advanced certificate, and the percentage of male students. If APHSs had introduced exogenous competition during the years of study, there should be no significant relationship between these school characteristics and the level of competition to which a school is exposed. Results are reported in Table 5A and Table 5B. Results indicate that none of the school characteristics significantly explain the level of competition, which suggests that the school choice policy has introduced exogenous competition to TPPSs when competition is measured *within a school district* due to the HSEP and random student assignment in place.

6.2. Competitive effects of APHSs in cross sectional analysis

Table 6 and Table A2 report the impact of competition, defined by the number of APHSs within 5 km radius (Table 6) and the number of freshmen attending APHSs within 5 km radius (Table A2) on CSAT English, Korean, and Math scores. Model 1 reports an estimate from a regression with no other control variables except district dummies. The result indicates positive effects of APHS competition on Korean, English, and math scores, but none of the coefficients are statisitically significnat. Model 2 introduces controls for student body characteristics including the percentage of FL students and the percentage of male students. Controlling these student characteristics shrinks the standard errors of the coefficient estimates substantally without meaningfully changing the coefficient estimates, which indicate that these measures of APHS competition are exogenously related to these characteristcs. After controlling school characteristics, the coefficient estimate for English becomes significant. We find that that each additional APHS is associated with an increase of 0.029 of a standard deviation in English scores. Similarly, in Table A2, we also find that one standard deviation increases in the number of 10^{th} graders that APHSs successfully attracted would increase English scores by 0.03 of a standard deviation. However, we

do not find evidence suggesting that APHSs competition significantly increase Korean and math scores.

6.3. Competitive effects of APHSs in cross-time analysis

In our cross-time analysis, we compare the achievement of high school seniors who were randomly assigned to their schools in 2008 and 2009 to high school seniors who were randomly assigned to their schools in 2007. The basis of this analysis is that because high school lasts three years in South Korea, those who entered in 2007 completed high school without ever experiencing the competitive effects of AHSs, whereas those who were randomly assigned to their schools in 2008-2009 finished their last 1-2 years of schooling in schools that experienced varying levels of competition across the years.

Using this framework, we then employ a fixed effect approach with the results shown in Table 7 and Table A3. In Table 7, we report the effect of competition defined by the number of APHSs within a 5 km radius. When estimated without any controls, the fixed effects estimate indicates that every additional number of APHSs would increase TPPSs' Korean scores by 0.014 of a standard deviation, which is also statisitcally significant. In contrast, for English and math scores, the estimates are positive, but they are not significantly different from zero. The addition of controls for school characteristics does not meaningfully change APHS competition estimates.

In Table A3, we report fixed effects specifications of APHS competition measured by the number of freshmen attending APHSs within a 5 km radius. The coefficient of APHS competition is 0.019 of a standard deviation in Korean after controlling student body characteristics, which is also statistically significant. For English, the coefficient estimate is 0.012, but it is not significantly different from zero. Likewise, the estimate for math is positive but statistically insignificant. Overall, fixed-effects specification provides results similar to those of OLS cross-sectional

specification in Table 6 and Table A2 in that the coefficient estimates show mostly zero to small positve impact of APHS competition.

6.4. Subgroup effects

Next, we examine whether the competitive effect of APHS on student achievement differs by school type. As a reminder, because traditional private schools have more autonomy, including autonomy over personnel decisions, compared to traditional public schools, theory would suggest that traditional private schools have greater ability to respond to reputational pressure and are more likely to experience a positive competitive effect.

In Table 8, we report separate estimates of the impact of APHS for traditional private schools (panel A) and traditional public schools (panel B). Competition is defined by the number of APHSs within a 5 km radius. Consistent with theory, we find some evidence of competitive pressure for private schools, but no evidence for traditional public schools. More specifically, for private schools, the coefficient estimate is 0.0195 of a standard deviation for Korean and 0.017 of a standard deviation for English, and these estimates are statistically significant. In contrast, we do not find a significant effect of APHS competition on the Korean and English achievement of public schools. We also do not find evidence suggesting that APHSs competition significantly increases math scores for traditional private and public schools.

In Table A4, we report estimates of APHS competition for traditional private schools (panel A) and traditional public schools (panel B), when competition is measured by the number of freshmen who were newly admitted to APHSs. Again, consistent with theory, we find some evidence for competitive effects in private schools, but no evidence in public schools. More specifically, the coefficient estimate for Korean is positive and significant for private schools; one standard deviation increase in the number of freshmen in APHSs is estimated to increase Korean

scores by 0.023 of a standard deviation for private schools. However, we do not find a significant effect of APHS competition on private schools for English and math at the 0.05 level. For traditional public schools, we do not find a statistically significant effect in any case.

6.5. Falsification test

In this section, we conduct a placebo test by estimating the effect of APHS using the data from 2009, 1 year before the introduction of APHSs. If competition is induced by the introduction of APHSs, post-treatment measures of competition should not have significant effects on student achievement in the pre-treatment period. We report the results of this placebo test for private schools (Table A5) and public schools (Table A6) separately. None of estimates for APHS competition are statistically significant, which suggests that the positive effects on Korean and English achievement among private schools during the post-reform period are driven by the introduction of APHSs.

6.6. Robust check: Autonomous public high school

With the introduction of APHSs, the Seoul LEA simultaneously converted some of the public high school into autonomous schools. One could argue that the areas where APHSs entered more were also ones that experienced substantial growth in the number of autonomous public high schools. If this was the case, then the growth in autonomous public high schools, rather than the growth in APHSs improved student achievement. In this case, our models overstate the achievement gains from APHSs. We test this possibility by adding an indicator for autonomous public high school competition in Table A7 and A8. The point estimates essentially remain unchanged compared to the estimates reported in Table 6, A2, 7 and A3, which suggests that the impact of APHS is exogenously related to autonomous public high schools.

7. Conclusion

A number of states have recently implemented hold-harmless policies as a means of protecting school districts financially from student enrollment losses suffered during the pandemic. Furthermore, policymakers in some locations have protected school districts from the loss of enrollment due to school choice programs. While it is unclear whether these hold-harmless polices will persist in the future, it does raise the question of whether school choice programs can create improvement in traditional public schools without financial pressure. We examine this question by examining a Seoul, South Korea school choice program and its effect on the achievement of students attending TPPSs. In Seoul's school choice program, students who are not admitted to any of their schools of choice are randomly assigned to remaining seats in TPPSs, which leaves these schools financially unaffected. By taking advantage of this unique feature of the policy, we estimate the competitive effects of APHSs without financial pressure that comes from a loss of enrollment.

In our analysis, we find evidence of an overall positive effect. This result is driven by a positive competitive effect in private schools, as the estimates across all tested subjects are small and statistically insignificant for public schools. We attribute the positive effects in private schools to the greater level of autonomy private schools have to react to the loss of students. These results suggest it is possible to create competitive effects without financial consequences embedded in a school choice program, but it also suggests that autonomy is important for realizing these positive effects. Before drawing definitive conclusions, it is important to do further qualitative work to examine how Seoul's schools reacted to the loss of students and to examine whether schools without financial pressure experienced positive effects in other locations.

Table 1
Levels of autonomy by school type during the pre- and post-policy periods

	Pre-choice		Post-choice		
	Traditional public	Traditional private	Traditional public	Traditional private	Autonomous private
Autonomy in teacher hiring	no	yes	no	yes	yes
Autonomy in curriculum	no	no	no	no	yes
Autonomy in student admission	no	no	no	no	yes
Autonomy in tuition	no	no	no	no	yes
Financial independence	no	no	no	no	yes
Autonomy in teacher salary	no	no	no	no	yes
Students' freedom to choose school	no	no	yes	yes	yes

Table 2
The number of high schools in Seoul

	2009	2010	2011	2012	2013	2014
Public schools	84	78	71	72	73	73
Private schools	131	120	107	108	110	110
Autonomous public schools	0	7	17	19	19	19
Autonomous private schools	0	14	27	26	25	25
Special purpose schools	16	18	19	19	20	20

Source: Data from the Ministry of Education, Technology, and Science

Table 3
Descriptive statistics for schools represented in 2009-2011

year	2009	2010	2011
Korean	0.03	0.01	-0.01
	(0.24)	(0.24)	(0.25)
English	0.04	0.01	-0.01
	(0.32)	(0.31)	(0.31)
Math	-0.04	-0.05	-0.06
	(0.25)	(0.25)	(0.23)
# of APHSs within 5 km	0	1.46	2.66
Distance to the nearest APHS	0	4.05	2.80
# private schools	74	74	74
% boys	48.25	48.39	48.83
% free lunch	10.01	12.20	16.56
avg class size	35.36	35.22	35.78
budget per pupil (unit 1,000 won)	4286.48	4808.84	4963.78
% teachers with an advanced certificate	74.33	73.95	72.88
% teachers with a fixed-term contract	7.64	8.97	10.93
teacher student ratio	17.21	16.66	16.00
# schools	116	116	116

Table 4
Percentage of the 2008 and 2009 cohorts who transferred to another school

		2010	2011
Cohort 2008	% transfer-out	1.58	NA.
Cohort 2009	% transfer-out	0.18	0.17

Source: Data from the Ministry of Education, Technology, and Science

Table 5A
Test of exogenous competition

	Number of APHSs within 5 km								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
English	0.488								
	(0.476)								
Korean		0.0141							
		(0.711)							
Math			0.486						
			(0.771)						
% of FL students				-0.0343					
				(0.0265)					
Spending per pupil					-0.000101				
					(8.30e-05)				
Teacher student ratio						-0.0523			
						(0.0817)			
Non-APHS Private school							-0.381		
							(0.350)		
% of teachers with an advanced certification								-0.0145	
								(0.0129)	
% of male students									0.00175
									(0.00164)
District fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note: Regressions include district fixed effects. Data comes from 2009 years. ** p<0.01, * p<0.05

Table 5B
Test of exogenous competition

	Number of APHS 10th graders within 5 km								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
English	0.346								
	(0.297)								
Korean		0.0343							
		(0.448)							
Math			0.354						
			(0.482)						
% of FL students				-0.0281					
				(0.0169)					
spending per pupil					-7.70e-05				
					(5.13e-05)				
Teacher student ratio						-0.0547			
						(0.0770)			
Private school							-0.287		
							(0.222)		
% of teachers with an advanced certification								-0.0103	
								(0.00814)	
% of male students									0.000969
									(0.00121)
District fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note: Regressions include district fixed effects. Data comes from 2009 year. ** p<0.01, * p<0.05

Table 6
OLS regression estimates of the effects of the introduction of APHSs competition on traditional public and private schools: competition is measured by the number of APHSs within a 5 km radius

	# of APHSs within a 5 km radius					
	Korean	Korean	English	English	Math	Math
APHS competition	0.0163	0.0137	0.0373	0.0292**	0.0155	0.00686
	(0.0172)	(0.00990)	(0.0181)	(0.00854)	(0.0132)	(0.0101)
% FL students		-0.0107*		-0.0168*		-0.0133*
		(0.00402)		(0.00598)		(0.00430)
% of male students		-0.00337**		-0.00292**		-0.000874*
		(0.000268)		(0.000264)		(0.000284)
District fixed effects	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓
Observations	232	232	232	232	232	232
R-squared	0.409	0.743	0.515	0.727	0.494	0.609

Note: The dependent variable is 2010 and 2011 Korean, English, and Math CSTA scores. Robust standard errors that adjust for clustering at the district level are beneath parameter estimates. Regressions include year and district fixed effects. Data comes from 2010 to 2011 years.
** p<0.01, * p<0.05

Table 7
School fixed effects regression estimates of the effects of the introduction of APHSs competition on traditional public and private schools (Data 2009 though 2011): competition is measured by the number of APHSs within a 5 km radius

	# of APHSs within a 5 km radius					
	Korean	Korean	English	English	Math	Math
APHS competition	0.0132*	0.0137*	0.00848	0.00917	0.000697	0.00127
	(0.00517)	(0.00567)	(0.00567)	(0.00617)	(0.00628)	(0.00605)
% FL students		0.000524		0.000715		0.00151*
		(0.000569)		(0.000705)		(0.000626)
% male students		0.000832		0.00406		0.00488*
		(0.00269)		(0.00339)		(0.00191)
School fixed effects	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓
Observations	348	348	348	348	348	348
R-squared	0.108	0.111	0.110	0.119	0.032	0.048
Number of school IDs	116	116	116	116	116	116

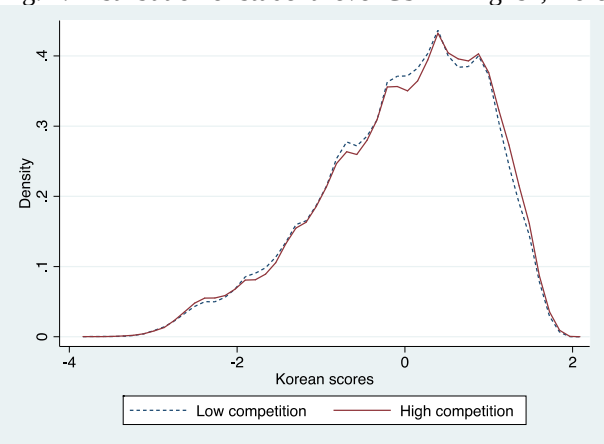
Note: The dependent variable is Korean, English, and Math CSTA scores. Competition is measured by the number of APHSs within a 5 km radius. Robust standard errors that adjust for clustering at the district level are beneath parameter estimates. Regressions include year and school fixed effects. Data come from 2009 to 2011.
** p<0.01, * p<0.05

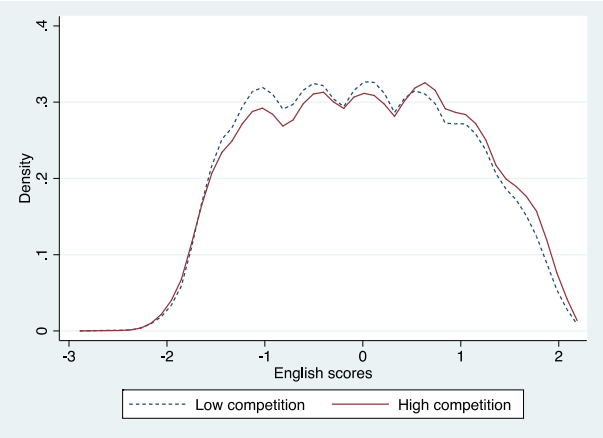
Table 8
School Fixed effects regression estimates of the effects of the introduction of APHSs competition on traditional public and private schools (Data 2009 though 2011): competition is measured by the number of APHS within a 5 km radius

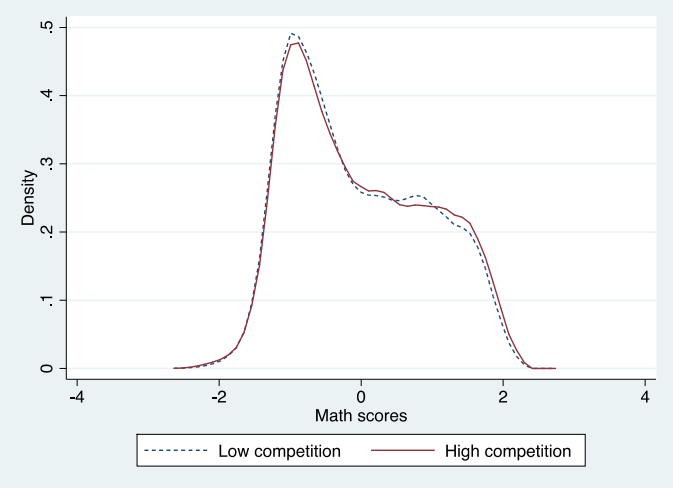
	Private			Public		
	Korean	English	Math	Korean	English	Math
	(1)	(2)	(3)	(1)	(2)	(3)
APHS competition	0.0195*	0.0169*	0.0102	0.00323	-0.00422	-0.0162
	(0.00621)	(0.00718)	(0.00614)	(0.00825)	(0.00931)	(0.0089)
% FL students	0.000163	0.000540	0.00150*	0.000751	0.000706	0.00203
	(0.000911)	(0.000892)	(0.000662)	(0.000855)	(0.00126)	(0.00130)
% male students	-0.00318	-3.37e-05	0.00360	0.00185	0.00511	0.00585**
	(0.00518)	(0.00642)	(0.00709)	(0.00220)	(0.00396)	(0.00173)
School fixed effect	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓
Observations	222	222	222	126	126	126
R-squared	0.203	0.213	0.047	0.029	0.049	0.137
Number of school IDs	74	74	74	42	42	42

Note: The dependent variable is Korean, English, and Math CSTA scores. Competition is measured by the number of APHSs within a 5 km radius. Robust standard errors that adjust for clustering at the district level are beneath parameter estimates. Regressions include year and school fixed effects. Data come from 2009 to 2011.
** p<0.01, * p<0

Fig. 1. Distribution of student-level CSAT English, Korean, and Math scores by the level of competition







Note: Kernel densities of student-level 2009 CSAT English, Korean, and Math scores. High competition is defined as having 3 or more APHSs within 5 *km* in radius. Low competition is defined as having 2 or lesser APHSs within 5 *km* in radius.

References

Atherton, M. J., & Rubado, M. E. (2014). *Hold harmless education finance policies in the US: A survey*. Philadelphia: Temple University, Center on Regional Politics. Retrieved from: https://williampennfoundation.org/sites/default/files/reports/Hold%20Harmless.pdf

Bifulco, R., & Ladd, H. F. (2006). The impacts of charter schools on student achievement: Evidence from North Carolina. *Education Finance and Policy*, *1*(1), 50-90

Bohlmark, A., & Lindahl, M. (2007). *The impact of school choice on pupil achievement, segregation and costs: Swedish evidence*. (IZA DP No. 2786). Retrieved from: http://ftp.iza.org/dp2786.pdf

Booker, K., Gilpatric, S. M., Gronberg, T., & Jansen, D. (2008). The effect of charter schools on traditional public-school students in Texas: Are children who stay behind left behind? *Journal of Urban Economics*, *64*(1), 123–145.

Bukowski, P., & Kobus, M. (2018). The threat of competition and public school performance: Evidence from Poland. *Economics of Education Review*, *67*, 14-24.

Cable, D. M., & Turban, D. B. (2001). Establishing the dimensions, sources and value of job seekers' employer knowledge during recruitment. In *Research in Personnel and Human Resources Management* (Vol. 20, pp. 115–163). Emerald Group Publishing Limited.

Center for Public Education. (2021). *How states implement hold-harmless provisions in 2020 and 2021*. National School Board Association. Retrieved from: https://www.nsba.org/-/media/NSBA/File/cpe-hold-harmless-research-brief-2021.pdf

Chubb, J. E., & Moe, T. M. (1990). *Politics, markets, and America's schools*. Washington, DC: Brookings Institution Press.

Clark, D. (2009). The performance and competitive effects of school autonomy. *Journal of Political Economy*, *117* (4), 745–783.

Cordes, S. A. (2018). In pursuit of the common good: The spillover effects of charter schools on public school students in New York City. *Education Finance and Policy*, *13*(4), 484-512.

Deephouse, D. L., & Carter, S. M. (2005). An Examination of Differences Between Organizational Legitimacy and Organizational Reputation*. *Journal of Management Studies*, *42*(2), 329–360.

Epple, D., Romono, R.E., & Urquiola, M. (2017). School vouchers: a survey of the economic literature. *Journal of Economic Literature*, *55*(2): 441-492.

Fombrun, C., & Shanley, M. (1990). What's in a Name? Reputation Building and Corporate Strategy. *Academy of Management Journal*, *33*(2), 233–258.

Friedman, M. (1955). The role of government in education. In R.A. Solo (Ed.), *Economics and the public interest* (pp.123-144) New Brunswick, NJ: Rutgers University Press.

Friedman,M. (1962) *Capitalism and freedom*. Chicago: University of Chicago Press.

Gilraine, M., Petronijevic, U., & Singleton, J. D. (2021). Horizontal Differentiation and the Policy Effect of Charter Schools. *American Economic Journal: Economic Policy*, *13*(3), 239–276.

Hahn, Y., Wang, L. C., & Yang, H. S. (2018). Does greater school autonomy make a difference? Evidence from a randomized natural experiment in South Korea. *Journal of Public Economics, 161*, 15-3

Hess, F. M. (2010). Does school choice "work". *National Affairs*, *5*(1), 35–53.

Hoxby, C. (2002). Would school choice change the teaching profession? *The Journal of Human Resources*, *37*(4), 846-891.

Hoxby, C. (2003). School choice and school productivity: Could school choice be a tide that lifts all boats? In C. M. Hoxby (Ed.), *The economics of school choice*. Chicago: University of Chicago Press.

Hsieh, C. T., & Urquiola, M. (2006). The effects of generalized school choice on achievement and stratification: Evidence from Chile's voucher program. *Journal of public Economics*, *90*(8-9), 1477-1503.

Imberman, S. (2011). The effect of charter schools on achievement and behavior of public-school students. *Journal of Public Economics*, *95*(7-8), 850–863.

Jabbar, H., Fong, C., Germain, E., Li, D., Sanchez, J., Sun, W. & Devall, M. (2019). The competitive effects of school choice on student achievement: A systematic review. *Educational Policy, 36*(2), 247–281

Jinnai, Y. (2014). Direct and indirect impact of charter schools' entry on traditional public schools: new evidence from North Carolina. *Economics Letters*, *124*(3), 452–456.

Kim, A. (2021, August 23) Will abolishing private schools fix public education? *The Korea Herald*. Retrieved from: https://www.koreaherald.com/view.php?ud=20210823001002

Kang, C. (2007). Classroom peer effects and academic achievement: Quasi-randomization evidence from South Korea. *Journal of Urban Economics*, *61*(3), 458-495.

Kim, H. (2014, September 4) Jasago 6gote powidon Ilbango mollak [Downfall of public and private schools surrounded by autonomous private high schools] *Hangyeorae*. Retrieved from: https://www.hani.co.kr/arti/society/schooling/654325.html

Kim, J. (2013, April 2) Gogyo gyosa 10 myoungjung 9 myoung ilbango wigi sanghwang [90% of teachers said traditional public and private schools are facing a crisis] *Hangukilbo*. Retrieved from: https://www.hankookilbo.com/News/Read/201304022180203585

Kim, Y. (2017). Does autonomy over teacher hiring affect student math and science achievement? *Education Economics, 25*(6), 562-574.

Kim, Y. (2018). The effects of school choice on achievement gaps between private and public high schools: Evidence from the Seoul high school choice program. *International Journal of Educational Development, 60.*

Kim, T., Lee, J. H., & Lee, Y. (2008). Mixing versus sorting in schooling: Evidence from the equalization policy in South Korea. *Economics of Education Review, 27*(6), 697-711.

Lavy, V., Paserman, M. D., & Schlosser, A. (2012). Inside the black box of ability peer effects: Evidence from variation in the proportion of low achievers in the classroom. *The Economic Journal, 122*(559), 208-237.

MacLeod, W. B., & Urquiola, M. (2009). *Anti-lemons: school reputation and educational quality*, No. w15112. Cambridge, MA: National Bureau of Economic Research.

Mumma, K. (2022). The Effect of Charter School Openings on Traditional Public Schools in Massachusetts and North Carolina. *American Economic Journal: Economic Policy, 14*(2), 445–474.

Nathan, J. (1996). *Charter schools: Creating hope and opportunity for American education*. San Francisco, CA: Jossey-Bass.

Ock, H. (2019, November 7) Elite high schools to be abolished in 2025. *The Korea Herald.* Retrieved from: https://www.koreaherald.com/view.php?ud=20191107000794

Oh, S. J., & Sohn, H. (2021). The impact of the school choice policy on student sorting: evidence from Seoul, South Korea. *Policy Studies, 42*(4), 415–436.

Rouse, C. E., & Barrow, L. (2009). School Vouchers and Student Achievement: Recent Evidence and Remaining Questions. *Annual Review of Economics, 1*(1), 17–42.

Roza, M., & Fullerton, J. (2013). Funding phantom students: state policies insulate districts from making tough decisions. *Education Next, 13*(3), 8-17.

Sass, T. (2006). Charter schools and student achievement in Florida. E*ducation Finance and Policy*, *1*(1), 91–122

Sorensen, C. W. (1994). Success and education in South Korea. *Comparative Education Review*, *38*(1), 10-35.

Thapa, A. (2013). Does private school competition improve public school performance? The case of Nepal. *International Journal of Educational Development*, *33*(4), 358-366.

Urquiola, M. (2016). Competition among schools: Traditional public and private schools. In H. F. Ladd, & E. B. Fiske (Eds.), *Handbook of research in education finance and policy* (pp. 209–237). New York: Routledge Publishing.

Yu, K. (2013, August 20) Autonomous schools: Expanding school choice is a worthy goal. *The Korea Herald*. Retrieved from: https://www.koreaherald.com/view.php?ud=20130820000568

Zimmer, R., & Buddin, R. (2009). Is charter school competition in California improving the performance of traditional public schools? Public administration review 69(5), 831-845.

Zimmer, R., Buddin, R., Smith, S.A, & Duffy, D. (2021). Nearly three decades into the charter movement, what has research told us about charter schools? in Brian McCall (Eds.). *The Routledge handbook of economics of education*, New York: Routledge Publishing

Zimmer, R. & Toma, E.F. (2000). "Peer Effects in Private and Public Schools Across Countries." *Journal of Policy Analysis and Management*, Vol. 19 (1).

Table A1
Distribution of APHSs in school districts in 2011

	School district	Number of APHSs
1	Gangnam	5
2	Gangseo	4
3	Gangdong	2
4	Seongbuk	2
5	Seobu	4
6	Nambu	1
7	Dongjak	1
8	Seongdong	1
9	Dongbu	2
10	Bukbu	2
11	Jungbu	3

Table A2
OLS regression estimates of the effects of the introduction of APHSs competition on traditional public and private schools: competition is measured by the number of APHS 10th graders within a 5 km radius

	# of APHS 10th graders within a 5 km radius					
	Korean	Korean	English	English	Math	Math
APHS competition	0.0194	0.0142	0.0434	0.0306*	0.0215	0.00886
	(0.0195)	(0.0114)	(0.0209)	(0.0115)	(0.0106)	(0.00785)
% FL students		-0.0107*		-0.0167*		-0.0133*
		(0.00408)		(0.00603)		(0.00431)
% male students		-0.00337**		-0.00291**		-0.000872*
		(0.000269)		(0.000267)		(0.000283)
District fixed effects	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓
Observations	232	232	232	232	232	232
R-squared	0.409	0.743	0.515	0.726	0.496	0.609

Note: The dependent variable is 2010 and 2011 Korean, English, and Math CSTA scores. Robust standard errors that adjust for clustering at the district level are beneath parameter estimates. Regressions include year and district fixed effects.
** p<0.01, * p<0.05

Table A3
School fixed effects regression estimates of the effects of the introduction of APHSs competition on traditional public and private schools (Data 2009 though 2011): competition is measured by the number of APHS 10th graders within a 5 km radius

	# of APHS 10th graders within a 5 km radius					
	Korean	Korean	English	English	Math	Math
APHS competition	0.0176*	0.0188**	0.0112	0.0119	0.00261	0.00310
	(0.00641)	(0.00626)	(0.00744)	(0.00763)	(0.00753)	(0.00730)
% FL students		0.000524		0.000718		0.00150**
		(0.000563)		(0.000733)		(0.000621)
% male students		0.000580		0.00388		0.00489**
		(0.00262)		(0.00336)		(0.00200)
School fixed effects	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓
Observations	348	348	348	348	348	348
R-squared	0.116	0.121	0.113	0.121	0.033	0.048
Number of school IDs	116	116	116	116	116	116

Note: The dependent variable is Korean, English, and Math CSTA scores. Competition is measured by the number of APHS 10th graders within a 5 km radius. Robust standard errors that adjust for clustering at the district level are beneath parameter estimates. Regressions include year and school fixed effects. Data come from 2009 to 2011.
** p<0.01, * p<0.05

Table A4
School fixed effects regression estimates of the effects of the introduction of APHSs competition on traditional public and private schools (Data 2009 though 2011): competition is measured by the number of APHS 10th graders within a 5 km radius

	# of APHS 10th graders within a 5 km radius					
	Private			Public		
	Korean	English	Math	Korean	English	Math
	(1)	(2)	(3)	(1)	(2)	(3)
APHS competition	0.0230**	0.0192	0.0129	0.0133	-0.000325	-0.0145
	(0.00700)	(0.00934)	(0.00719)	(0.0122)	(0.0130)	(0.00731)
% FL students	0.000164	0.000543	0.00150*	0.000684	0.000642	0.00189
	(0.000900)	(0.00104)	(0.000657)	(0.000839)	(0.00124)	(0.00132)
% male students	-0.00372	-0.00054	0.00335	0.00213	0.00530	0.00618*
	(0.00550)	(0.00670)	(0.00738)	(0.00243)	(0.00396)	(0.00198)
School fixed effect	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓
Observations	222	222	222	126	126	126
R-squared	0.206	0.213	0.049	0.039	0.047	0.122
Number of school IDs	74	74	74	42	42	42

Note: The dependent variable is Korean, English, and Math CSTA scores. Competition is measured by the number of APHS 10th graders within a 5 km radius. Robust standard errors that adjust for clustering at the district level are beneath parameter estimates. Regressions include year and school fixed effects. Data come from 2009 to 2011.
** p<0.01, * p<0.05

Table A5
Falsification test for traditional private schools using the 2009 data

	# of APHSs within an 5 km radius			# of APHSs 10th graders within an 5 km radius		
	Korean	English	Math	Korean	English	Math
APHS competition	-0.0184	0.00747	-0.00610	-0.0254	0.0115	-0.00791
	(0.0185)	(0.0219)	(0.0216)	(0.0250)	(0.0263)	(0.0299)
% FL students	-0.0174*	-0.0234*	-0.0229*	-0.0178*	-0.0231*	-0.0230*
	(0.00554)	(0.00758)	(0.00879)	(0.00584)	(0.00747)	(0.00881)
% male students	-0.00349**	-0.00362**	-0.00130	-0.00350**	-0.00362**	-0.00130
	(0.000383)	(0.000617)	(0.000612)	(0.000386)	(0.000613)	(0.000612)
Spending per pupil	-4.11e-05*	-5.93e-05	-5.08e-05*	-4.18e-05*	-5.91e-05	-5.11e-05*
	(1.44e-05)	(2.84e-05)	(2.16e-05)	(1.34e-05)	(2.79e-05)	(2.10e-05)
% teachers with advanced certification	-2.05e-05	0.00201	0.00302	-2.78e-05	0.00205	0.00303
	(0.00219)	(0.00358)	(0.00369)	(0.00213)	(0.00353)	(0.00373)
Teacher student ratio	-0.00426	0.00168	0.00554	-0.00564	0.00237	0.00514
	(0.00973)	(0.0130)	(0.0184)	(0.00977)	(0.0128)	(0.0190)
district fixed effects	✓	✓	✓	✓	✓	✓
R-squared	0.797	0.824	0.672	0.796	0.824	0.672
Observations	74	74	74	74	74	74

Note: The dependent variable is 2009 Korean, English, and Math CSTA scores. Competition is measured by the number of APHSs and the number of APHSs 10^{th} graders within a 5 km radius. Robust standard errors that adjust for clustering at the district level are beneath parameter estimates. Regressions include district fixed effects.
** p<0.01, * p<0.05

Table A6
Falsification test for traditional public schools using the 2009 data

	# of APHSs within an 5 km radius			# of APHSs 10th graders within an 5 km radius		
	Korean	English	Math	Korean	English	Math
APHS competition	0.0350	0.0399	0.0391	0.0473	0.0552	0.0525
	(0.0309)	(0.0296)	(0.0227)	(0.0360)	(0.0327)	(0.0246)
% FL students	-0.0295**	-0.0480**	-0.0322**	-0.0298**	-0.0483**	-0.0325**
	(0.00414)	(0.00601)	(0.00634)	(0.00377)	(0.00557)	(0.00605)
% male students	-0.00449**	-0.00544**	-0.00270*	-0.00445**	-0.00540**	-0.00266*
	(0.00101)	(0.00111)	(0.00105)	(0.000972)	(0.00109)	(0.00104)
Spending per pupil	0.000229	0.000301	0.000205	0.000232	0.000305	0.000208
	(0.000159)	(0.000160)	(0.000127)	(0.000158)	(0.000157)	(0.000126)
% teachers with advanced certification	-0.00823	-0.00361	-0.00681	-0.00859	-0.00408	-0.00719
	(0.00712)	(0.00683)	(0.00608)	(0.00694)	(0.00652)	(0.00575)
Teacher student ratio	0.0193	0.0319	0.0335	0.0201	0.0329	0.0344
	(0.0464)	(0.0575)	(0.0432)	(0.0460)	(0.0573)	(0.0431)
District fixed effects	✓	✓	✓	✓	✓	✓
R-squared	0.811	0.87	0.838	0.811	0.871	0.839
Observations	42	42	42	42	42	42

Note: The dependent variable is 2009 Korean, English, and Math CSTA scores. Competition is measured by the number of APHSs and the number of APHSs 10th graders within a 5 km radius. Robust standard errors that adjust for clustering at the district level are beneath parameter estimates. Regressions include district fixed effects.
** p<0.01, * p<0.05

Table A7
Robust check for OLS regression estimates

	# of APHSs within a 5 km radius			# of APHS 10th graders within a 5 km radius		
	Korean	English	Math	Korean	English	Math
APHS competition	0.0119	0.0271*	0.00463	0.0139	0.0301*	0.00859
	(0.0105)	(0.00931)	(0.00955)	(0.0121)	(0.0119)	(0.00845)
% of FL students	-0.0106*	-0.0167*	-0.0132*	-0.0104*	-0.0163*	-0.0131*
	(0.00399)	(0.00602)	(0.00434)	(0.00401)	(0.00603)	(0.00434)
% of male students	-0.00337**	-0.00292**	-0.000879*	-0.00339**	-0.00294**	-0.000887*
	(0.000269)	(0.000262)	(0.000286)	(0.000272)	(0.000263)	(0.000291)
autonomous public	0.0133	0.0150	0.0164	0.0184	0.0275	0.0145
	(0.0267)	(0.0319)	(0.0228)	(0.0166)	(0.0194)	(0.0162)
District fixed effects	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓
R-squared	0.744	0.728	0.610	0.746	0.731	0.612
observations	232	232	232	232	232	232

Note: The dependent variable is Korean, English, and Math CSTA score. Competition is measured by the number of APHSs and the number of APHSs 10th graders within a 5 km radius. Robust standard errors that adjust for clustering at the district level are beneath parameter estimates. Regressions include year and district fixed effects. Data comes from 2010 to 2011.
** p<0.01, * p<0.05

Table A8
Robust check for school fixed effects estimates

	# of APHSs within a 5 km radius			# of APHS 10th graders within a 5 km radius		
	Korean	English	Math	Korean	English	Math
APHS competition	0.0143*	0.00875	0.000422	0.0188**	0.0129	0.00350
	(0.00590)	(0.00625)	(0.00551)	(0.00578)	(0.00711)	(0.00734)
% of FL students	0.000510	0.000725	0.00153*	0.000524	0.000724	0.00150*
	(0.000579)	(0.000702)	(0.000656)	(0.000564)	(0.000707)	(0.000637)
% of male students	0.000704	0.00415	0.00506*	0.000590	0.00423	0.00504*
	(0.00268)	(0.00329)	(0.00192)	(0.00246)	(0.00317)	(0.00202)
autonomous public	-0.00725	0.00497	0.00996	0.000266	0.00876	0.00342
	(0.0122)	(0.00932)	(0.0102)	(0.00621)	(0.00443)	(0.00683)
District fixed effects	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓
Observations	348	348	348	348	348	348
R-squared	0.114	0.120	0.051	0.121	0.128	0.049
Number of school IDs	116	116	116	116	116	116

Note: The dependent variable is average Korean, English, and Math CSTA score. Competition is measured by the number of APHSs and the number of APHSs 10^{th} graders within a 5 km radius. Robust standard errors that adjust for clustering at the district level are beneath parameter estimates. Regressions include year and school fixed effects. Data come from 2009 to 2011.
** p<0.01, * p<0