Canceling the Admission Priority of Private Schools Enlarges Housing Price Gap in Public School Districts: Evidence from Shanghai's New Admission Policy

Abstract

In 2018, Shanghai implemented an admission policy that canceled the admission priority of private schools to promote education equity. Since this policy is a unique measure for adjusting private and public school competition and discouraging private school choice priority, little is known about the policy effects. In this research, to examine the impact of the new admission policy on the capitalization of public education quality, we apply boundary fixed effect and Difference in Differences (DID) analysis to housing transaction records before and after the policy. The admission policy on average led to an additional 2% housing price premium for every standard deviation increase in public school quality. However, this average increase in premium was mainly driven by elite (top 5%) school districts, where an additional 8.6% housing price premium was generated by the policy. Housing prices in non-elite school districts, on the other hand, demonstrated no significant changes. These results indicate that the policy enlarges the housing price gap among school districts with different education quality. Thus, rather than promoting education equity, this policy may overall worsen the housing affordability in good public-school districts and make access to quality education more exclusive.

Keywords: School sector, Admission policy, Housing prices, Capitalization effect, School district housing

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Introduction

In the last two decades, private schools providing elite education have become more prevalent in developing countries (Maxwell & Aggleton, 2015; Yang, 2015). This has also been the case in China, where private schools in some places have become extraordinarily popular and have driven families to opt out of public schools. The overheated competition for entrance to private schools and detraction from the public education system has raised concerns about the effects of private schools on education equity. As a result, there has been some popular discourse urging local governments to regulate private school priorities (Xiong, 2017). The reasons for this phenomenon include the push of insufficient elite education provision in public schools and the pull of preferential conditions for private schools (Xue & Li, 2021). Among the advantageous condition of private schools is their ability to make admission decisions ahead of public schools. This allows children who fail to be admitted to private schools to continue to compete for elite public schools via the public school admission procedure afterward. In this way, private schools provide an alternative channel to enter good schools, other than buying expensive elite public school district housing that gives children the right to attend the corresponding public schools.

In 2018, Shanghai promulgated a new policy on the admission process of private schools in order to rebalance the competitiveness of the two school sectors and improve education equity. Specifically, the policy canceled the priority of private schools in new student admissions and stipulated that they should admit students synchronously with public schools to curb the overheated competition for private school admission. Under the new policy, families must determine whether to compete for private schools or public schools in the first admission round. Children who fail to be admitted to private schools have no choice but enter the second admission round of public schools (Shanghai Municipal Education Commission, 2018). Due to the keen competition in entering private schools and elite public schools, children who choose private schools may face the consequence of entering neither private schools nor elite public schools. As a result, the new policy makes competing for private schools much riskier than before. The effects on private schools manifested very soon, and the number of applications to private primary schools decreased by over 50% in 2018 (Zhang & Zhu, 2018). On the contrary, competing for public schools by buying school district housing is expected to become more reliable and attractive because owning a housing unit in a public school district almost guarantees the enrolment of the corresponding public school. (Chan et al., 2020).

However, since this policy to adjust the competition between school sectors is relatively new and has few precedents, the effects, particularly the effects on the cost of education, require further examination. To the best of our knowledge, although some research has discussed how school choice influences the capitalization effect of public school quality (e.g., Nechyba, 2000; Ferreyra, 2007; Fack & Grenet, 2010; Brunner et al., 2012), there is little research that investigates the influence of government intervention in public and private school choice competition in this aspect. Considering the change in the relative situations of the two school sectors will affect families' school choice decisions and subsequently reflect on the capitalization effect of public schools. Our research, therefore, extends the existing literature by examining the Shanghai case of how a policy affecting the private school sector affects the capitalization effects of public education. We hypothesize two potential scenarios. In both cases, we expect that the increased relative appeal of public schools will lead to bidding up of elite public school district housing prices. In one potential scenario, the ripple effects of the policy may extend to the whole housing market. The bidding up of prices in elite school districts by families seeking to compensate for the increased risk of competition for private school admission may crowd out families who initially could afford such housing. As they move to housing units in districts with lower

public school quality, this may also increase housing prices in those districts. However, in a second scenario, it is also possible that the effects of the new policy are limited to elite public school districts. Since elite public schools account for a tiny share of Chinese public education systems, the effects of some families being crowded out of elite public housing districts might quickly be diluted in the larger housing market.

To test our hypothesis, we utilize housing transaction data in Shanghai before and after the new policy and apply boundary fixed effect and Difference in Differences (DID) analysis to quantify the policy's influence on the capitalization effect. Our research had three main contributions. First, our research argues that the relative status of available school choices would affect the families' decisions and property value. More specifically, it sheds light on how policy toward the private school sector influence the competition with the public school sector and the housing capitalization effect. Second, unlike extant literature, which studied the effect of favoring school choice (e.g., improving the availability, providing vouchers), our research investigates the policy of discouraging school choice. Our research provides evidence on different policy practices intervening in school choice and its consequence on the property market. Third, given the rapid growth of the private school

sector in developing countries, studying the effects of policies on private schooling can help policymakers craft better policies to support the healthy development of both the public and private school sectors.

Our analysis shows that the implementation of Shanghai's new admission policy on average led to an additional 2% housing price premium for one standard deviation higher Math Olympiad tournament performance of a given school. However, this increase was mainly driven by elite public school districts (top 5% in school quality), where an additional 8.6% housing price premium was generated by the policy. Housing prices in school districts with lower education quality, on the other hand, demonstrated no significant change. The results support our second hypothesis that the ripple effects of the policy diluted quickly, and the effects were primarily concentrated in housing in districts with top public education quality. Based on the results, the research indicates that the policy of discouraging prioritization of private school choice increases the value families place on residential location and admission to elite public schools. As a result, the policy had the unintended effect of increasing the capitalization effect of elite public schools and enlarging the housing price

gap between elite and non-elite school districts, which worsened the payment burden for public district housing and exacerbated inequality in access to elite education resources.

The rest of the paper is as follows: Section 2 reviews the relevant literature, Section 3 introduces our estimation method and the dataset we use, Section 4 presents our results, and Section 5 concludes and discusses.

Literature review

Capitalization effect

There are many components determining housing price, and public school quality is an important element constituting housing commodities (Rosen, 1974). Parents incline to purchase housing with good public schools nearby to ensure their children's access to a good school. This leads to housing price premiums, called the capitalization effect (Black & Machin, 2011). The capitalization effect has been well studied in developed countries (e.g., Black, 1999; Black & Machin, 2011; Dhar & Ross, 2012; Imberman & Lovenheim, 2016). Nguyen-Hoang & Yinger (2011)'s review found that most research suggested that one standard deviation higher school performance is associated with 1-4% higher housing values in the corresponding school district.

Some research recently has started to focus on the capitalization effect in developing countries, and the situation in China has received significant attention. Two main streams of research have been done in China regarding the capitalization effect. The first stream investigates the capitalization effect in metropolitan areas and tends to agree on the findings in developed countries. Particularly, Zheng et al. (2016) analyzed tenant discrimination by pairing the housing price data with housing rent nearby. They found that housing prices in key-point public school (elite schools designated by the government) districts are 6.8% higher than outside the key-point public school districts. Zhang & Chen (2018) further indicated that tenant discrimination in school enrollment is a reason behind rent-yield gaps in China. Chan et al. (2020) adopted the boundary fixed effect method and found that the gap in housing prices between elite school districts and their neighboring districts is around 14%. Another research stream uses education policies as natural experiments to investigate the policy effects on housing prices. For example, Feng & Lu (2013) and Huang et al. (2020)'s studies show that housing prices increased when corresponding public schools were designated as key-point schools, an indicator that the public schools' education quality is endorsed by governments. Wen et al. (2017) studied the effect of the "zero school choice" policy that strictly prohibited parents from sending children to public schools

outside their designated school districts. They found that the policy strengthened the capitalization effect of the school district. Su & Yu (2022) investigated the effects of the policy promoting school acquisition on housing prices, they found that if the regular schools are acquired by high-quality schools, the housing prices in the corresponding school districts would increase by 7%.

To summarize, existing literature suggests that parents' preferences for public schools are reflected in housing price premiums, which can be amplified by education policies strengthening the importance of public schools.

School choice and property value

A body of research has investigated the effect of school choice on families' locational preference for housing, and thereby on housing prices. The variety of school choices, such as inter-district choice programs, magnet schools, private schools, and charter schools, have the common feature of weakening the link between residential location and traditional public school admission (Andreyeva & Patrick, 2017).

Nechyba (2000) and Ferreyra (2007) developed a theoretical framework on school choice and housing mobility. Their general equilibrium model suggested that families in high-income communities where the capitalization effect occurs would move to cheaper communities given greater availability of private schools or more private school vouchers. To provide further empirical evidence on the effect of school choice on residential location preference and housing prices, Reback (2005) studied the effects of inter-district choice on residential mobility and housing value in Minnesota. He found that school districts' transfer rates are highly correlated with local housing prices. Brunner et al. (2012) indicated that inter-district choice programs lead high-income households to move to previously lower-quality school districts, which causes an increase in the housing prices of lower-quality school districts. Some studies further found that introducing an inter-district choice program narrows the gap between the housing prices of high-quality school districts and low-quality school districts (Chung, 2015; Machin & Salvanes, 2016; Park et al., 2021). The availability of magnet schools was also found to diminish the capitalization effect of public school quality (Walden, 1990). Furthermore, Fack and Grenet (2010) investigated the effects of access to private schools on housing value. Their results indicate more access to private schools mitigates the capitalization effect.

Nevertheless, a small stream of recent studies points out that school choice is directly capitalized into housing prices. Andreyeva & Patrick (2017) found that housing prices increase in the zone with priority in attending charter schools. Bonilla-Mejí a et al. (2020) found that policy strengthening the link between residential location and access to magnet schools increases the price of housing units that increase the possibility of being admitted.

Overall, the extant literature consistently finds a strong correlation between school choice, residential choice decisions, and the housing market. Greater school choice weakens the capitalization effect of public school quality.

Methodology

Research area

Five central districts in Shanghai, a large city of 24 million people in 2016, respectively *Huangpu*, *Changning*, *Jingan*, *Putuo*, and *Hongkou* were selected as research areas (See Figure 1). Three central districts, respectively *Pudong*, *Yangpu,* and *Xuhui*, are excluded as these districts have not published explicit school data. Suburban districts are excluded from this research for two reasons: first, few good public schools are distributed in suburban districts, so few variations in school quality exist there. Second, housing market

heterogeneity exists between central and suburban districts, which would complicate the analysis.

[Insert Figure 1 here]

Data source

Housing transaction data

Housing transaction data for the chosen study districts between July 2016 and December 2019 (the policy was implemented in January 2018) are obtained from *lianjia*[1], the largest online housing transaction platform in China. This dataset includes housing unit transaction information such as transaction prices, transaction time, and housing characteristics. The sample consists of 21,866 housing units. Each housing unit is linked to a *xiaoqu*, representing a particular residential development project in China and reflecting the neighborhood environment. The *xiaoqu* sample size is 2,240.

School data

Nearby enrollment policy is employed mainly for public primary and junior middle schools. Since a few public junior middle schools can admit students outside their corresponding

[1] See, https://sh.lianjia.com

school districts (e.g., talented student admission), we only study primary schools in this research. Based on primary school district information published by the Education Commission of sub-districts annually, geographic information of school districts' range and boundaries are digitized. In total, there are 177 primary public schools in the sample. Based on this data, we link each *xiaoqu* to its designated school district.

To measure the school quality, we use Math Olympiad tournaments performance as the indicator of school quality. The Math Olympiad tournaments consist of a series of high-level math tournaments, among which Asia Pacific Mathematical Olympiad, *Xiaojiling* Cup, *Zhonghuan* Cup, and *Zoumei* Cup are the top four famous tournaments and are widely recognized as the standard to measure a school education quality (Chan et al., 2020; Huang et al., 2020). To participate in the Math Olympiad tournaments, students with interest can sign up. The success in the Math Olympiad tournaments is a sign of brilliant student enrollments as well as the high education quality of the schools. Moreover, getting awards from this tournament may help students to be admitted to prestigious schools (Zhang & Bray, 2018; Zhang, 2020). Thus, the student's performance in the Math Olympiad tournaments is an essential criterion for parents to judge the education quality of the school. To note, though some earlier research used magnet schools to measure school quality,

considering the governments already stopped publishing the magnet school list in the 1990s, the magnet school measurement is outdated to our research.

The Math Olympiad tournaments data is derived from *jiazhangbang*[2], China's largest parental forum. Such performance data is only available until 2016 because Shanghai has prohibited tournament competitions at the primary school stage since 2016. We add up the number of awards each school's student won in the four most famous Math Olympiad tournaments which are mentioned above in 2016 to measure school quality. A total score to reflect overall school performance in the tournaments is calculated based on the following principles: the school will be assigned four/three/two/one points for each first/second/third/fourth prize won by its students in each tournament (Chan et al., 2020). The points in four tournaments are added to a total score to represent the school's overall performance.

To examine the ripple effect on public schools at different levels, we refer to the school grading standard of Chan et al. (2020) to categorize the school samples into four groups based on their tournament performance scores. The schools ranking in the top 5% (with

[2] See, http://www.jzb.com/

more than 18 total points) are categorized as elite schools. The schools in the 85th to 94th percentile (with 8-17 total points) are categorized as high-quality schools. The schools in the 70th to 84th percentile (with 2-7 total points) are categorized as middle-quality schools. The schools below the 70th percentile are categorized as low-quality schools.

Variables and Descriptive Statistics

Table 1 describes the variables used in the research. Housing transaction prices reflecting the capitalization effect are used as the dependent variable. There are 121 missing records of management fees and 4 missing recordings of the age of the housing units. The missing values are imputed by the mean of the variable, respectively.

[Insert Table 1 here]

The summary statistics of housing feature variables are presented in Table 2. The mean unit transaction price is 64,692.99 *yuan*. The mean area is 74.39 m^2. About 4.64% of housing units are in the elite public school districts, and about 65% are in the low-quality public school districts.

[Insert Table 2 here]

Model specification

Boundary fixed effect and DID models are combined to evaluate the policy impact on school district housing prices. We use the boundary fixed effect to tackle the endogeneity from the correlation between unobserved and time-invariant neighborhood characteristics and school quality (Black, 1999; Bayer et al., 2007). The method has been applied in many studies of the capitalization effect (e.g., Dhar & Ross, 2012; Livy, 2018; Chan et al., 2020). The intuition is to link housing units to their closest school district boundary and include the boundary fixed effect in the hedonic model. It can compare the transaction prices of housing units very close to each other but in two different school districts (i.e., on two sides of the school district boundary) and control for the unobservable neighborhood factors. To minimize the potential variance in large geographical ranges, this method needs to limit the sample to be within a certain distance from the boundary and check whether the results are consistent with the full sample. Extant research recommends using 300 m as the distance (Fack & Grenet, 2010; Chan et al., 2020). In this paper, we have tested 250m, 300m, and 350m.

The effects of policy change are estimated using a DID model. In this research, the control group is housing units located in low-quality school districts since they were not in the

competitive market and parents did not need to compete for them despite the policy. As discussed above, the policy may increase the competition among parents for good public school districts, so housing units in such school districts are designated as the treatment group. The analysis is limited to the period from July 2016 to December 2019 to rule out other changes in admission policies that may confound the result. The transaction date of each housing unit is clustered by half-year. This results in seven half-year groups, which are respectively indexed as "2016-H2, 2017-H1, …, 2019-H1, 2019-H2". The policy was promulgated on January 25, 2018 (belonging to the 2018-H1). Considering that, although the official admission procedure begins in April, the housing market would react to the policy once it was announced. Thus, we treat the time after the policy promulgation as the post-treatment period.

The specification combining the boundary fixed effect and DID models is as below:

$$ln\,Price_{icst} = \beta_1 Z_s \times Post_t + \beta_2 Z_s + \boldsymbol{\beta_3 X_i} + \boldsymbol{\beta_4 K_c} + \theta_{by} + \eta_t + \epsilon_{icst} \quad (1)$$

Where $Price_{icst}$ represents the transaction price of housing unit i in *xiaoqu* c, belonging to school district s, and in half-year t. $Post_t$ represents whether the transaction happened after the policy. Z_s represents the school-quality measure. The parameter estimating the effect of

the interaction of Z_s and $Post_t$, β_1, measures the policy-induced change in the capitalization effect. β_2 is the coefficient of the capitalization effect without the policy. $\mathbf{X}_i$ is a series of variables measuring the quality of housing units. $\mathbf{K}_c$ represents variables measuring *xiaoqu* quality. θ_{by} is the boundary-year fixed effect. Because school district boundaries change across academic years, it is important that we define the boundaries respectively for each academic year. η_t is half-year fixed effect. ϵ_{icst} is the error term.

The parallel trend assumption is tested, which assumes the effects of the school quality measures are parallel before the policy implementation. The assumption infers that the policy drives the change in the outcome. It is tested by conducting an event study. The specification is as below:

$$ln\,Price_{icst} = \sum_{\lambda=1}^{6} \beta_{1\lambda} Z_s \times I(t=\lambda) + \beta_2 Z_s + \boldsymbol{\beta_3 X_i} + \boldsymbol{\beta_4 K_c} + \theta_{by} + \eta_t + \epsilon_{icst} \quad (2)$$

In the specification, λ (λ = 1, 2, ..., 6) denotes the index of half-years from 2016-H2 to 2019-H2. 2018-H1 is the treatment time as the policy was implemented in January 2018. 2017-H2 is *t*-1 (one period before the treatment time) and serves as the baseline, because it was the last period that was not influenced by this policy. $I(t=\lambda)$ is equal to one if the transaction time is in half-year λ and to zero otherwise. In this setting, $\beta_{1\lambda}$ estimates the

capitalization effect in half-year λ (compared with 2017-H2). The coefficients $\beta_{I\lambda}$ are expected not to increase or decrease across time before 2017-H2 and to remain insignificant. We expect the housing market reacted to the admission policy once it was promulgated, and the significant change should be in 2018-H1. Thus, times after 2018-H1 are treated as the post-treatment periods. The coefficients $\beta_{I\lambda}$ are expected to increase and remain significantly larger than the 2017-H2 reference group after 2018-H1.

Result of the Policy Effect

Overall Effect on Housing Prices in Public School Districts

DID Result

In this subsection, we estimate the average policy effect on housing prices in public school districts. Table 3 presents the DID results, which evaluate the policy effect on the capitalization effect. Column 1 suggests that, without considering the variance in effects across different periods, one standard deviation higher public school quality was associated with a nearly 4% ($e^{0.004}$-1) increase in corresponding school districts' housing prices, consistent with existing literature about the capitalization effect (Nguyen-Hoang & Yinger, 2011). Column 2 estimates the effect of the new admission policy. The result shows that the housing price premium of school quality was 3% ($e^{0.003}$-1) without the policy, and policy

amplified the capitalization effect by 2/3. Namely, the policy led to an *additional* 2% ($e^{0.002}$-1) housing price premium per standard deviation increase in school quality. The results in Columns 3-6 restrict the samples to housing units at a certain distance from a school district boundary. The coefficients do not change substantially after adjusting the bandwidth, suggesting that the boundary fixed effect works well in this research (Fack & Grenet, 2010).

Based on the analysis results, canceling the admission priority of private schools strengthened the association between housing prices and school quality. In other words, the policy weakening private schools' advantage in competition amplified the capitalization effect.

[Insert Table 3 here]

Event Study Result

The result of the event study is reported in Figure 2. The result suggests that the parallel trend assumption is valid in our specification. There was no significant increase or decrease in effect coefficients in the pre-treatment period. This means the capitalization effect was nearly the same until 2017-H2, while the effect in 2018-H1 was significantly larger than in 2017-H2. This suggests that the policy's effect on housing prices very quickly began to

manifest in the half-year of promulgating the policy. Moreover, the result shows that the policy effects continued to increase in the second half-year. After that, the effects remain stable with a slight drop but remain significantly larger than the reference group.

[Insert Figure 2 here]

Test the Effect Mechanism Hypothesis

DID Result

This subsection examines whether the policy led to a significant ripple effect across all school districts or whether the ripple effect was fairly diluted. The estimation results of a DID specification for schools with different education quality are presented in Table 4. The results imply that the amplified capitalization effect was mainly driven by the housing prices in elite school districts. The new policy generated an additional 8.6% ($e^{0.083}$-1) housing price premium in elite school districts, or in other words, an 87.75% (8.6%/9.8%) increase in the premium. However, the effect was not significant for lower-quality schools. The result suggests that elite public schools have become much more attractive than before. However, schools at lower levels (and the associated housing in these districts) have not become more popular after the policy. The result further indicates that there was no significant ripple effect. Instead, the effects of the policy on housing prices existed

primarily in elite public school districts. They can directly substitute for private schools, so these effects quickly diluted in the larger market. This indicates that the policy led to further differentiation among public schools. The policy enlarged the housing price gap between elite public school districts and high-quality school districts by 115% (($e^{0.083-0.015}$-1)/($e^{0.094-0.035}$-1)).

According to Columns 2-4 of Table 4, after adjusting the bandwidth of the boundary buffer, the DID specification results are slightly different, but all differences in coefficient are smaller than 0.01. This result implies that the policy treatment effects were geographically similar.

[Insert Table 4 here]

Event Study

In Figure 3, we report the event study result of testing the ripple effect. The result is consistent with the DID result reported in Table 4. Before the policy, the coefficients of housing in different school districts compared to 2017-H2 were not significant. This means that little housing price change occurred among school districts at different levels before the policy. However, after the policy, housing price divergence soon appeared. As shown in Figure 3, all coefficients of high-quality and middle-quality school district housing are

insignificant compared to 2017-H2. This indicates that housing prices in school districts at two lower levels remained similar to the period before the policy. However, the coefficients of elite school districts housing are significantly positive compared to 2017-H*2*. This indicates that housing prices in elite school districts significantly increased after the policy and continued to grow in the following half-years. The results thus suggest that the attractiveness gap between elite schools and non-elite schools has been enlarged.

[Insert Figure 3 here]

Potential Explanation

To figure out why the policy effects quickly diluted beyond public school districts with elite education quality, we compare the tournament performance score between private schools and public schools. As shown in Figure 4, the distribution of public school performance was skewed. Only a few public schools could provide elite education resources, whereas there were lots of public schools at lower levels. Considering that parents who compete for private schools pursue elite education, the new admission policy may greatly influence such parents. As a result, these parents would likely turn to elite public schools as a substitute for their preferred private schools. Due to the limited choice of elite public schools, the policy's effects crowded into such schools. Whereas the number

of public schools at lower levels may be large enough so that such schools could meet the demand from families crowded out, and thus the spill-over effects diluted very quickly.

[Insert Figure 4 here]

Robustness Check

Substitute School Quality Measure

We adopt an alternative measure of school education quality to validate whether the estimation results remain consistent with different choices of school quality measurement. Namely, we use the education quality evaluation by Tencent News, China's most well-known news platform[3], as a robustness check. Based on their evaluation system, public school samples are divided into four tiers, where first/second/third/fourth-tier schools represent the high to low quality of public schools.

The DID estimation results based on the Tencent News education quality are in Table 5. As shown in Table 5, the pattern is similar to the results using tournament performance as the measurement. Particularly, a similar heterogeneous capitalization effect is found. The treatment effect of the policy only manifests in first-tier school districts, while the policy

[3] See, https://news.qq.com/

effects on housing in second-tier and third-tier school districts are not significant. After the policy, households must pay an extra 8.76% ($e^{0.084}$-1) to purchase first-tier school district housing. This represents an increase of more than 80% in the housing price premiums in these districts.

[Insert Table 5 here]

Excluding changes in school districts

The government adjusts the geographic boundaries of school districts each year. Considering that there is a chance that housing buyers do not get the most updated information on school districts, the transaction prices may be confounded by misinformation. Moreover, there may be selection in adjusting the geographic boundaries of school districts since it may be correlated with the features of the school districts. We use a subsample excluding housing units in changed school districts (389 housing unit samples, accounting for 2%) for DID estimation to rule out this potential bias. The results are shown in Table 6. As shown in Table 6, the results are similar to our main results.

[Insert Table 6 here]

Conclusion

In 2018, Shanghai promulgated a new admission policy that canceled the admission priority of private schools, aiming at promoting education equity between public and private school sectors. Our research examines how the policy adjusting competition between school sectors and discouraging school choice priority has affected the capitalization effect of public schools. We utilize housing transaction data between 2016 and 2019 in Shanghai and combine the boundary fixed effect and DID models to examine our hypotheses. Two major findings are obtained.

First, our results suggest that, on average, Shanghai's new admissions policy led to an *additional* 2% housing price premium per standard deviation increase in school quality. This result indicates that the policy of eliminating the advanced admission advantage of private schools amplified the capitalization effect in a context where public school enrollment is strongly linked with homeownership. Second, the policy effects are also found to vary with public schools' education quality. Particularly, housing prices in elite school districts increased by 8.6% after the policy, while housing prices in non-elite school districts experienced little change. Overall, the policy of discouraging school choice priority makes families place more value on the stable connection between residential location and admission to traditional public schools. Consequently, it increases the

capitalization effect of public school quality, increases the housing payment burdens on parents, and worsens the housing market bubble in China. However, the effects are limited to elite school districts and thus primarily affect families able to compete for elite education. Our results support the ripple effect dilution scenario, where the effect of families reverting from private schools to public schools was concentrated in public school districts with top education quality. Due to the insufficient supply of elite public schools and the sufficient supply of non-elite public schools, the policy led to a 115% increase in the housing price gap between elite public schools and high-quality public schools. This indicates that instead of promoting education equity, this policy makes access to elite education resources more exclusive. Thus, compared with regulating private school enrollment priority to promote education equality, weakening the linkage between housing ownership and public school enrollment and providing more public schools with high education quality might be more efficient in achieving the education equity goal.

There are a few limitations to the current research. In particular, education policy implementation is a dynamic process where new policies were promulgated after our research period (Dong, 2020). Since this research only focuses on one education policy, the

interactions of different education policies on capitalization are unknown. To address this limitation, future research might investigate the cumulative effect of the relevant education policies recently promulgated and estimate the overall effects on capitalization.

Acknowledgments

We thank Jasmine Zhang for her excellent editing works. We thank the editor, McMillen, Daniel, and two anonymous referees for their valuable comments and suggestions. All errors are our own.

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Table

Table 1 Variable Description

Classification	Variable	Destination and Quantification
Housing variables	Unit transaction price	The transaction price of the housing unit per square meter (*yuan/m*^{2}). The logarithm price serves as the dependent variable. Continuous Variable.
	Transaction time	Transaction time of the housing unit. It is converted to half-year dummies in the estimation. Categorical variable.
	Area	The area of the housing unit(m^2). Continuous variable.
	Number of bedrooms	The number of bedrooms in the transaction housing unit. Continuous variable.
	Direction	The direction of the housing unit is mainly facing to (Mostly refer to the direction of the living room). Categorical variable with the values of north, south, east, west, multi-direction, unknown.
	Decoration	Categorical variable. The interior decoration status of the housing unit. Categorical variable with the values of no decoration, normal, excellent, other.
	Lift	Whether there are lifts in the building of the housing unit. Categorical variable with the values of yes, no, unknown.
	Floor	The floor of the housing unit is on. Categorical variable with the values of the underground, low, medium, high.
	Total floor	The total floors of the building. Continuous variable.
Xiaoqu variables	Management fee	The monthly management fee per square meter (*yuan/m*^{2}). Continuous variable.
	Age	Age of the housing unit in the transaction year. Continuous variable.

Classification	Variable	Destination and Quantification
	Distance to the nearest metro station	Straight line distance between housing unit and the nearest metro station (m). Continuous variable.
	Distance to the city center	Straight-line distance to People Park represents the distance to Shanghai's center (km). Continuous variable.
	Elite private schools availability	The availability of elite private schools (with more than 18 points) within 1 km straight line distance. Categorical variable (binary, yes or no).
School quality measure	Tournament performance score	Total points won by each school in four tournaments in 2016. Continuous variable.
	Tournament performance score range	Categorical variable. Classification: low-quality schools, middle-quality schools, high-quality schools, elite schools.
	Education quality evaluation by Tencent News	Categorical variable. Classification: normal schools, third-tier schools, second-tier schools, first-tier schools.

Table 2 Summary Statistics

Variable	Mean/ Proportion	St. Dev.
Unit transaction price	64,692.990	17,992.720
Area (m^2)	74.396	43.434
Number of bedrooms	1.834	0.782
Age	26.717	14.882
Distance to People Park (km)	6.798	3.263
Distance to the nearest metro station (m)	659.317	373.729
Corresponding public schools' tournament performance	4.091	9.753
In the elite school district	4.64%	-
In the high-quality school district	12.37%	-
In the middle-quality school district	16.54%	-
In the low-quality school district	66.43%	-
With elite private schools nearby	13.70%	-
Transaction post the policy	54.30%	-
N	21,866	

Table 3 DID Result

	Dependent Variable: Log of Transaction Prices (*yuan*)				
	All records	All records	within 350 m	within 300 m	within 250 m
Score	0.004 ***	0.003 ***	0.003 ***	0.003 ***	0.004 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Score × Post		0.002 ***	0.002 ***	0.002 ***	0.002 ***
		(0.000)	(0.001)	(0.001)	(0.001)
Housing variables	Yes	Yes	Yes	Yes	Yes
Xiaoqu variables	Yes	Yes	Yes	Yes	Yes
Half-year FE	Yes	Yes	Yes	Yes	Yes
Boundary-year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.810	0.811	0.796	0.799	0.804
Observations	21,866	21,866	19,952	19,199	18,014

Note: ***: $p < 0.01$; **: $p < 0.05$; *: $p < 0.1$ Cluster standard errors in the parentheses are at the school district-year level. Housing variables consist of area, number of bedrooms, direction, decoration, lift, floor, total floor, and the interaction of floor and total floor. *Xiaoqu* variables include management fee, age, elite private schools nearby, distance to the nearest metro station, and distance to People Park. Linear and quadratic forms measuring the distance between school district boundary and housing units are controlled in all models

Table 4 Result of Heterogeneous Effect

	Dependent Variable: Log of Transaction Prices (*yuan*)			
	All records	within 350 m	within 300 m	within 250 m
Reference group:				
Low-quality schools				
Elite schools	0.094 ***	0.093 ***	0.106 ***	0.109 ***
	(0.022)	(0.022)	(0.024)	(0.025)
High-quality schools	0.035 **	0.040 ***	0.044 ***	0.047 ***
	(0.014)	(0.013)	(0.012)	(0.013)
Middle-quality schools	0.036 ***	0.040 ***	0.039 ***	0.038 ***
	(0.009)	(0.009)	(0.009)	(0.010)
Elite schools × Post	0.083 ***	0.088 ***	0.090 ***	0.090 ***
	(0.029)	(0.030)	(0.031)	(0.032)
High-quality schools × Post	0.015	0.016	0.013	0.014
	(0.019)	(0.018)	(0.018)	(0.018)
Middle-quality schools × Post	-0.002	-0.005	-0.004	-0.003
	(0.011)	(0.011)	(0.011)	(0.011)
Housing variables	Yes	Yes	Yes	Yes
Xiaoqu variables	Yes	Yes	Yes	Yes
Half-year FE	Yes	Yes	Yes	Yes
Boundary-year FE	Yes	Yes	Yes	Yes
R^2	0.810	0.795	0.798	0.802
Observations	21,866	19,952	19,199	18,014

Note: ***: $p < 0.01$; **: $p < 0.05$; *: $p < 0.1$ Cluster standard errors in the parentheses are at the school district-year level. Housing variables consist of area, number of bedrooms, direction, decoration, lift, floor, total floor, and the interaction of floor and total floor. *Xiaoqu* variables include management fee, age, elite private schools nearby, distance to the nearest metro station, and distance to People Park. Linear and quadratic forms measuring the distance between school district boundary and housing units are controlled in all models

Table 5 DID result based on Substituting School Quality Measure

	Dependent Variable: Log of Transaction Prices (*yuan*)	
Reference group: Normal schools		
First-tier schools	0.149 ***	0.104 ***
	(0.015)	(0.016)
Second-tier schools	0.055 ***	0.056 ***
	(0.009)	(0.012)
Third-tier schools	-0.015 **	-0.015
	(0.007)	(0.009)
First-tier schools × Post		0.084 ***
		(0.022)
Second-tier schools × Post		-0.002
		(0.013)
Third-tier schools × Post		0.001
		(0.010)
Housing variables	Yes	Yes
Xiaoqu variables	Yes	Yes
Half-year fixed effect	Yes	Yes
Boundary-year fixed effect	Yes	Yes
R^2	0.813	0.813
Observations	21,866	21,866

Note: ***: $p < 0.01$; **: $p < 0.05$; *: $p < 0.1$ Cluster standard errors in the parentheses are at the school district-year level. Housing variables consist of area, number of bedrooms, direction, decoration, lift, floor, total floor, and the interaction of floor and total floor. *Xiaoqu* variables include management fee, age, elite private schools nearby, length to the nearest metro station, and distance to People Park. Linear and quadratic forms measuring the length between school district boundary and housing units are controlled in all models

Table 6 Result of Excluding Districts that Experienced Boundary Changes

	Dependent Variable: Log of Transaction Prices (*yuan*)	
	Excluding changes in school districts	
Reference group: Low-quality schools		
Elite schools	0.139 ***	0.098 ***
	(0.021)	(0.024)
High-quality schools	0.045 ***	0.036 **
	(0.013)	(0.014)
Middle-quality schools	0.036 ***	0.038 ***
	(0.007)	(0.010)
Elite schools × Post		0.072 **
		(0.031)
High-quality schools × Post		0.018
		(0.019)
Middle-quality schools × Post		-0.002
		(0.011)
Housing variables	Yes	Yes
Xiaoqu variables	Yes	Yes
Half-year fixed effect	Yes	Yes
Boundary-year fixed effect	Yes	Yes
R^2	0.810	0.810
Observations	21,477	21,477

Note: ***: $p < 0.01$; **: $p < 0.05$; *: $p < 0.1$ Cluster standard errors in the parentheses are at the school district-year level. Housing variables consist of area, number of bedrooms, direction, decoration, lift, floor, total floor, and the interaction of floor and total floor. *Xiaoqu* variables include management fee, age, elite private schools nearby, length to the nearest metro station, and distance to People Park. Linear and quadratic forms measuring the length between school district boundary and housing units are controlled in all models

Figure

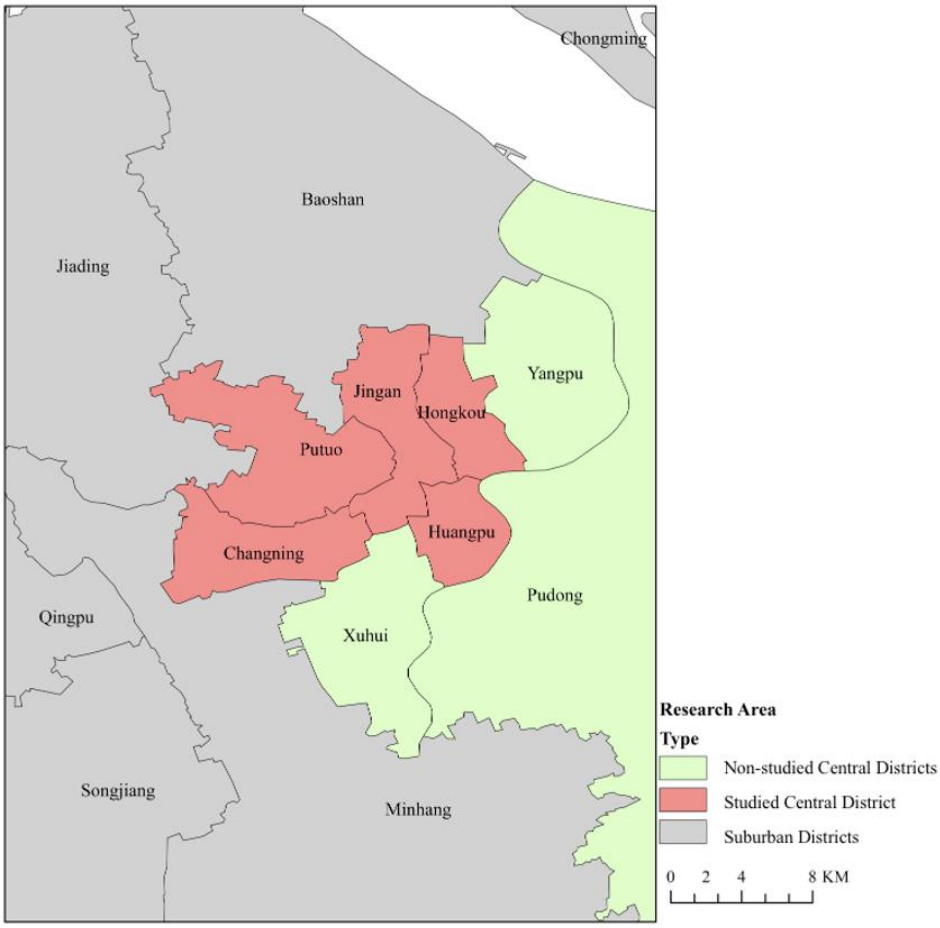

Figure 1 Research Area

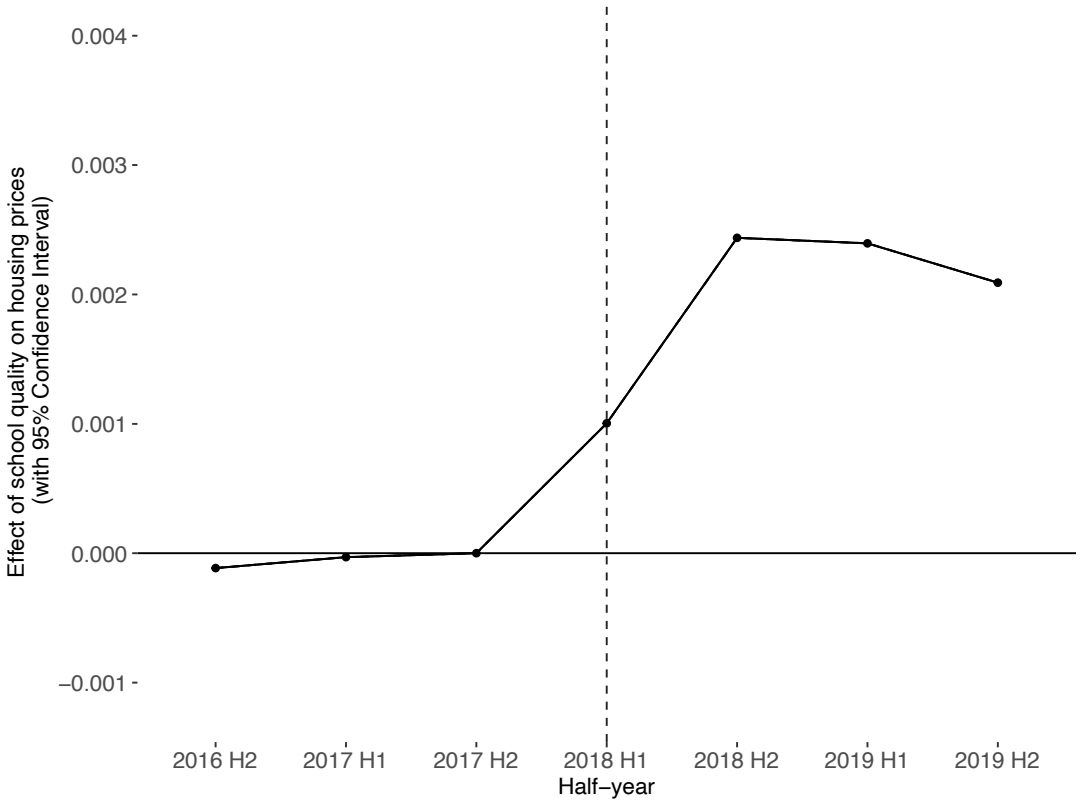

Figure 2 Event Study Result

Note: Sample only includes housing units with 300m to the boundary. The reference group is the interaction of score and 2017-H2 (*t*-1). The standard errors are clustered at the school district-year level. Other variables include housing variables, *xiaoqu* variables, half-year fixed effects, distance to boundary, and boundary-year fixed effects

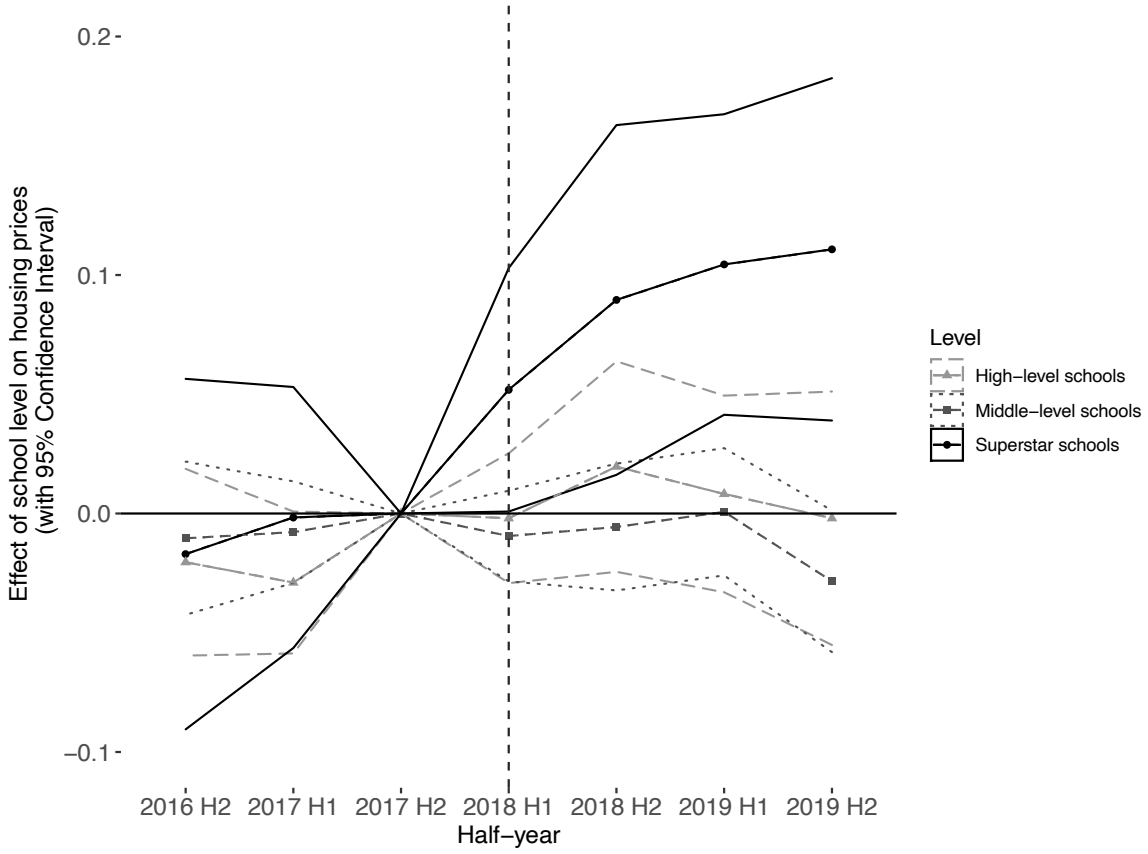

Figure 3 Event Study of Heterogeneous Effect

Note: Sample only includes housing units with 300m to the boundary. The reference group is the interaction of score and 2017-H2 (*t*-1). The standard errors are clustered at the school district-year level. Other variables include housing variables, *xiaoqu* variables, half-year fixed effects, distance to boundary, and boundary-year fixed effects

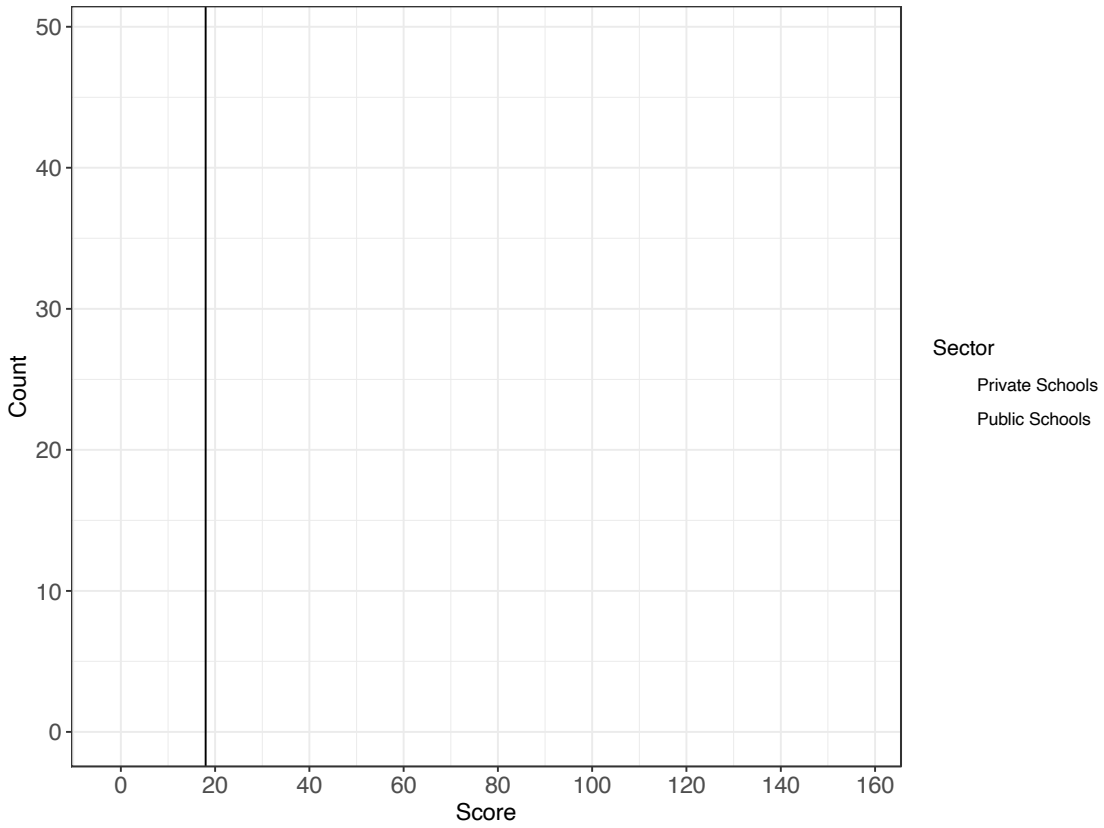

Figure 4 Performance Score of private schools and public schools in Shanghai

Note: Only the schools that won at least one tournament award are shown.