Access to Better Public Schools: Effects on Private Expenditure on Children

Pei Gao, Yiqing Lü, Xin Zhou[1]

Abstract

This paper studies how parental investment in children responds to changes in public education provision. Using transactions made via China UnionPay debit and credit cards, we identify two types of expenditure on children: extra-curriculum training and other child support. We exploit a quasi-experimental shock on education provision – a merger between two districts with substantially different educational resources in Shanghai. The merger allows students to apply for schools across the two districts. Using a difference-in-differences estimation, we find that, compared to a third control district, cardholders in the district where fewer top-tier high schools were located spent more on children after the merger. The effect is stronger for cardholders who have children of pre-high-school age and for those who live closer to the old border, but disappears for those who have adult children. Last, we rule out alternative channels via increased competition and housing appreciation. Overall, our findings suggest that parents spend more on children once educational opportunities improve; thus, equal allocation of public educational resources could encourage private parental investment in children.

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Keywords: parental investment, child-related expenditure, public education, district merger

JEL Classification: H31, H41, J13, R53, D12

[1] Pei Gao, New York University Shanghai, p.gao@nyu.edu; Yiqing Lü, New York University Shanghai, yiqing.lu@nyu.edu; Xin Zhou, New York University Shanghai, xinzhou@nyu.edu. For helpful comments, we thank Kaiji Chen, Raquel Fernandez, Hans-Martin von Gaudecker, Steven Lehrer, Yu-Hsiang Lei, Andres Liberman, Stijn Van Nieuwerburgh, Ryo Okui, Daniel Xu, Xiaoyun Yu, and seminar participants at the 4th Fanhai Economics and Finance workshop and NYU Shanghai. We are grateful to Feng Ding and Minwei Tang at China UnionPay Advisors and Yun Dai for research support. Any errors are attributable solely to the authors.

1. Introduction

Parental investment constitutes an indispensable part of human capital development in children. The literature provides extensive evidence that parental investment in varying forms is vital for shaping children's long-term outcomes in health, cognitive and non-cognitive skills, education attainment, and income (Carneiro and Heckman, 2003; Driessen, Smit, and Sleegers, 2005; Cunha, Heckman, Lochner, and Masterov, 2006; Sacerdote, 2007). It is therefore of paramount importance to understand the incentives for parental investment in children. Besides household efforts, the other input of human capital development in children is the provision of public education. While the existing literature mainly focuses on the direct impact of public education on children, the indirect impact that is mediated through parental investment is largely underexplored. In this paper, we study how parental investment in children responds to changes in the provision of public education.

It is theoretically unclear whether the provision of public education promotes or crowds out private parental investment in children. If the effect of public investment in child outcome is additive to that of parental investment (Becker, 1981; Becker and Tomes, 1976 and 1986), then the two are substitutes, whereas if the effect of public investment in child outcome is multiplicative to that of parental investment (Goldberger, 1989), then the two are complementary. In other words, changes in the rate of return of parental investment that result from the provision of public education could either amplify or reduce parental investment in children. Because the public education of children may either further stimulate private parental investment or not significantly improve it, if it offsets parental investment, understanding this question is of normative significance, especially given the fact that governments worldwide face budget constraints that limit the size and distribution of educational resources (Fryer and Katz, 2013).

Despite its theoretical importance and relevance for policy, the debate on the interplay of these two types of input of child development is still ongoing, since empirical work, if any, is scarce and inconclusive. The empirical research in this literature presents two major challenges. First, parental investment in children varies in its form and is hard to observe. Current research mainly focuses on time investment in children, which often involves parental behaviors at home and in schools to support children's educational progress and social competence. For example, Pop-Eleches and Urquiola (2011), using Romanian data, find that students who attend higher-achievement schools receive less homework-related help from their parents than other

children. In contrast, Gelber and Isen (2013) show that the Head Start program in the US causes a substantial increase in parents' involvement with their children. Unfortunately, one of the most important forms of parental investment, monetary spending on children, is largely overlooked in the extant literature due to the difficulty of observing micro-level categories of household expenditure.[2]

To identify parental monetary investment in children, we use the credit and debit card transactions of China UnionPay to trace child-related expenditure. Since UnionPay is the only interbank payment network in China that intermediates all card-based expenditures, all the nation's spending on children via bankcards enters into our data. Specifically, based on transaction information about merchant categories, we divide child-related expenditure into two categories: extra-curriculum (EC) spending and other child support (OCS). EC includes payment to private institutions that provide extra-curriculum training for children, and OCS includes expenditure on child clothing, toys, zoo visits, etc. We believe that EC captures the parental investment in children's tangible skills that directly contribute to their school outcomes, whereas OCS captures parental investment in children's intangible skills, which are more likely to be associated with children's social and emotional competence, such as curiosity, self-confidence, and communication skills.

The second empirical challenge lies in isolating the causal effects of access to better schools on parental behaviour, because most people choose where they live carefully. For example, parents who value education highly are likely to both spend more on children and live in places with better public educational resources. To facilitate a causal interpretation, we exploit an exogenous shock to students' access to public education: a merger between two districts in Shanghai, Jing'an (JA) and Zhabei (ZB). This shock has several appealing features that make it a suitable setting for answering our research question. First, the school zoning policy in China constrained students to apply for high schools in their own district and before the merger JA was endowed with significantly better educational resources than ZB. The merger lifted the barriers so that ZB students could apply for high schools in JA, and vice versa. In other words, the merger gave improved opportunities to ZB students to access better high schools in JA. Second, school district mergers in a global context often suffer from the endogeneity problem, because

[2]Using data from Zambia and India, Das et al. (2011) find that household spending substantially offsets variations in predictable school grants, but unpredictable grants have no impact on household spending.

merger decisions are usually made by voters in these affected districts (Coate and Knight, 2007; Gordon and Knight, 2008). The district merger in Shanghai, however, was a centralized political decision intended to increase the land supply of JA district rather than to improve the educational resources in ZB.

We construct a panel dataset that consists of the monthly expenditure of 1,300,690 bankcards for 12 months, 6 months before and 6 months after the merger. The average total expenditure per card per month is 1,897 RMB. The average EC expenditure on children is 10 RMB and that for OCS is 2 RMB. However, child expenditure in the full sample is low because childless cardholders are also included. Thus, we create a subsample by including only cardholders who are identified as having pre-high-school children. In this subsample, child expenditure is on average 468 RMB per card per month, which accounts for 24% of the total expenditure. We find that parents tilt heavily toward training children's tangible skills: EC spending accounts for 22% of the total expenditure, whereas OCS accounts for only 2%.

This paper employs a difference-in-differences (DiD) strategy by including a third district, Huangpu (HP), as the control group. As another inner ring district in Shanghai, HP is bordered by both JA and ZB and is not affected by the merger. Our baseline estimation compares the logarithm of monthly child expenditure of ZB cardholders to that of HP cardholders before and after the merger to discover whether improved access to public schools affects parental investment. We find that cardholders in ZB spent 2.6% more than those in HP on EC and OCS after the merger. EC went up by 0.5%, and OCS by 2.1%. Unlike child expenditure, total spending in ZB did not change significantly relative to that in HP, implying that ZB cardholders had to cut down other spending to increase their expenditure on children. The fact that we do not detect any significant increase in total expenditure also suggests that the effect of the merger was confined to parental investment in children.

While the underlying assumptions of DiD estimation are not directly testable, we examine whether cardholders in the two districts exhibit any parallel trends in expenditure before the merger. First, we do not detect any persistently different trends in total expenditure, EC, or OCS before the merger. Second, we find that the increase in child expenditure is immediate and long-lived.

Because only cardholders who have children of pre-high-school age are directly affected, the baseline specification captures only intent-to-treat (ITT) estimates. To better gauge the

treatment effect, we perform the same DiD analysis within the subsample of cardholders that are identified with children of pre-high-school age. The results are consistent with what we find in the full sample: that ZB cardholders with young children spent 15% more in EC and 14% more in OCS than HP cardholders with young children but no difference was made to total expenditure. We then confirm that the effect of the merger was indeed significantly greater for cardholders with young children by running a cross-sectional analysis using the full sample.

Next, we explore whether a second dimension of heterogeneity, i.e., distance to the old border, could moderate the effect of the merger on child expenditure. Residential location affects the treatment intensity, since daily commuting time is an important concern for school choices. Naturally, cardholders in ZB who live closer to the old border should have a greater incentive to send their children to good schools that are located in the old JA than those who live farther away.[3] We identify cardholders who are likely to live within 2 km of two underground stations in ZB, one closest to and the other farthest from the border. We find that after the merger the cardholders who lived farthest away from the border indeed spent less on children than did those who lived closest to the border. In this analysis, we also do not find any significant differences in total expenditure.

We examine whether a third dimension of heterogeneity, i.e., personal income, could moderate the effect of the merger on child expenditure. Personal income is measured by the average monthly total expenditure via each bankcard before the merger. We show that after the merger the more prosperous cardholders spent more than the others on OCS; however, we do not find a similar wealth effect on EC spending. This finding implies that parental investment in children's intangible skills may be more elastic than parental investment in tangible skills and is less likely to vary significantly across social classes.

Taken together, we find that improved access to public education in ZB encouraged parental investment in children, suggesting that after the merger parents perceived an increase in return on private investment. Because the merger could have intensified competition among students, the previous findings could also be driven by the stronger competition brought by the merger. We conduct several tests to examine the competition channel. First, we show that the merger probably introduced for the JA students more intensified competition than it did for the ZB students. As noted above, ZB had fewer top-tier high schools per capita than JA before the

[3] In JA, all the top-tier high schools are non-boarding.

merger; consequently, the average admission score was higher in ZB than in JA, suggesting that the competition to get into top-tier schools in ZB was stronger. However, the gap in the average admission score between JA and ZB narrowed after the merger, implying that the competition in ZB became easier. Consistently, the direction of student flows after the merger also verifies the finding from the admission scores: when comparing the fraction students who went to the top-tier high schools in the other district among all the students who went to study in the other district, ZB had a significant larger fraction than JA.

Second, if intensified competition is the primary channel that explains all of our results for ZB cardholders, given that the merger should have introduced more competition to JA, we would expect to see a similar or even stronger effect on the child expenditure of JA cardholders. To test this idea, we use the same DiD framework that compares the change in child expenditure of cardholders in JA to that of cardholders in HP. We find after the merger no significant change in EC, and a significant but a very moderate increase in OCS (only 30% of the magnitude for ZB cardholders). We also compare the change in child expenditure of the JA cardholders to that of the ZB cardholders. Consistently, ZB cardholders show a higher increase in both EC and OCS after the merger. Taken together, the merger significantly improves parental investment in ZB; it also mildly stimulates parental investment in JA. However, the increase in ZB is more likely to be driven by improved educational opportunities and the increase in JA by the more intense competition brought by the merger.

An alternative channel is that the merger could have led to housing appreciation, thereby generating a positive wealth shock for ZB residents. If potential gains in housing wealth could explain the increase in spending on children after the merger, we should also expect to see an overall positive impact on total expenditure. After all, there is no particular reason for a newly wealthier household to cut other spending and exclusively increase expenditure on children. The fact that we do not detect any significant changes in total expenditure in our previous analysis lends support to the interpretation that the merger affected child expenditure through improved educational opportunities rather than a wealth shock. In addition, we find that neither the price nor the transaction volume of residential apartments in ZB after the merger experienced any more noticeable increases than the HP district. Finally, we identify cardholders who owned apartments in their own districts. We find that, after the merger, their expenditure on EC and OCS did not change significantly compared to those who did not own apartments.

Finally, we conduct several robustness checks to verify our results. First, to further isolate the effect of the merger on parental investment, we run a placebo test on cardholders whom we identify as parents with adult children (those who before the merger made payments to vocational schools after junior high school or universities). We find that cardholders with adult children in ZB and HP show no significant difference in either category of child expenditure, which suggests that the effect of the merger is likely to be specific to cardholders who have children of pre-high-school age. Furthermore, we discuss the issue of one person owning multiple cards. In a previous analysis, we estimate that as a response to the merger, there are a 2.6% increase and a 28.5% increase in total spending on children in the full sample and in the young children subsample, respectively. However, it is difficult to interpret these economic magnitudes at the individual level because one person could own several cards. To address this issue, we repeat the analysis using a sample that includes debit cards only. Underlying this exercise is the common notion that people have a great incentive to own multiple credit cards in order to earn bonus points and repay the overdraft on other credit cards. For the debit card subsample, we still find significant increases in child expenditure of 1.11% and 40.08%, respectively, in the full sample and in the young children subsample.

This paper contributes to the theoretical literature that studies the effect of public education on parental investment in children. If public and private parental investments are substitutes (Becker, 1981; Becker and Tomes, 1976 and 1986), then public education and other programs to aid the young may not significantly improve them. If the two are complements (Goldberger, 1989), then public education to aid the young may improve them through boosting parental investment. Based on the setting of a district merger in China that promotes equal access to better public schools, we find evidence that supports the complementarity effect.

Our paper also fills a gap in the empirical literature on the interplay between public and private child education. To the best of our knowledge, this paper presents the first empirical evidence of parental pecuniary investment in children. The extant literature mainly focuses on parental time involvement with children in response to a change in the provision of public education, and reaches mixed conclusions (Pop-Eleches and Urquiola, 2011; Gelber and Isen, 2013). We show that monetary investment made by parents responds positively to the provision of higher-quality public education.

More broadly, our paper adds to the literature that studies the optimal size of a school district. School district consolidation is prevalently observed in the global context. For instance, the number of school districts in the United States has shrunk from about 117,000 to about 15,000 today. Extensive studies focus on the analysis of the same trade-off arising from a school district merger – reaching economies of scale versus retaining local control over school quality – and report mixed findings on its full impact on students' long-term outcomes (Andrews, Duncombe, and Yinger, 2002; Heinesen, 2002; Gordon and Knight, 2008). The literature, however, fails to incorporate into its analysis the potential effect on private parental investment, which is equally important for developing children's human capital. Our result that equalizing education resources stimulates private parental investment in children who were initially disadvantaged alludes to implications of education resource consolidation above and beyond the commonly analyzed trade-off.

Finally, our paper sheds light on public education policies. A large body of literature analyzes the effect of social programs to improve children's outcomes, such as Moving to Opportunities and Head Start in the US. These programs usually require significant fiscal spending, and their intended effects on children's outcomes remain inconclusive (Currie and Thomas, 1995; U.S. Department of Health and Human Services, 2010; Gelber and Isen, 2013; Chetty, Hendren, and Katz, 2016). There are two noticeable features about the setting we study here: the merger is characterized by effectively a *redistribution* policy that equalizes the educational resources based on a meritocratic exam across two districts; thus, it requires no additional fiscal subsidies. We observe increases in expenditure on children after the merger in both districts, albeit more moderate ones in JA. We interpret the increase in ZB as mainly driven by improved educational opportunities and the increase in JA by more competition. Our findings suggest that without extra public spending, simply improving the perceived opportunity to get into good schools could stimulate the private investment in children, thus supplementing the inadequacy in public investment. As the fiscal constraint on public education has always been a challenge worldwide that inhibits education development, our study provides what might be a practical and cost-effective solution to alleviate such constraint. By building a more egalitarian and meritocratic education system, governments may reap the benefit of stimulating private investment in children, which in turn could supplement the inadequacy in public investment.

Our paper proceeds as follows. Section 2 details the context of the merging of districts in Shanghai in 2015. Section 3 describes our data. Section 4 outlines our econometric framework and results. We provide several robustness tests in Section 5 and discuss alternative mechanisms in Section 6. Section 7 concludes.

2. Institutional Background

This paper exploits a quasi-experimental shock to students' access to public education – the district merger in Shanghai – to examine how parents respond to changes in public education provision. On September 7, 2015, Shanghai Municipal Government suddenly announced that districts Jing'an (JA) and Zhabei (ZB) would be merged into a new district named after the former, effective from November 2015. The old JA district used to be the smallest district in Shanghai with a rich cultural heritage and concentrated high-end shopping centers. It was generally regarded as one of the most affluent districts in the city.[4] In contrast, ZB district, also located inside the inner ring, had a humbler economy over a larger area. A map of the inner ring districts in Shanghai is presented in the Appendix (Figure 1). In 2015, the old JA had a resident population of 2,486,000, a land area of 7.62 km² and a GDP of 73.2 billion RMB, compared to ZB's resident population of 8,485,000, a land area of 29.26 km² and a GDP of 74.8 billion RMB.

Unlike school district mergers studied in the literature that are usually an endogenous decision made by multiple partners (Gordon and Knight, 2008; Coate and Knight, 2007),[5] this merger in Shanghai was a purely centralized political decision seeking potential economic synergies. The government officially claimed that the merger was to "improve the city's layout, making administrative divisions better suited for the city's development, lift the urban function, and promote sustainable regional development." The general interpretation and conjecture of the official statement were that this merger was intended to increase the land supply of JA district and to upgrade the use of land in ZB district in the hope of increasing revenues source for local governments.[6]

[4] Shanghai is divided into 16 districts, 7 of which are considered downtown districts (located within the inner ring).
[5] Studies working in the US context show that mergers must be approved by voters in both districts.
[6] Under the Chinese fiscal system, one of the most important revenue resources for municipal government is the revenue from land sales. For Shanghai city, about 30 % of its revenues in 2015 came from land sales. Market prices for urban land are governed by a rating system with 10 ranks; land with a higher rank is associated with a higher price. Land in the old JA district ranks higher than that in ZB, and a district merger could upgrade old ZB land, thus generating higher revenue for the local government.

Before the merger, most of the local public services, such as hospitals, were not exclusive to local residents, with one exception, i.e., the access to public high schools.[7] Public high school admission in Shanghai is based on students' performance in a city-level standard entrance examination, but the selection is limited within each district. We offer an illustration of the system of public school entrance in Shanghai in the Appendix (Figure 2). In other words, students can apply only for high schools within their own district. The merger between JA and ZB lifted the admission barrier and allowed students to apply for high schools across the two districts; thus, both students and schools had a larger pool to apply for and select from.

Before the merger, the old JA district was endowed with more top-tier public high schools exclusively for its own residents.[8] According to Figure 1, before the merger the old JA had 7 top-tier high schools, while the old ZB had 8, but with a population three times the size of that of JA. Naturally, the top-tier school density (school per capita) in old ZB was less than half its level in JA, suggesting that students in old ZB had had to face much stronger competition to get into a top-tier high school. The fiercer competition among students in the old ZB before the merger is also reflected in Figure 2: the average admission score for top-tier high schools in ZB was also higher than that in JA before the merger.

[[Insert Figures 1 and 2 about here]]

Given the uneven distribution of high-quality educational resources across these two districts, the merger was generally perceived as a pronounced improvement in educational opportunities for ZB students. In theory, it might have led good students in ZB who would have had no chance to attend top-tier high schools in ZB without such a merger, to apply for top-tier high schools in JA. We confirm this idea in Figures 2 and 3. Figure 2 shows that admission scores for top-tier high schools in JA increased more than those in ZB, suggesting stronger positive selection in JA after the merger. Figure 3 reports the data on student flows between these two districts in the years 2016 and 2017. While 92.6% of the old ZB students who studied in the old JA schools after the merger managed to enrol into top-tier high schools, only 55.8% of the old JA students who studied in the old ZB schools enrolled into the top-tier high schools in

[7] The school zone of public primary and junior high schools is divided on the basis of a smaller unit, e.g. at postcode level, therefore the district merger did not affect the access to public primary and junior high schools.

[8] China has a two-tier public schools system in which top-tier schools (重点中学) explicitly receive much better resources and support than normal schools (普通中学), therefore show much better academic performances.

ZB. The two figures combined suggest that students from ZB would have been likely to benefit more from the merger.

[[Insert Figure 3 about here]]

3. Data

The unique dataset that this paper uses is the credit and debit card transaction dataset provided by China UnionPay. Founded in 2002, China UnionPay is an association for China's banking card industry, operating under the approval of the People's Bank of China (the central bank of China). UnionPay is the only interbank payment network in China; it intermediates all card-based expenditures. It is the largest network in the world in terms of both the number and value of transactions, ahead of Visa and Mastercard. It transfers funds electronically in a Point-of-Sale (POS) network and is the only interbank network in China, linking all the Automatic Teller Machines (ATMs) of all banks throughout the country.

We use all the bankcard transactions in the three districts of Shanghai, namely, Zhabei, Jing'an and Huangpu, to identify total expenditure and specific expenditure on children per card. All transactions on child-related items made via bankcards entered our data. Our data includes the transactions of 1,300,690 cards over 274 merchant categories between April 2015 and March 2016. Each observation records the location, time, value, and the merchant category of the transaction. We aggregate the data to the card-month level. Given that bankcard transactions have a high penetration in the retail spending in China, our data represent a sizeable proportion of household real spending activities. According to official statistics from the Central Bank of China (2015), bankcard transactions accounted for 48% of overall spending in the retail sales of consumer goods in the third quarter of 2015, and we believe that the ratio should be even higher in Shanghai, as it is the most commercialized metropolis in China

We examine two types of expenditure on children, namely, extra-curriculum (EC) spending and other child support (OCS). Specifically, EC includes payment to private institutions that provide extra-curriculum training (e.g., Shao Nian Gong) and stationery. OCS includes expenditure on children's clothing, toys, zoo visits, etc. EC captures parental investment in children's tangible skills, which could directly enhance student's academic performance, while OCS spending may help develop such intangible children's skills as are largely believed to be associated with social competence, such as curiosity, self-confidence, etc. (Chen and French,

2008). Because the school zone of public primary and junior high schools is divided on the basis of a unit smaller than the district, no district merger should affect the access to public primary and junior high schools. In addition, because China mandates nine years of compulsory education, parental expenditure on formal education earlier than high school does not reflect the parent's own investment decisions. Thus, we do not include payment to formal education before high school.

Transaction data feature two important advantages over consumer expenditure surveys. First, card transactions reflect real-time purchases as opposed to respondents' self-reporting and recollection of their spending. Second, they are of high frequency, which enables researchers to study immediate changes in spending. One limitation of our data is nevertheless the lack of demographic information on cardholders. To overcome this limitation, we develop algorithms with the research team at UnionPay to explore the knowledge graph of cardholders. In the context of this paper, our knowledge graph aims to uncover the residence location of each cardholder at the district level for the main analysis of the paper and within 2 kilometers of several underground stations for the cross-sectional analysis.

Specifically, we infer the residence location for each cardholder by employing a score-based algorithm that reads into the card's historical expenditure one year before the merger. Underlying our methodology is the assumption that the places where purchases are made are correlated with the residence location, but to a varying degree. For example, people are more likely to go to a laundry that is in their neighborhood, whereas the restaurant where they might dine is less indicative of their home address. Thus, we assign a score ranging from 1 to 10 to different spending categories. A higher score is assigned to property management, utilities, laundries, kindergartens, primary and middle schools, and a lower score is assigned to ATMs, restaurants, supermarkets, convenience stores, etc. Since each merchant has an address, we aggregate, for each card, the scores of all transactions by district. Finally, the district that receives the highest score is viewed as the primary residence district of the cardholder. In total, we identify 334,024 cards with primary residence location in JA, 860,890 cards in ZB, and 105,776 cards in HP. In Section 4.4, we discuss the algorithm that identifies the residence location of each cardholder within 2 kilometers of several underground stations.

We summarize the key variables in Table 1 for the full sample and by residence districts. Average total expenditure per card per month is 1,897 RMB. Debit cards have a higher

expenditure (2,706 RMB) than credit cards (1,262 RMB). Given that the annual income per capita in Shanghai was 47,710 RMB in 2015 and that the private saving ratio was around 50%[9], our data are likely to capture a considerable proportion of actual spending. The average EC expenditure on children is 10 RMB, and for OCS it is 2 RMB. Because the full sample covers all cards, including childless cardholders, child expenditure in the full sample is likely to underestimate the parental investment. Comparing districts, ZB and JA residents spend similar amounts, close to 2000 RMB per month, and HP residents spend a third more. This is also largely consistent with the notion that HP is the center of downtown Shanghai.

[[Insert Table 1 about here]]

To assess the expenditure on children more precisely, we identify cardholders who have children below high-school age by examining their historical spending. We identify cards that spent on EC, OSC, and formal schooling before high school, and on children's hospitals one year before the merger. We summarize the key variables for the subsample of cardholders who have young children in Table 2. While total expenditure for this subsample is as high as that of the full sample, and is also as high in district-by-district comparisons, the child expenditure is much higher in Table 2. Child expenditure is on average 468 RMB per card per month, which accounts for 24% of total expenditure. We also find that parental investment in child skills tilts heavily toward tangible skills. Average EC spending is 458 RMB, accounting for 22% of total expenditure, whereas average OCS spending is 10 RMB, accounting for only 2% of total expenditure.

[[Insert Table 2 about here]]

4. Empirical Results

In this section, we examine the difference in the expenditure of cardholders between JB and HP district (our control group, as noted in the section on data) before and after the merger using a DiD strategy for the full sample (Section 4.1), a pre-trend analysis (Section 4.2), a subsample of cardholders with pre-high-school children (Section 4.3), heterogeneous results on distance to the older border (Section 4.4), and heterogeneous results regarding income level (Section 4.5).

4.1. Baseline Analysis

[9] More details at http://www.shanghai.gov.cn/nw2/nw2314/nw24651/nw31071/nw31120/u21aw734365.html.

We conduct an empirical analysis at the card-month level for the year that starts from March 2015 and ends in February 2016, 6 months before and 6 months after the announcement of the merger. It covers all the cardholders whose residence location was either in ZB or HP (the control group). By focusing on monthly expenditure in a one-year horizon, we can study the immediate effect of the merger and rule out other confounding changes that would take more time to materialize, for example, new schools or establishments built in these districts as a specific response to the merger. We employ a DiD estimation as in Equation (1).

$$C_{ijt} = \alpha + \beta \ (\ Zhabei_{i,j} \times After_t) + \gamma_i + w_t + \varepsilon_{ijt} \qquad (1)$$

where C_{ijt} refers to the logarithm of monthly expenditure for card i in district j in month t. It includes total child-related expenditure, extra-curriculum spending (EC), and other child support spending (OCS).

The dummy variable $After_t$ equals 1 for months starting from September 2015. $Zhabei_{i,j}$ is a dummy variable that equals 1 if a cardholder's residence location is in the old ZB district and 0 if it is in HP. In this specification, we control for all the time-invariant differences across cardholders (e.g., gender, education, etc.) by including card fixed effects γ_i. We also include month fixed effects w_t to control for changes over time that affect both districts in the same way. All standard errors are clustered at the card level.

[[Insert Table 3 about here]]

Since not every cardholder had pre-high-school children, our baseline specification captures only the intent-to-treat (ITT) estimates. Table 3 presents the results. Columns (1)–(3) show that after the merger cardholders in ZB spent 2.6% more on children-related items than those in HP. It corresponds to an economic magnitude of 0.3 RMB more per month after the merger. Both extra-curriculum (EC) spending and other child support (OCS) spending increased. EC went up by 0.5%, and OCS by 2.1%. Although these effects are all statistically significant, the economic magnitude is somewhat limited. This is probably due to the fact that not all cardholders have children. We will discuss this issue below in Section 4.3.

In contrast, columns (4)-(6) suggests that after the merger total monthly expenditure, either through credit cards or debit cards, did not vary much between ZB and HP. This finding implies that the ZB cardholders had to cut down other spending to increase their expenditure on children. In unreported tests, we explore some categories of adult-exclusive expenditure that are likely to be cut down in such circumstances, namely, coffee, cigarettes and alcohol, and beauty

(including beauty salons and cosmetics). We find that only beauty expenditure declined for cardholders in ZB after the merger, suggesting that mothers probably cut down their beauty spending to subsidize their increased spending on children.

4.2. Pre-trend Analysis

While the underlying assumptions of DiD estimation are not directly testable, we provide a pre-trend analysis to verify whether expenditure patterns differed between the two districts in the months leading up to the merger. We replace $Zhabei_j \times After_t$ in Equation (1) with $Zhabei_j \times w_t$. Table 4 reports the results.

[[Insert Table 4 about here]]

In Panel A of Table 4, we use the full sample and take August 2015 as the reference month. Overall, we do not find a systematic difference in either child expenditure or total expenditure in the months leading up to September 2015. For example, Column (3) in Panel A of Table 4 shows that there was no significant difference in OCS spending between these two districts before the merger. The effect of the merger started to bite in September, precisely the month when the merger was announced. In addition, the impact on OCS persists in the 6 months after the merger. Figure 4 further illustrates the findings on total child expenditure with a 95% confidence interval. As shown, the cardholders in ZB started to spend significantly more than those in HP just after the merger, and the spending gaps ranged from 1.67% to 3.49%.

[[Insert Figure 4 about here]]

EC spending exhibits seasonality. Column (2) in Panel A of Table 4 shows that, after the merger, the spikes in EC occurred in September and January, which correspond to the beginning of an academic year and the winter holiday. Extra-curriculum training schools usually start new programs in these months and require tuition fees to be paid upon enrolment.

In Panel B of Table 4, we extend the sample period and include only the months in which EC spending is likely to have been concentrated, in order to better understand the dynamic effect of seasonality on EC. We include January 2015, June 2015, September 2015, January 2016, and June 2016; they correspond to the beginning of either a school break or an academic year. We conduct a similar pre-trend analysis as in Panel A and take January 2015 as the reference month. Overall, we do not find a persistent difference in EC spending in the months before the merger. In addition, EC spending in January 2016, and June 2016 for cardholders in ZB increased significantly in relation to those in HP after the merger.

4.3. Subsample with Young Children

While the baseline analysis indicates a significant increase in child expenditure for ZB cardholders after the merger, the economic magnitude is limited. This is likely to have been caused by the fact that not all cardholders have children. In other words, the baseline specification captures only the intent-to-treat (ITT) estimates by treating all the cards in ZB as affected by the merger. In fact, the district merger should directly impact only the cardholders whose children were below high-school age. In an ITT framework, the effect of the district merger in our baseline results should increase mechanically if the fraction of cardholders who have pre-high-school children was higher in ZB than the one in HP.

As discussed in Section 3, we cannot observe cardholders' demographic information. To better gauge the effect of the merger on parental spending on children, we identify a group of cardholders who have children of below high-school age (hereafter, young children) on the basis of a bankcard's transaction history. Specifically, we identify the cards used for spending on tuition fees for primary schools or junior high schools, children's hospitals, EC or OSC, one year before the merger. We are fully aware that the algorithm to create the subsample of cardholders with young children may not be precise; however the statistical error is more likely to be type I (failing to include all the cardholders with young children) than type II (including childless cardholders in the sample). We therefore first perform the same DiD analysis for this subsample of cardholders with young children (see Table 5), and then offer a cross-sectional analysis using the full sample (see Table 6).

[[Insert Table 5 about here]]

Table 5 presents the subsample DiD results. We find that the effect of the merger is significant for both child expenditure categories, EC and OCS spending. Noticeably, the ZB cardholders who are identified as having young children spent 15% more on EC and 14% more in OCS than the HP cardholders in the same category. In total, spending on children went up by 25.1%. This is in sharp contrast with the moderate increases in the full sample analysis (i.e., 0.5% in EC, 2% in OCS, and 2.5% in total spending). Measuring by RMB, total spending on children went up by 117 yuan per month in this subsample. Consistent with the results in the full sample, we do not find any significant changes in total expenditure.

$$C_{ijt} = \alpha + \beta \ (\ Zhabei_{ij} \times After_t \ \times Kid_{ij}) + Other\ \ interactions + \gamma_i + w_t + \varepsilon_{ijt} \qquad (2)$$

To further test whether the magnitude of the effect is significantly higher for cardholders with young children, we conduct a cross-sectional analysis using the full sample. We include a triple interaction between Zhabei×After×Kid as in Equation (2); it allows for additional variation along the dimension of whether a cardholder is regarded as having young children. We report the results in Table 6.

[[Insert Table 6 about here]]

First, we find that the effect of the merger is more pronounced for cardholders with young children than those without, with magnitudes of 25.1% more in total spending on children, 13.6% more in EC, and 12.2% more in OCS. Second, the DiD coefficient of Zhabei×After stays significant for total child expenditure and for OCS after adding the triple interaction term, suggesting that our algorithm indeed fails to identify all the cardholders with children. Taken together, the results in this section lend further support to the baseline analysis by showing that the merger is likely to impact most on cardholders with young children.

4.4. Heterogeneity: Distance to the Old Border

One major concern for our previous subsample analysis is that we rely on historical child-related expenditure to detect whether a cardholder has a young child or not. Thus, the algorithm may select parents who care about children and are more willing to spend on children into our subsample, therefore overestimating the effect of the merger. In this section, we explore another dimension of heterogeneity which uses all the categories of expenditure that are more likely to be independent of future child expenditure: distance to the old border between JA and ZB.

In JA, all the top-tier high schools are non-boarding. Thus, the cardholders in ZB who live closer to the old border between JA and ZB should have a greater incentive to send their children to the top-tier schools located in JA. The Appendix (Figure 3) shows that Underground Line One passes through ZB and JA. On this line, Hanzhong Road (汉中路) Station in ZB district is closest to JA, and Gongkang Road (共康路) Station in ZB is farthest from JA. There are six more underground stations between these two stops.

We infer the distance of the ZB cardholders to the eight underground stations in ZB by employing a similar score-based algorithm as the one we used to identify a cardholder's residential district (see the Data section). Underlying our methodology is the assumption that the location of a purchase is correlated with the home address. We sift through each card's historical spending one year before the merger. But we require more precise identification of the residence

location this time – within 2 km of each underground station. To do this, we use the Global Positioning System (GPS) provided by Baidu Map for each merchant. We calculate the coordinate distance from each merchant to the nearest of the eight underground stations. We keep the transactions with merchants who are within a 2km radius of the nearest underground station. We then employ the same scoring system for the merchants as described in the Data section. We aggregate for each card the scores of all transactions by underground station. Finally, the underground station that receives the highest score is viewed as nearest to the primary residence location of the cardholder.

$$C_{ijt} = \alpha + \beta \ \ Far_{ij} \times After_t + \gamma_i + w_t + \varepsilon_{ijt} \qquad (3)$$

We perform a DiD analysis within the ZB cardholders as in Equation (3). Specifically, we compare the change in child expenditure after the merger between the cardholders who live close to the Gongkang Road Station with to those close to the Hanzhong Road Station. We construct a dummy variable *Far*, which equals 1 if the cardholder lives near Gongkang Road Station, and 0 if near Hanzhong Road Station. Table 7 presents the results.

[[Insert Table 7 about here]]

Because all top-tier high schools in JA are non-boarding, daily commuting is important for school choice. In other words, the effect of the merger tends to be stronger for cardholders living near the Gongkang Road Station than for cardholders near the Hanzhong Road Station, since it is more costly and time consuming for parents and children to attend schools that require a long commute. For total child expenditure, we find that cardholders near the Gongkong Road Station spent less on children after the merger than did those near the Hanzhong Road Station. The effect is most noticeable for OCS spending: cardholders near the Gongkong Road Station spent 1.5% less on OCS than those near the Hanzhong Road Station. Regarding EC spending, after including only the associated months (September, June and January, as suggested in Table 4), cardholders living far away from the old border spent 0.91% less on EC compare to those close to the border. In this analysis, we also find no significant increase in total expenditure.

4.5. Heterogeneity: Personal Income

We explore another dimension of heterogeneity – personal income – to examine whether the merger effect varies across different income groups. As noted earlier in the Introduction, the extant literature provides mixed findings on the effect of public education provision on parental investment in children, specifically, their time investment. One possible explanation is that the

effect may vary across families with different economic endowments. On the one hand, more prosperous families invest more resourcefully in their children and therefore are more likely to exploit the improved educational opportunities brought by the merger. On the other, as wealthier families have more outside alternatives to public high school, such as private high schools, these families are less motivated to respond to the merger.

$$C_{ijt} = \alpha + \beta \left(Zhabei_{ij} \times After_t \times Income_{ij} \right) + Other \ \ interactions + \gamma_i + w_t + \varepsilon_{ijt} \quad (4)$$

Because we do not observe a cardholder's actual income levels, we calculate the average monthly total spending for each card before the merger to indicate personal income. We believe that consumer spending is indicative of a cardholder's actual income level. In Equation (4), we include a triple interaction term $Zhabei_j \times After \times Wealth_{ij}$ to capture the different treatment effect of varying income levels. Table 8 reports the results.

[[Insert Table 8 about here]]

We find that after the merger wealthier cardholders spent more on OCS than more impoverished cardholders. A 1% increase in personal income is translated into a 0.12% increase in OCS spending. In contrast, we do not find any significant differences in EC spending between the rich and poor cardholders. Parents may perceive clothes and zoo visits as less necessary for their children than skill training, since the former does not directly improve a child's performance. When the perceived opportunity of getting into a good public school improves, poorer parents prioritize their investment in tangible skills over that in intangible skills. This finding suggests that parental investment in children's tangible skills is less elastic than their investment in intangible skills.

This finding suggests that access to better educational resources could promote more investment in children's academic performance across all social classes; however, it encourages only wealthy families to invest more in child intangible skills, implying that other aspects of human capital, such as social skills and confidence, are more likely to be subject to the persistence of income inequality.

5. Robustness Tests

5.1. Subsample of Debit Cards

One limitation of this dataset is that we cannot match card ID to cardholder. As a result, we cannot make inferences for one individual on the basis of card-level analysis because it is possible for one person to own several cards.

[[Insert Table 9 about here]]

To see the sensitivity of our results to the possibility of owning several cards, we repeat the DiD analysis using a sample that includes debit cards only; the results are presented in Table 9. We restrict our sample to debit cards, because people are more likely to possess several credit cards than several debit cards, given that credit cards can earn bonus points and repay the overdraft of other credit cards. In Table 9, we find that after the merger total spending on children increases by 1.11% for ZB debit-card holders, compared to 2.6% when all cards are included. The slightly smaller effect is perhaps to be explained by the fact that childless cardholders tend to be young people who are less eligible to apply for credit cards. Then, to better gauge the effect of multiple cards, we select a subsample of the previous group that covers only debit-card holders with young children. In this sub-subsample, the effect jumps to 40.08%, compared to 28.5% when all cards are considered. In short, the impact of the merger on expenditure on children is more pronounced if we look only at debit-card holders with young children.

Overall, our findings suggest that the merger also has a significant effect on the sample of debit cards, but at the individual level the magnitude is inferred to be sensitive to the issue of multiple cards.

5.2. Placebo Test: Subsample with Adult Children

To see whether the effect of the merger is specific to cardholders who have young children (below high-school age children), we run a placebo test by examining whether the merger also affects cardholders who are identified as having adult children (too old to go to high school) or as too young to have school-age children.

To do so, we identify the cards used to pay tuition fees to tertiary education institutions, including universities, vocational schools and correspondence schools, one year before the merger. The assumption here is that the cardholders who paid for such tertiary education are either parents with children of post-secondary-school age or university/college students themselves. Neither group would be affected by the high-school-district merger. We then perform the same DiD analysis within this subsample.

[[Insert Table 10 about here]]

Table 10 presents the results. Unlike the findings in Table 5, the merger presented an impact that was no different for ZB cardholders or HP cardholders. Neither EC nor OCS experienced increases after the merger. In short, the results in this section further confirm that the effect of the merger was specific to cardholders who had young children.

6. Alternative Channels

In section 5, we find that the merger between ZB and JA positively affected the ZB cardholders' investment decisions in their children, and, more importantly, we argue that their improved entitlement to accessing better public schools drove this change. However, apart from access to public education, other factors may have altered at the same time as the merger and may have influenced cardholders' expenditure on children too. In this section, we discuss two possible mechanisms through which the merger may have impacted on cardholders' expenditure decisions.

6.1. Housing Appreciation

The first altered channel would have taken effect if there had been housing appreciation in the old ZB district. As discussed in Section 2, the old JA was regarded as one of the most affluent districts in Shanghai, with a rich cultural heritage and concentrated shopping centers, leading to high real estate prices. ZB had a much humbler economy and extended over a larger area, with consequently lower housing prices. It is possible that, after the merger, housing prices in the former ZB would go up, now that properties could claim to be in JA, and converge to the prices in the old JA. In addition, as cardholders who have young children are also more likely to own residential properties, they may have been the ones who benefited most from such a housing appreciation. In this section, we test whether housing appreciation was the primary driver that affected the changes in the expenditure patterns of ZB cardholders.

First, we document both the prices and transaction volumes of the residential properties in ZB and HP districts (see Figure 5). It is clear that after the merger neither the housing prices nor the transaction volume in ZB experienced a significant surge within half a year of August 2015. This, contrary to what one might have expected, means that the housing market in ZB remained relatively stable after the merger. Thus, there was no actual positive wealth shock for the ZB house owners.

[[Insert Figure 5 about here]]

Second, although we do not find evidence of actual housing appreciation, the residents in ZB might have responded to the merger by upwardly adjusting their anticipation of real estate prices; this could also have influenced expenditure patterns. If this was the case, instead of observing an increase in child expenditure alone, we should expect to see a rise in total expenditure for ZB cardholders after the merger. However, Column 4 of Table 3 and Column 4 of Table 5 both indicate that the merger did not bring significant changes in total expenditure. These findings lend further support to our interpretation that the merger affected child expenditure through improved educational opportunities but not through anticipated gains in wealth.

Third, we further identify cardholders who are property owners in their own districts by examining the payments made to local property service agencies and real estate agencies. If it had been a housing appreciation that primarily drove the previous results, then cardholders who were property owners should have responded in more pronounced ways to the merger than did non-property owners. We test this idea in Table 11.

[[Insert Table 11 about here]]

In Panel A of Table 11, we examine whether the effect of the merger was stronger for house owners by including a triple interaction Zhabei×After×House. One challenge arises when interpreting the results in Panel A: parental status tends to be positively associated with property ownership. In other words, cardholders with children are also more likely to own residential properties. To separate the effect of housing price appreciation from improved educational opportunities, we employ an interaction between Zhabei×After×Child×House under the same DiD strategy in Panel B. House is a dummy variable that indicates whether a cardholder is a property owner in their own district. We find that in the group that is identified as parents of young children, the effects of the merger on EC and OCS did not differ significantly between cardholders with and those without properties. Taken together, our findings further confirm that the merger was unlikely to have affected a ZB cardholder's expenditure decisions because of higher anticipated gains in the real estate market.

6.2. Stronger Competition

Another possible explanation is that parents anticipated fiercer competition after the merger and thus invested more in their children. As discussed previously, each student is allotted to a public

high school in Shanghai on the basis of her/his performance in a standard examination. Indeed, by enlarging the candidate pool, the district merger may have intensified the competition. We conduct several tests to examine the competition factor.

First, the detailed study in Section 2 shows that the merger if anything even weakened the competition among students in the old ZB, whereas it intensified the competition in the old JA. As shown in Figure 1, the old ZB had only half as many top-tier high schools per capita as JA had. Hence, students in the old ZB used to face much stronger competition to get into a good public high school. This is also reflected in Figure 2, which shows that the average admission score of top-tier high schools was higher in ZB before the merger than after it. Consistently, the gap in average admission score also narrowed after the merger. Figure 3 further shows that the merger allowed a higher percentage of good students than before to enroll in top-tier high schools in the old JA.

Given that the merger tended to introduce more competition to JA than to ZB, if the increase in expenditure on children in ZB was driven by competition brought by the merger, we should expect an even more noticeable effect for the cardholders in JA. To test this, we compare the change in expenditure on children by cardholders in JA to that of cardholders in HP by employing the same DiD strategy. We report the results in Table 12.

[[Insert Table 12 about here]]

We consider all the cardholders in columns (1)-(3) and a subsample of cardholders whom we identify having young children in columns (4)-(6). In contrast with the results in Tables 3 and 5, we find that JA cardholders after the merger did not increase their EC spending, as compared to HP cardholders. Second, we observe a significant but only a moderate increase in OCS spending by JA cardholders; and the magnitude of the effect is only 30% of the effect when ZB is compared to HP. In unreported tests, we directly compare the change in expenditure on children of JA cardholders to that of ZB cardholders. The findings consistently show that ZB cardholders have a higher increase in child expenditure, both EC and OCS, as compared to JA cardholders,

In conclusion, we believe that the increase in parental investment in ZB was more probably driven by improved opportunities to invest in education, and the mild response in JA was possibly driven by stronger competition.

7. Conclusion

This paper examines whether parental investment in children responds to changes in the provision of public education and presents what is, to our knowledge, the first evidence of parental pecuniary investment in children. We exploit an exogenous shock in public education provision brought by a district merger in Shanghai. The merger equalized and, more importantly, improved the chances of ZB students, who were initially disadvantaged, to get into good public high schools. We construct a unique transaction-level dataset of China UnionPay debit and credit cards across three districts in Shanghai.

Using a simple DiD framework, this paper shows that cardholders indeed increased their spending on children, in both extra-curriculum training and other child support, in response to the improved educational opportunities. The effect is both immediate and persistent. In addition, we further explore the heterogeneity in cardholders' response to the merger and find that the effect is stronger for cardholders who have children of pre-high-school age and for those who live closer to the old border, but disappears for those who have adult children. Last, we discuss potential alternative changes that might have influenced expenditure decisions, and rule out the possibility that the previous results were driven by the increased competition and housing appreciation that may have resulted from the merger.

This paper fills gaps in the literature on the interplay between public education and child education and presents important policy implications. Many public programs that have been widely studied in the literature usually require monetary subsidies for education provision. The district merger in Shanghai was a redistribution of educational resources based on a meritocratic exam across two districts; it thus did not require additional fiscal subsidies. Our findings suggest that without extra public spending, simply improving the perceived opportunity to get into good schools could stimulate the private investment in children, thus supplementing the inadequacy in public investment.

This study also opens interesting questions for future research. For example, cultural values often influence education decisions; it is, therefore, unclear whether the pattern of investment in children that we reveal is a feature of Chinese parents that also exists in other societies. In addition, because this paper is silent on children's actual outcomes, more empirical research that can link children's long-term outcomes to parents' pecuniary investment in them

will be needed to complete our understanding of the role of the interplay between public and parental investment in the development of children's human capital.

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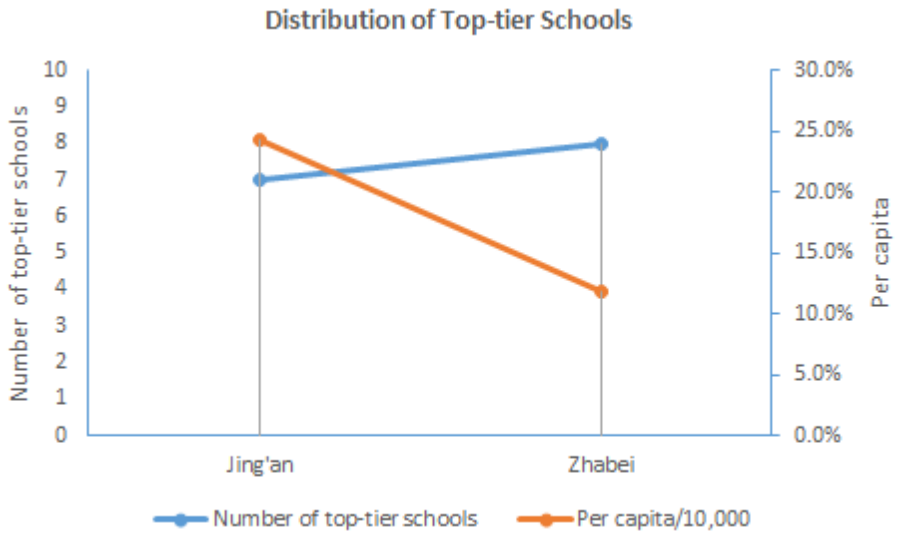
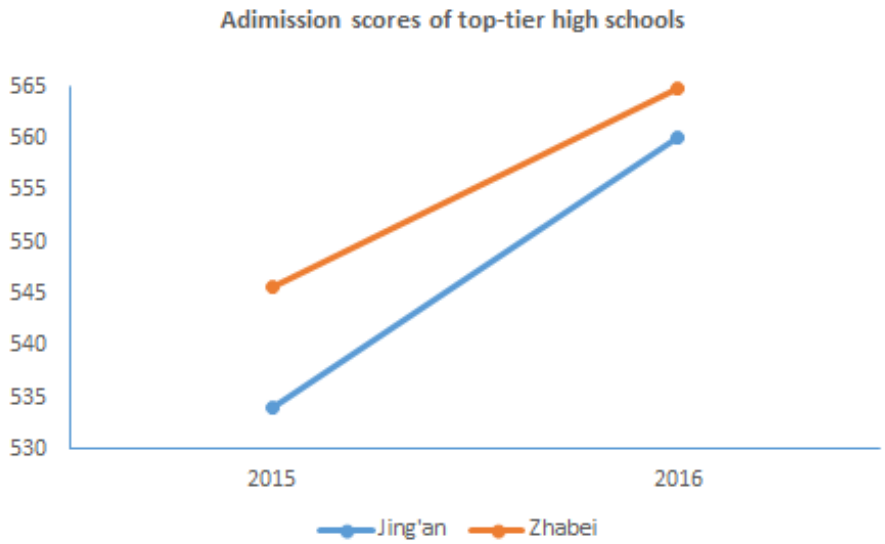
Figures

Fig. 1. Supply of Top-tier High Schools in Zhabei *vs* Jing'an



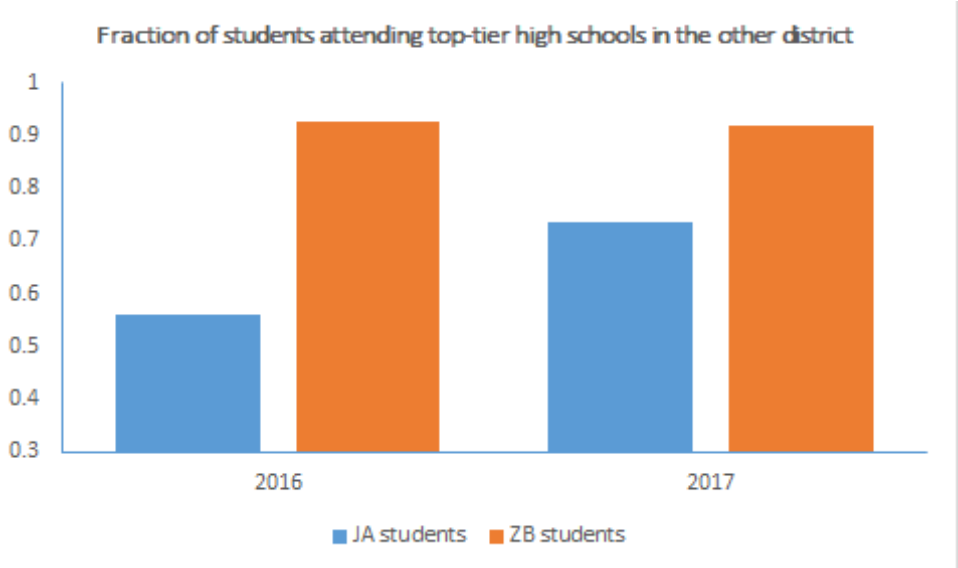
Notes: This figure presents the inequality in public school provision between Jing'an and Zhabei before the merger. The blue line displays the number of top-tier public high schools in each district (left y-axis), while the orange line reports the density of top-tier public high schools over district population in 10,000 (right y-axis).

Fig. 2. Admission Scores Before and After the Merger



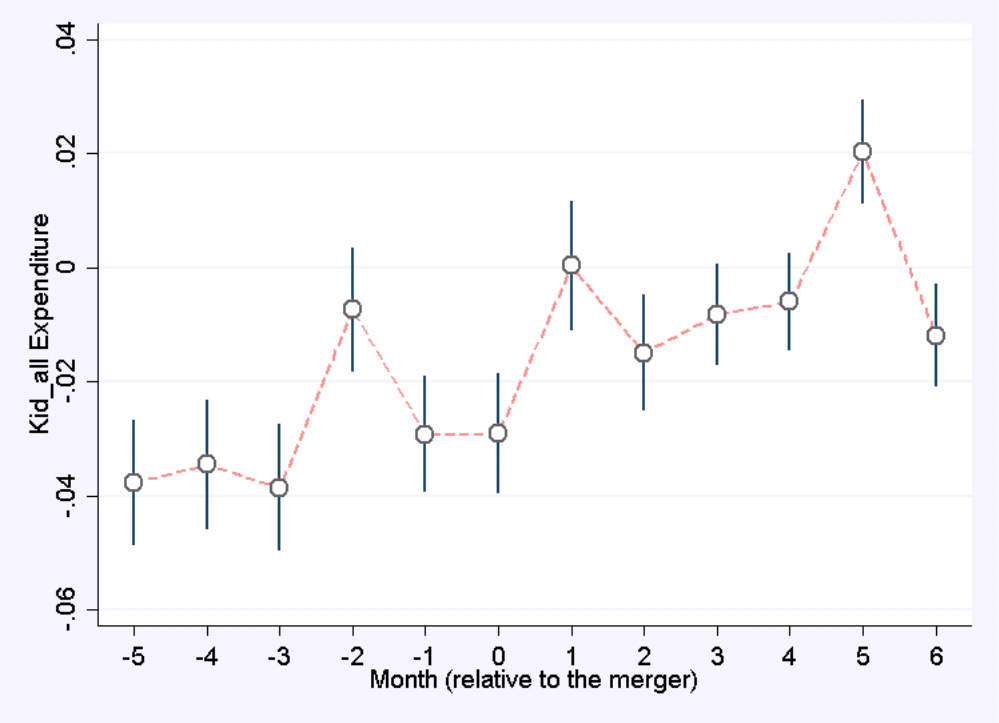
Notes: This figure displays the average admission scores of the standard entrance examination for top-tier high schools by districts in years 2015 and 2016. The orange line represents the average score in Zhabei district, and the blue line Jing'an district.

Fig. 3. Student Flows After the Merger



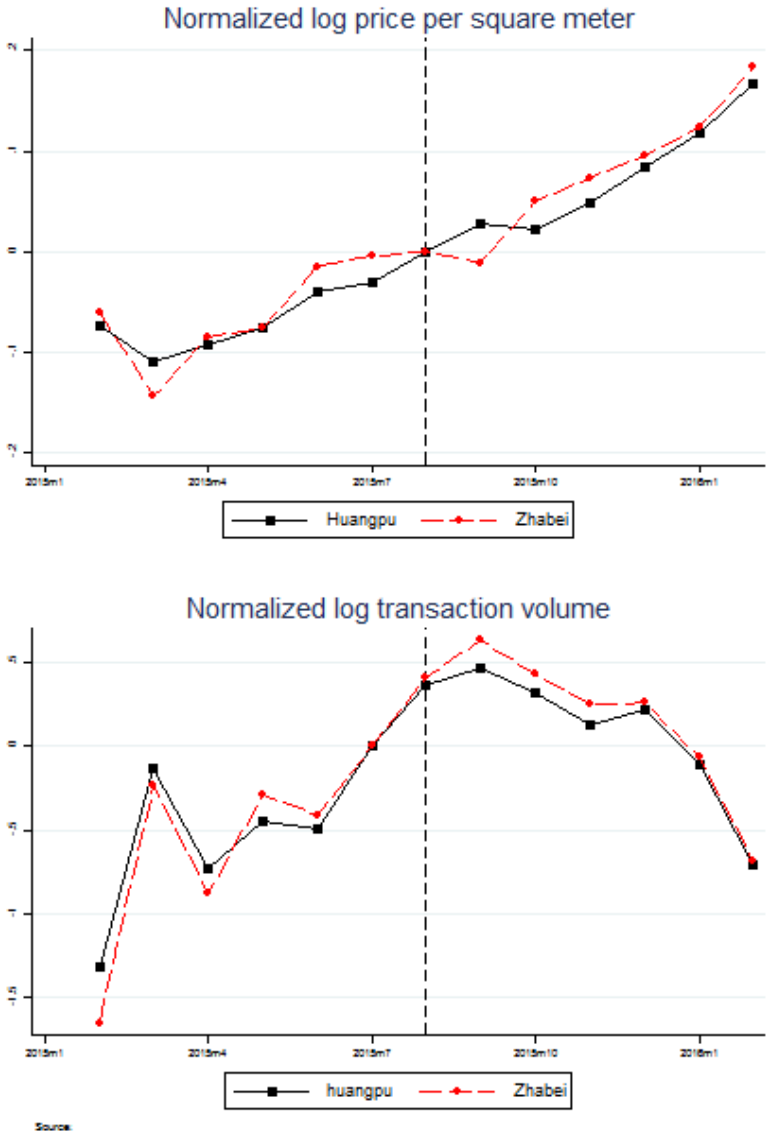
Notes: This figure reports the data on student flows between Zhabei (ZB) and Jing'an (JA) in the years 2016 and 2017. We calculate student flows from ZB to JA as the number of ZB students who enrolled in JA top-tier high schools over the number of ZB students who enrolled in JA high schools. We calculate student flows from JA to ZB as the number of JA students who enrolled in ZB top-tier high schools over the number of JA students who enrolled in ZB high schools. The orange bars represent student flow from ZB to JA, while the blue bars the student flow from JA to ZB.

Fig. 4. The Dynamic Impact of the Merger on Total Child Expenditure



Notes: This figure presents the DiD coefficients with a 95% confidence interval in Table 4. The horizontal line indicates months where month 0 corresponds to August 2015.

Fig. 5. Housing Market In ZB *vs* HP



Notes: This figure displays the logarithms of average housing price per square meter and total transaction volume, normalized at their corresponding levels in August 2015, for all residential properties by districts over time.The dotted line indicates August 2015. The red line represents Zhabei district and the black line Huangpu district. Data is obtained from China Real Estate Price Platform run by China Real Estate Association.

Tables

Table 1: Summary Statistics for Main Variables

VARIABLES	N	mean	sd	p50	min	max
Panel A: Full Sample of Zhabei and Huangpu						
Total expenditure	3,788,260	1,897.03	14,228.96	400.00	1.01	9,721,200.00
Credit	2,122,671	1,262.39	6,660.32	300.34	1.04	3,534,023.00
Debit	1,665,589	2,705.82	20,069.56	600.00	1.01	9,721,200.00
Child expenditure	3,788,260	11.96	415.49	0.00	0.00	150,258.00
EC	3,788,260	9.71	409.25	0.00	0.00	150,258.00
OCS	3,788,260	2.24	70.25	0.00	0.00	42,723.00
Panel B: Zhabei Sample						
Total expenditure	3,542,071	1,792.95	14,407.52	386.50	1.04	9,721,200.00
Credit	1,975,140	1,123.05	6,272.79	288.56	1.04	3,534,023.00
Debit	1,566,931	2,637.36	20,453.67	569.80	1.05	9,721,200.00
Child expenditure	3,542,071	12.20	407.38	0.00	0.00	105,876.00
EC	3,542,071	9.87	400.71	0.00	0.00	104,800.00
OCS	3,542,071	2.33	71.83	0.00	0.00	42,723.00
Panel C: Huangpu Sample						
Total expenditure	246,189	3,394.49	11,247.16	1,180.50	1.01	2,008,622.00
Credit	147,531	3,127.88	10,378.80	1,005.50	1.40	2,008,622.00
Debit	98,658	3,793.17	12,422.41	1,591.62	1.01	823,804.70
Child expenditure	246,189	8.42	518.33	0.00	0.00	150,258.00
EC	246,189	7.43	516.70	0.00	0.00	150,258.00
OCS	246,189	0.99	41.16	0.00	0.00	9,736.00
Panel D: Jing'an Sample						
Total expenditure	1,607,768	1,949.14	12,209.49	447.10	1.01	4,010,000.00
Credit	1,008,700	1,442.68	7,711.95	343.10	1.05	1,900,984.00
Debit	599,068	2,801.91	17,285.13	669.00	1.01	4,010,000.00
Child expenditure	1,607,768	15.98	462.40	0.00	0.00	70,000.00
EC	1,607,768	12.39	442.83	0.00	0.00	70,000.00
OCS	1,607,768	3.58	133.08	0.00	0.00	48,806.00

Notes: This table reports summary statistics for the main variables. Panel A reports the full sample including all cards in Zhabei and Huangpu districts, Panel B all cards in district Zhabei, Panel C all cards in district Huangpu, and Panel D all cards in district Jing'an.

Table 2: Summary Statistics for Subsample of Cardholders with Young Children

Variable	N	mean	sd	p50	min	max
Panel A: Full Sample						
Total expenditure	79,032	2,092.72	9,021.31	511.10	1.60	1,200,000.00
Credit	70,264	1,830.09	5,661.05	483.00	1.60	272,000.00
Debit	8,768	4,197.35	21,721.38	1,000.00	2.00	1,200,000.00
Child expenditure	79,032	468.19	2,775.91	0.00	0.00	150,258.00
EC	79,032	458.61	2,773.93	0.00	0.00	150,258.00
OCS	79,032	9.57	87.90	0.00	0.00	5,702.00
Panel B: Zhabei Sample						
Total expenditure	76,630	2,069.88	8,938.48	510.00	1.60	1,200,000.00
Credit	68,456	1,811.65	5,595.35	483.00	1.60	272,000.00
Debit	8,174	4,232.47	21,946.20	1,000.00	2.00	1,200,000.00
Child expenditure	76,630	466.04	2,688.65	0.00	0.00	105,876.00
EC	76,630	456.22	2,686.53	0.00	0.00	104,800.00
OCS	76,630	9.83	89.05	0.00	0.00	5,702.00
Panel C: Huangpu Sample						
Total expenditure	2,402	2,821.38	11,329.04	548.59	3.50	387,009.40
Credit	1,808	2,528.10	7,718.77	482.91	3.50	150,258.00
Debit	594	3,714.09	18,359.01	900.00	6.00	387,009.40
Child expenditure	2,402	536.56	4,787.76	0.00	0.00	150,258.00
EC	2,402	535.05	4,787.81	0.00	0.00	150,258.00
OCS	2,402	1.51	33.80	0.00	0.00	1,000.00

Notes: This table reports summary statistics for the main variables of a subsample that only includes cardholders identified as having pre-high-school children. Panel A reports the full subsample including all such cards in Zhabei and Huangpu, Panel B all such cards in district Zhabei, and Panel C all such cards in district Huangpu.

Table 3: Baseline DiD Results

Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)
	Child Expenditure			Total Expenditure		
	Total	EC	OCS	Total	Credit	Debit
After*Zhabei	0.0256***	0.0045***	0.0213***	-0.0101	-0.0045	-0.0198
	(0.0026)	(0.0017)	(0.0019)	(0.0081)	(0.0104)	(0.0129)
Card Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Month Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,771,182	3,771,182	3,771,182	3,771,182	2,111,732	1,659,450
R-squared	0.001	0.001	0.001	0.005	0.005	0.004

Notes: This table reports the differences in expenditure between cardholders in Zhabei district and Huangpu district before and after the merger. Zhabei is a dummy variable that equals 1 if a cardholder resides in district Zhabei, and 0 if in Huangpu. After is a dummy variable that equals 1 if the month is after August 2015, and 0 otherwise. All dependent variables are in logarithm. Dependent variables in Columns (1)-(3) are total child spending, extra-curriculum spending (EC) and other child support spending(OCS), respectively. Dependent variable in Column (4) is total expenditure. Columns (5) and (6) examine total expenditure by credit and debit cards separately. The baseline specification includes card fixed-effects and month fixed-effects. Standard errors in parenthesis are clustered at the card level: $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 4: Dynamic Impacts of the Merger on Expenditure

Panel A

Dep. Var.	(1)	(2)	(3)	(4)
	Child Expenditure			Total
	Total	EC	OCS	Expenditure
April'15*Zhabei	-0.0038	-0.0054	0.0016	-0.0085
	(0.00587)	(0.00422)	(0.00407)	(0.0167)
May*Zhabei	-0.0079	-0.0059	-0.0020	-0.0092
	(0.00586)	(0.00405)	(0.00423)	(0.0162)
June*Zhabei	0.0226***	0.0190***	0.0037	0.0025
	(0.00563)	(0.00419)	(0.00378)	(0.0158)
July*Zhabei	0.0007	0.0009	-0.0002	-0.0084
	(0.00541)	(0.00373)	(0.00392)	(0.0153)
Sep*Zhabei	0.0357***	0.0182***	0.0180***	
	(0.00577)	(0.00405)	(0.00420)	(0.0153)
Oct*Zhabei	0.0148***	-0.0018	0.0167***	0.0105
	(0.00557)	(0.00405)	(0.00382)	(0.0151)
Nov*Zhabei	0.0245***	0.0044	0.0202***	-0.0568***
	(0.00494)	(0.00328)	(0.00378)	(0.0151)
Dec*Zhabei	0.0259***	0.0031	0.0228***	-0.0731***
	(0.00483)	(0.00318)	(0.00364)	(0.0150)
Jan'16*Zhabei	0.0515***	0.0227***	0.0294***	-0.0083
	(0.00509)	(0.00324)	(0.00394)	(0.0154)
Feb*Zhabei	0.0180***	-0.0018	0.0198***	0.0103
	(0.00536)	(0.00372)	(0.00386)	(0.0154)
March*Zhabei	0.0326***	0.0003	0.0324***	0.0237
	(0.00551)	(0.00361)	(0.00419)	(0.0161)
Card Fixed Effect	Yes	Yes	Yes	Yes
Month Fixed Effect	Yes	Yes	Yes	Yes
Observations	3,788,260	3,788,260	3,788,260	3,788,260
R-squared	0.001	0.001	0.001	0.005

Panel B: EC Seasonality

Dep. Var.	EC
June'15* Zhabei	0.0042
	(0.0040)
Sep* Zhabei	0.0032
	(0.0048)
Jan'16* Zhabei	0.0117***
	(0.0039)
June* Zhabei	0.0198***
	(0.0046)
Card Fixed Effect	Yes
Month Fixed Effect	Yes
R-squared	0.0002
N	1,734,740

Notes: This table reports the dynamic effect of the merger on cardholders in Zhabei district relative to those in Huangpu district. Zhabei is a dummy variable that equals 1 if a cardholder resides in district Zhabei, and 0 if in Huangpu. Columns (1)-(4) include the full sample and take month August 2015 as the reference month. Dependent variables in Columns (1)-(3) are total child spending, extra-curriculum spending (EC) and other child support spending(OCS), respectively. Dependent variable in Column (4) is total expenditure. Column (5) analyzes seasonality of EC by including Jan 2015, June 2015, Sep 2015, Jan 2016, and June 2016, and takes Jan 2015 as the reference month. All dependent variables are in logarithm. We include card fixed-effects and month fixed-effects. Standard errors in parenthesis are clustered at the card level: $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 5: Young Children Subsample: the DID Results

Dep. Var.	(1)	(2)	(3)	(4)
	Child expenditure			Total expenditure
	Total	EC	OCS	
After*Zhabei	0.285***	0.153**	0.140***	-0.001
	(0.0777)	(0.0747)	(0.0212)	(0.0673)
Card Fixed Effect	Yes	Yes	Yes	Yes
Month Fixed Effect	Yes	Yes	Yes	Yes
Observations	78,532	78,532	78,532	78,532
R-squared	0.011	0.035	0.037	0.006

Notes: This table reports the DiD results for a subsample that only includes cardholders who are identified as having pre-high-school children. Zhabei is a dummy variable that equals 1 if a cardholder resides in district Zhabei, and 0 if in Huangpu. After is a dummy variable that equals 1 if the month is after August 2015, and 0 otherwise. All dependent variables are in logarithm. Dependent variables in Columns (1)-(3) are total child spending, extra-curriculum spending (EC) and other child support spending (OCS), respectively. Dependent variable in Column (4) is total expenditure. We include card fixed-effects and month fixed-effects. Standard errors in parenthesis are clustered at the card level: $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 6: Heterogeneous Effects of the Merger: Cardholders with Children *vs* the Others

Dep. Var.	(1)	(2)	(3)	(4)
	Child Expenditure			Total Expenditure
	Total	EC	OCS	
After*Zhabei	0.0197***	0.0015	0.0182***	-0.0103
	(0.00221)	(0.00104)	(0.00194)	(0.00817)
After*Child	-0.0788	-0.0576	-0.0211	0.0072
	(0.0753)	(0.0724)	(0.0199)	(0.0670)
After*Zhabei* Child	0.251***	0.136*	0.122***	0.0053
	(0.0774)	(0.0743)	(0.0213)	(0.0679)
Card Fixed Effect	Yes	Yes	Yes	Yes
Month Fixed Effect	Yes	Yes	Yes	Yes
Observations	3,771,182	3,771,182	3,771,182	3,771,1822
R-squared	0.002	0.001	0.001	0.005

Notes: This table reports the results of a cross-sectional analysis of the effect of the merger with respect to having young children. Child is a dummy variable that equals 1 if a cardholder is identified as having young children, and 0 otherwise. Zhabei is a dummy variable that equals 1 if a cardholder resides in district Zhabei, and 0 if in Huangpu. After is a dummy variable that equals 1 if the month is after August 2015, and 0 otherwise. All dependent variables are in logarithm. Dependent variables in Columns (1)-(3) are total child spending, extra-curriculum spending (EC) and other child support spending (OCS), respectively. Dependent variable in Column (4) is total expenditure. We include card fixed-effects and month fixed-effects. Standard errors in parenthesis are clustered at the card level: $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 7: Heterogeneous Effects of the Merger: Distance to the Old Border

Dep. Var.	(1)	(2)	(3)	(4)	(5)
	Child Expenditure				Total Expenditure
	Total	EC	EC (Seasonality)	OCS	
After*Far	-0.0162***	-0.0010	-0.0091*	-0.0152***	-0.0064
	(0.0044)	(0.0022)	(0.0052)	(0.0039)	(0.0107)
Card Fixed Effect	Yes	Yes	Yes	Yes	Yes
Month Fixed Effect	Yes	Yes	Yes	Yes	Yes
Observations	405,169	405,169	137,561	405,169	405,169
R-squared	0.0014	0.0017	0.0013	0.0009	0.0049

Notes: This table reports the DiD results for a subsample that only includes cardholders who are identified as residing within 2km of underground stations Hanzhong Road and Gongkang Road. Far is a dummy variable that equals 1 if the cardholder resides within 2km of underground stations Gongkang Road, and 0 if within 2km of Hanzhong Road. After is a dummy variable that equals 1 if the month is after August 2015, and 0 otherwise. All dependent variables are in logarithm. Dependent variables in Columns (1)-(4) are total child spending, extra-curriculum spending (EC) and other child support spending (OCS), respectively. Dependent variable in Column (5) is total expenditure. We include card fixed-effects and month fixed-effects. Standard errors in parenthesis are clustered at the card level: $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 8: Heterogeneous Effects of the Merger: Personal Income

Dep. Var.	(1)	(2)	(3)	(4)
	Child Expenditure			Total Expenditure
	Total	EC	OCS	
After*Zhabei	0.0200***	0.001	0.017***	-0.009
	(0.002)	(0.001)	(0.002)	(0.008)
After*Income	-0.174	-0.151	-0.023	0.140
	(0.179)	(0.176)	(0.029)	(0.109)
After*Zhabei*Income	0.352*	0.236	0.124***	-0.120
	(0.180)	(0.177)	(0.029)	(0.109)
Card Fixed Effect	Yes	Yes	Yes	Yes
Month Fixed Effect	Yes	Yes	Yes	Yes
Observations	3,771,182	3,771,182	3,771,182	3,771,182
R-squared	0.002	0.001	0.001	0.005

Notes: The table presents the results of a cross-sectional analysis of the effect of the merger with respect to personal income. Income is proxied as the average historical monthly total expenditure for each card. Zhabei is a dummy variable that equals 1 if a cardholder resides in district Zhabei, and 0 if in Huangpu. After is a dummy variable that equals 1 if the month is after August 2015, and 0 otherwise. All dependent variables are in logarithm. Dependent variables in Columns (1)-(3) are total child spending, extra-curriculum spending (EC) and other child support spending (OCS), respectively. Dependent variable in Column (4) is total expenditure. We include card fixed-effects and month fixed-effects. Standard errors in parenthesis are clustered at the card level: $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 9: Debit Card Subsample: the DiD Results

Panel A: Debit Card Sample				
Dep. Var.	(1)	(2)	(3)	(4)
	Child Expenditure			Total Expenditure
	Total	EC	OCS	
After*Zhabei	0.0111***	0.0042**	0.0070***	-0.0198
	(0.0027)	(0.0106)	(0.0020)	(0.0129)
Card Fixed Effect	Yes	Yes	Yes	Yes
Month Fixed Effect	Yes	Yes	Yes	Yes
Observations	1,659,450	1,659,450	1,659,450	1659450
R-squared	0.0002	0.0000	0.0002	0.0043
Panel B: Debit Card & Young Children Sample				
After*Zhabei	0.4008***	0.2942**	0.1188***	0.1320
	(0.1417)	(0.1403)	(0.0227)	(0.1275)
Card Fixed Effect	Yes	Yes	Yes	Yes
Month Fixed Effect	Yes	Yes	Yes	Yes
Observations	8,705	8,705	8,705	8,705
R-squared	0.0021	0.0005	0.0050	0.0074

Notes: The panel A of this table reports the DiD results for a subsample that includes only debit cards. The panel B presents the DiD results for a subsample that includes debit cards that are identified as having pre-high-school children. Zhabei is a dummy variable that equals 1 if a cardholder resides in district Zhabei, and 0 if in Huangpu. After is a dummy variable that equals 1 if the month is after August 2015, and 0 otherwise. All dependent variables are in logarithm. Dependent variables in Columns (1)-(3) are total child spending, extra-curriculum spending (EC) and other child support spending (OCS), respectively. Dependent variable in Column (4) is total expenditure. We include card fixed-effects and month fixed-effects. Standard errors in parenthesis are clustered at the card level: $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 10: Placebo Test: Adult Children Subsample

Dep. Var.	(1)	(2)	(3)	(4)
	Child Expenditure			Total Expenditure
	Total	EC	OCS	
After*Zhabei	0.0319	-0.0169	0.0488	-0.4491***
	(0.0662)	(0.0513)	(0.0418)	(0.0800)
Card Fixed Effect	Yes	Yes	Yes	Yes
Month Fixed Effect	Yes	Yes	Yes	Yes
Observations	238,274	238,274	238,274	238,274
R-squared	0.000	0.000	0.000	0.004

Notes: This table reports the DiD results in a subsample only includes cardholders who are identified as having old children or no children. Zhabei is a dummy variable that equals 1 if a cardholder resides in district Zhabei, and 0 if in Huangpu. After is a dummy variable that equals 1 if the month is after August 2015, and 0 otherwise. All dependent variables are in logarithm. Dependent variables in Columns (1)-(3) are total child spending, extra-curriculum spending (EC) and other child support spending (OCS), respectively. Dependent variable in Column (4) is total expenditure. We include card fixed-effects and month fixed-effects. Standard errors in parenthesis are clustered at the card level: $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 11: Alternative Mechanism: Housing

Panel A: Triple Interaction				
Dep. Var.	(1)	(2)	(3)	(4)
	Child Expenditure			Total Expenditure
	Total	EC	OCS	
After*Zhabei*House	0.192	0.176	0.016**	0.556*
	(0.1718)	(0.1717)	(0.0072)	(0.3114)
Other Interactions	Yes	Yes	Yes	Yes
Card Fixed Effect	Yes	Yes	Yes	Yes
Month Fixed Effect	Yes	Yes	Yes	Yes
Observations	3,771,182	3,771,182	3,771,182	3,771,182
R-squared	0.001	0.001	0.001	0.005
Panel B: Fourth Interaction				
After*Zhabei*Child*House	-0.264	-0.226	-0.031	-0.748**
	(0.220)	(0.215)	(0.047)	(0.337)
Other Interactions	Yes	Yes	Yes	Yes
Card Fixed Effect	Yes	Yes	Yes	Yes
Month Fixed Effect	Yes	Yes	Yes	Yes
Observations	3,771,182	3,771,182	3,771,182	3,771,182
R-squared	0.002	0.001	0.001	0.005

Notes: The panel A of this table presents the results of a cross-sectional analysis of the effect of the merger with respect to property ownership. The panel B presents the results of a cross-sectional analysis within a group that identified as having pre-high-school children, whether the effects of the merger differ between cardholders with and without properties. House is a dummy variable that equals 1 if a cardholder is identified as having properties in his or her own district, and 0 otherwise. Child is a dummy variable that equals 1 if a cardholder is identified as having young children, and 0 otherwise. Zhabei is a dummy variable that equals 1 if a cardholder resides in district Zhabei, and 0 if in Huangpu. After is a dummy variable that equals 1 if the month is after August 2015, and 0 otherwise. All dependent variables are in logarithm. Dependent variables in Columns (1)-(3) are total child spending, extra-curriculum spending (EC) and other child support spending (OCS), respectively. Dependent variable in Column (4) is total expenditure. We include other interactions, card fixed-effects and month fixed-effects. Standard errors in parenthesis are clustered at the card level: $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 12: The Impact of the Merger: Jing'an *vs* Huangpu

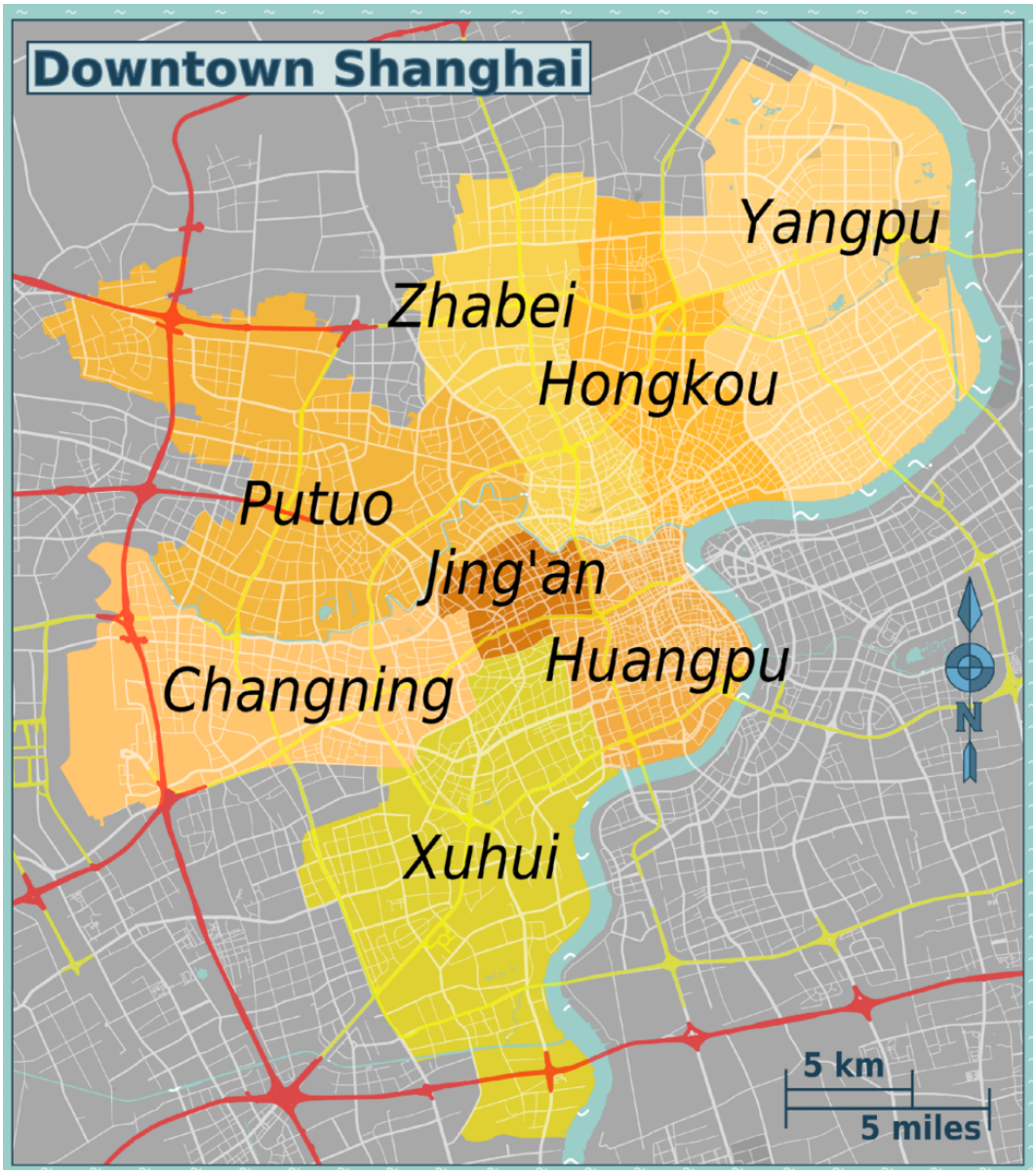
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.: Child Expenditure	Full Sample			Young Children Subsample		
	Total	EC	OCS	Total	EC	OCS
After*Jing'an	0.010***	0.002	0.008***	0.127*	0.077	0.051***
	(0.0027)	(0.0017)	(0.0020)	(0.0715)	(0.0695)	(0.0196)
Card Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Month Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,837,605	1,837,605	1,837,605	90,358	90,358	90,358
R-squared	0.000	0.000	0.000	0.002	0.002	0.001

Notes: This table reports the differences in expenditure between cardholders in Jing'an and Huangpu before and after the merger. Jing'an is a dummy variable that equals 1 if a cardholder resides in district Jing'an, and 0 if in Huangpu. After is a dummy variable that equals 1 if the month is after August 2015, and 0 otherwise. All dependent variables are in logarithm. Columns (1)-(3) examine the full sample, and Columns (4)-(6) the subsample that includes only cardholders that are identified as having pre-high-school children. Dependent variables in Columns (1)-(3) or (4)-(6) are total child spending, extra-curriculum spending (EC) and other child support spending (OCS), respectively. The baseline specification includes card fixed-effects and month fixed-effects. Standard errors in parenthesis are clustered at the card level: $***p < 0.01, **p < 0.05, *p < 0.1$.

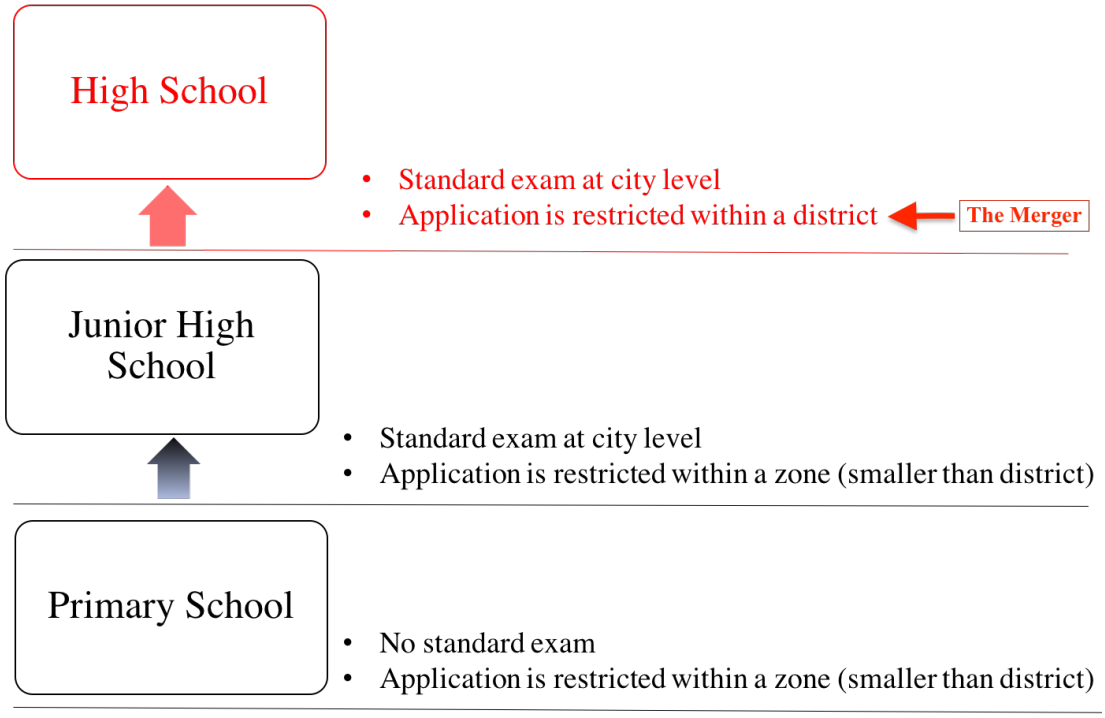
Appendix 1. Variable Definitions

Variables	Definitions
Total consumption	Monthly total expenditure of each card
Kid consumption	Monthly total expenditure on child-related items of each card
Extra-curriculum spending (EC)	EC includes expenditure on private institutions that provide extra-curriculum training and on stationary
Other child spending (OCS)	OCS includes expenditure on children clothing, toys, and zoos
After	Dummy variable that equals 1 if the month is after August, 2015, and 0 otherwise
Zhabei	Dummy variable that equals 1 if a cardholder resides in the district Zhabei, and 0 otherwise
Kid	Dummy variable that equals 1 if a cardholder spent on EC, OSC, formal schooling that is before high schools, and children hospitals one year before the merger, and 0 otherwise
Far	Dummy variable that equals 1 if a cardholder lives within 2 km of Gongkang Road Station, and 0 if within 2 km of Hanzhong Road Station
Income	Mean of monthly total consumption for each card before the merger
House	Dummy variable that equals 1 if a cardholder made payments to local property services agencies and real estate agencies one year before the merger, and 0 otherwise
Jing'an	Dummy variable that equals 1 if a cardholder resides in the district Jing'an, and 0 otherwise

Fugure A 1. **Shanghai Map**



Fugure A 2. **Public School Entrance in Shanghai**



Fugure A 3. **Underground statations Along Line 1 in Shanghai**