Dragon's Peers: (High-Achieving) Asian Schoolmates and Student Performance in NYC Primary Schools

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This paper examines the effects of Asian peers on the performance of non-Asian students in New York City elementary schools. To gain identification, we employ variation in Asian student share across schools stemming from the Asian fertility shock in the year of the dragon 2000, the magnitude of which depends on the initial Asian population share in a school zone. While we detect no effects of Asian peers on math and literacy test scores of white students, who are located at the upper part of the achievement distribution and perform equally well as Asian students, the results suggest significant adverse effects on Hispanic and black students, who are at the lower part of the achievement distribution. These adverse effects are driven by a rising share of students who have insufficient skills in terms of expectations at their age.

Keywords*: Peer Effects, Racial Composition, Primary Education, School Achievement, Dragon Cohort, Ethnicity.*
JEL Codes*: I20, I29, J15.*

I. Introduction

Primary education provides the foundation for developing skills essential for individual's later success in higher levels of education and, eventually, in work life. Therefore, it is unsurprising that many parents are willing pay significant sums of money to improve their children's educational environment.[1] A major rational for such significant investments seems to be based on the common belief that better peers can significantly improve scholastic outcomes. However, recent evidence suggests that some students might be negatively affected by high-achieving peer environment (Burke and Sass 2013; Dobbie and Fryer 2014; Abdulkadiroglu et al. 2014).[2]

The aim of this study is to examine the effects of well-performing peers on scholastic outcomes at the elementary school level, for which compelling evidence is much rarer than for the secondary level.[3] This lack of evidence is likely due to the difficulty of finding suitable sources of exogenous variation in exposure to high-achieving peers across schools. In fact, primary education is mainly publicly organized and students are typically allocated to schools by place of residence, which is hardly independent of school achievement. Therefore, causal designs based admission thresholds, as in Dobbie and Fryer (2014) and Abdulkadiroglu et al. (2014), or random allocation of students into classes, as in De Giorgi and Pellizzari (2014) and Feld and Zölitz (2014), are typically unavailable. Moreover, public programs that generate quasi-experimental settings, such as the Metco used by Angrist and Lang (2004), are rarely targeted to high-achieving students.

We contribute to the literature on student peer effects by examine the effects of Asian peers on non-Asian student performance in New York City elementary schools. We start by showing that Asian students perform extremely well: our data indicate that they score considerably better than black and

[1] As an example, extensive prior work shows considerable capitalization of school quality on property prices in the UK (see, e.g., Gibbons and Machin 2003) and the US (see, e.g., Black 1999).

2 For evidence suggesting positive effects of high-achieving peers on students at the lower part of the achievement distribution in Louisiana middle and high schools, see Imberman, Krugler, and Sacerdote (2012), who examine the impacts of Hurricane Katrina evacuees on students in receiving schools. For theoretical work on economic mechanisms that may generate peer effects, see, e.g., De Giorgi and Pellizzari (2014).

3 Much of the prior literature on peer effects in elementary schools based on causal designs focuses on peers at the lower part of the ability distribution. The Metco study by Angrist and Lang (2004) provides little evidence of the effects of peers from low socio-economic background on students in more affluent receiving areas, while Fruehwirth (2013) finds positive effects of rising achievement of low-ability peers on other student's scholastic performance in a study exploiting new student promotion threshold. Similarly, in a study based on within-pupil variation and subject-specific test scores, Lavy, Weinhardt, and Silva (2011) find negative effects from low-ability peers on average achievement. Using within-school variation, Lavy, Paserman, and Schlosser (2011) find similar results for high schools in Israel. Ammermueller and Pischke (2012) exploit within-school variation in peer composition across roughly randomly formed classes in European primary schools.

Hispanic students and at least as well as white students in math and English Language and Arts tests. In addition of being "good peers" in terms of performance, Asian students are also a specifically relevant peer group because China has become the top immigrant-sending country in the US in 2013, with other Asian countries, such as South Korea, the Philippines, and Japan, also ranking high in the immigration statistics (WSJ, 2015). With rising share of Asian population, it is important to understand the consequences of Asian peers in US schools.

Our empirical strategy employs variation in the Asian student share stemming from the common belief among Asian population according to which children born in the Chinese Year of the Dragon are luckier, brighter, and more likely to flourish than those born in any other year. This widespread belief generates considerable shocks to fertility among Asian population and variation in the fraction of Asian children across cohorts. Our empirical strategy is based on the disproportionately large Asian cohort born in the Dragon Year coinciding with the 2000 Western calendar year. In this year, the Asian birth rate (births divided by 1,000 woman) in the US was around 7 percent higher compared to the average rate in the years 1998-1999 and 2001-2002 (US Census Bureau 2013). This fertility shock induces considerably larger share of Asian children in the cohort born in 2000.[4]

To gain identification, we exploit the fact that the demographic shock induced by the dragon cohort is a function of the initial Asian population share. In areas with zero Asian residents, the dragon effect does not alter the share of Asian children across cohorts, while in areas with Asian population, the dragon effect tends to increase the share of Asians in the dragon cohort.[5] We employ spatial variation in the magnitude of this mechanical population shock generated by the interaction between the dragon effect and the historic Asian population share to identify the effect of Asian student share on test scores of non-Asian students.

We use data on average math and English Literature and Art (ELA) test scores by school, year, grade, and ethnic background (white, black, Hispanic, and Asian) in 1,082 New York City primary public schools covering grades three to six over the years 2006-2012. We link this data to information on teaching resources and pupil background. Our IV estimates indicate adverse effects of rising Asian student share on non-Asian ELA score. This is driven by large negative effects on Hispanic and black students, who are at the lower part of the achievement distribution, while we are unable to detect any

[4] See also Johnson and Nye (2011), who provide evidence of the a dragon effect for the 1976 cohort in the US, and Yip et al. (2002), who document the dragon effect in Hong Kong for cohorts born in 1976, 1988 and 2000. The analysis by Nye and Xue (2014) suggests a dragon effect on birth rates in China's urban areas in 2000.

[5] More specifically, we show that the dragon effect is a concave function of the initial Asian population share equating zero at 0 and 1.

statistically significant effects on white students, who are at the upper part of the ability distribution and whose score distribution is comparable to the score distribution of Asian students. The adverse effects on black and Hispanic ELA scores do not appear in the third grade but begin to emerge in the fourth grade and persist until the sixth grade (the last grade in our data). Moreover, we observe statistically significant negative effects on non-Asian math scores in the fourth and fifth grades. The adverse effect on fourth grade math score is, again, driven by large negative effects on the performance of black and Hispanic students.

Our study contributes to literature on the effects of racial composition on educational outcomes. To our knowledge, ours is the first quasi-experimental study focusing on Asian peers in US schools.[6] We also contribute to literature examining peer effects by student achievement. Our findings are in line with recent studies on secondary school students that provide some evidence of negative effects of high-achieving peer environment on students at the lower part of the achievement distribution (Abdulkadiroglu et al. 2014; Dobbie and Fryer 2014).[7] We believe that our results for the elementary school students provide important complementary evidence in this branch of literature, especially in light of prior work suggesting that investment in education has the largest returns in early ages and that disadvantages that develop early may be costly to remedy in later ages (see e.g., Cunha, Heckman, Lochner & Masterov 2006; Cunha and Heckman 2006).

The paper proceeds as follows. Section II provides an institutional background on NYC public primary schools and presents data sources and descriptive statistics. Section III provides a formal discussion of the mechanical relationship between historic ethnic population structure and the dragon effect on the share of Asian students and documents the demographic shock induced by the dragon cohort. Section IV provides details of the empirical strategy employed and presents the results. Section V discusses potential threats for the identification and examines the robustness of the results. Section VI concludes.

[6] Most prior literature on racial composition in US schools has focused on black peers. Studies by Angrist and Lang (2004) and Hanushek et al. (2009) find little evidence of the effects of black peers on non-black students, while both studies provide some evidence of negative peer effects within the group of black students. Our work is also closely related to studies examining immigrant peer effects. Ballatore et al. (2015) exploit rules of class formation in Italy to identify the causal effect of increasing the number of (low-performing) immigrants in a classroom on natives test scores.

[7] The findings of Imberman et al. (2012) suggest negative effects of hurricane evacuees in the two middle ability quartiles on the ELA score of low-achieving elementary school students, but also large positive effects of high-achieving peers and negative effects of low-achieving peers on math and ELA scores of high-achieving student.

II. New York City Primary Schools

The New York City Department of Education (DOE) is one of the largest schooling authorities in the US serving around 1.1 million students. New York City is divided into school districts and districts are divided into zones. Each school is assigned to a zone. The DOE is required to provide a place for every child in a local public school in the year they turn five (kindergarten level).

Allocation of students is based on parents' residential address, and only special needs and circumstances may allow students to relocation outside their designated school.[8] Students can move to an undesignated school for the following reasons: 1) medical, 2) safety, 3) the primary childcare or parent's employer is far from the zoned school, 4) or a sibling is attending a different school.[9] Furthermore, if a school is listed as a School in Need of Improvement[10] or a New York State Persistently Low Achieving school in the past two years, a child may request a transfer to a higher-achieving school under the Public School Choice Program.

ELA and math Tests

Outcomes of interest in this paper are the New York state math and ELA tests, developed by McGraw-Hill. These are standardized exams conducted in the spring semester of third through eighth grade. All public-school students are required to take the tests unless they are medically excused or have a severe disability. Students with moderate disabilities or who are English Language Learners must take both tests, but may be granted special accommodations (additional time, translation services, and so forth) at the discretion of school or state administrators. The math test is designed to assess students on three learning standards: (1) number sense and operations; (2) algebra; (3) geometry, (4) measurement, and (5) statistics and probability. Tests in the earlier grades emphasize more basic content such as number sense and operations, while later tests has more weight on advanced topics such as algebra and geometry. The ELA test is designed to assess students on three learning standards: (1) information and understanding, (2) literary response and expression, and (3) critical analysis and evaluation. The ELA

[8] Each school district's Community Education Council sets the boundaries for school zones.

[9] The child's guidance counselor is the first reviewer of the transfer request, which it will then be brought to the Borough Enrollment Office. To be placed in a specific school, priority for admission in kindergarten and elementary school is given to students in this order: 1) Zoned students with a sibling who will be in grades one through five at the school. 2) All other zoned students. 3) Students living in the school's district but outside the school's zone, with a sibling who will be in grades one through five. 4) Students living outside the district with a sibling who will be in grades one through five. 5) All other students living in the school's district but outside the zone. 6) All other students.

[10] Title I of the No Child Left Behind Act

test includes multiple-choice and short-response parts based on reading and listening sections, as well as brief editing tasks.

The number of correct answers a student gives in a test is converted into a "scale score". The aim of the scaling is to improve the comparability of scores across grades. Students are also assigned a performance level. There are four possible performance levels which are based on EOD's grade-specific *Common Core Learning Standards* (CCLS). [11] Level 4 requires skills that are more than sufficient in terms of expectations in a grade, while level 3 requires sufficient skills. Students on level 2 are on track to meet school graduation requirements but are not yet proficient at the grade. Students at level 1 have insufficient skills in terms of expectations in a grade. Importantly, achievement levels are not based on percentile criterion, and therefore we can examine responses in terms of absolute rather than relative skill structure.

Data

We use data on 1,082 primary public schools that reported the results of the New York State English Language Test (ELA) and Mathematic Test (math) from 2006 to 2012, through grades 3 to 6.[12] DOE provides files for average math and ELA scores by school, grade, ethnicity (white, black, Asian, and Hispanic), and year.[13] Each file contains information on the number of students tested and number and percentages of students in each of the four CCLS achievement groups. ELA and math mean scores are not reported when the number of students in a school-grade-ethnicity-year cell is below or equal to 5. We append these files with annual school-level variables from the New York State Report Cards.[14] These cards provide information on enrollment, pupil background, attendance, suspensions, dropout rate, teacher resources, graduation rates, and average class size. Reports cards are available for all schools in New York City across our test score data window. We merged report card data to score files by school name. We were able to link 70% of school-year observations to test score files.

To measure initial Asian student share in a school's catchment area, we use the share of Asian students tested in grades three to six in the school in 2006 available from the BEDS files. These

[11] For a detailed description of the skills, knowledge, and practices that are required at each performance level, see https://www.engageny.org/resource/performance-level-descriptions-for-ela-and-mathematics
[12] As of 2006, the New York State Education Department expanded the ELA and mathematics testing programs to Grades 3-8. Previously, state tests were administered in grades 4 and 8 and citywide tests were administered in grades 3, 5, 6 and 7.
[13] Accessible at: http://schools.nyc.gov/NR/exeres/05289E74-2D81-4CC0-81F6-E1143E28F4C4,frameless.htm
[14] Data available at: https://reportcards.nysed.gov/

students are born 3 to 6 years before the 2000 dragon cohort (that is in 1994-1997). The dragon cohort enters our data in 2009 and in the empirical analysis we employ data over the years 2007-2012 (excluding the year on which the measure of the initial Asian share is based on).

Table 1 provides summary statistics for the full sample and subsamples where 2006 Asian share is below and above the median. The first block of statistics presents means and standard deviations for the math and ELA mean test scores observed for school-grade-ethnicity-year cells. The average math mean test score for all students is 675.6 with a standard deviation of 20.2. The average math mean test score is the highest for Asian students at 699.6, followed by white (689.9), Hispanic (671.2) and black (667.1) students. The average ELA mean test score is also the highest for Asian students (673.3) although it is very close to the average of white students (671.9). Hispanic and black students score considerably lower in this test, with both groups receiving around 655 points, on the average. Looking at subsamples divided by the 2006 median Asian share, schools above the median share have higher math and ELA mean test scores compared to schools below the median share across all student groups. The ranking across ethnic groups is the same as in the full sample in schools above the median while it slightly changes for schools below the median with black students slightly outperforming Hispanic students.

The bottom panel of Table 1 provides descriptive statistics for school characteristics. Schools above the median are characterized by higher average grade size (494.9 vs. 369.6), higher pupils per teacher ratio (9.2 vs. 8.6), and lower percentage of students having access to free lunch (59.8% vs. 77.9%) but higher percentage having access to reduced lunch (11.1% vs. 6.7%). These schools have also fewer teachers with no valid certificate (3.1% vs. 7.1%) and fewer teachers with three years or less of experience (16% vs. 20.8%). Looking at the last four rows of Table 1 showing shares of students by ethnicity, Hispanic students have the highest share (39.4%), followed by black (35%), white (14.1%) and Asian (11.5%) students. In schools above the median 2006 Asian share, Asians cover a substantially larger proportion of students (22%), while in schools below the median share, the Asian share is very small (1.2%), on the average.

Table 2 displays fractions of students in each CCLS achievement group by ethnicity. 48.3% of Asian students have more than sufficient skills in math (highest share across ethnic groups). Only 2.5% of Asian students have insufficient skills as opposed to around 9% and 10% for Hispanic and black students, respectively. Asian students have also the largest share in the top ELA achievement group, and the difference compared to white students is small. In appendix figure A1, we show that the mean

ELA and math test score distributions are remarkably similar for Asian and white students. The figure also shows that the dragon and non-dragon cohorts have very similar score distributions.

Overall, the above descriptive analysis demonstrates that Asian students perform extremely well in elementary schools with a very small fraction of students having less than sufficient skills. It also shows that Asian students are very similar compared to white students in terms of performance distribution.

III. The Dragon Cohort

In the Chinese calendar, the year of the dragon appears once every 12 years. Dragon is the only mythical creature in the Chinese zodiac and a symbol of good fortune, power, and wealth. According to a widespread belief among ethnic-Chinese populations, children born in a dragon year are luckier, brighter, and more likely to flourish. This belief affects the timing of birth (Yip et al. 2002) and has induced considerable spikes in birth rates in Singapore, Taiwan (Yip et al. 2002), Hong Kong (Yip et al. 2002; Lau 2012), and Malaysia (Goodkind 1995).

The analysis of Johnson and Nye (2011) suggests a considerable spike in Asian fertility rate in the dragon year 1976 also in the US. Our research design will exploit variation induced by a more recent dragon cohort born in 2000.[15] Figure 1 shows the birth rate in the US between 1990 and 2011 by mother's ethnic background. It indicates a substantial spike in the birth rate among Asian population in the dragon year 2000: the birth rate is around 7% higher in 2000 compared to the average rate in the years 1998, 1999, 2001, and 2002. Notably, there are no significant spikes in 2000 among white, black, and Hispanic populations. This indicates that the dragon year increases the fraction of Asian children in the 2000 cohort compared to other cohorts.

One may expect that the effect of the dragon cohort on the Asian population share across cohorts is larger in areas with a larger historic proportion of Asian inhabitants. To see the link between the share of Asians in an initial cohort and the dragon effect, consider a school zone with A_0 Asian births in the initial Asian cohort and H_0 births in the initial non-Asian cohort. The share of Asians in the initial cohort is then $a_0 = A_0/(A_0 + H_0)$. Suppose that the dragon effect increases the number of Asian births by $\delta \cdot 100\%$ and has no impact on the number of non-Asian births. The share of Asian children in the dragon cohort will then be $a_1 = (1 + \delta)A_0/((1 + \delta)A_0 + H_0)$. It is straightforward to show that the

[15] This dragon year coincides with the Western calendar period from the 5th of February 2000 to 23rd of January 2001.

increase in the fraction of Asian children between the two cohorts as a function of initial Asian share and the dragon effect is

$$a_1 - a_0 = \frac{a_0 - a_0^2}{\delta^{-1} + a_0} \tag{1}$$

This function is increasing in $\boldsymbol{\delta}$ and concave in $\boldsymbol{a_0}$. Figure 2 plots the function setting $\boldsymbol{\delta}$ to 0.7 and 0.15, and a histogram of 2006 Asian student share which is our empirical counterpart of $\boldsymbol{a_0}$. For $\boldsymbol{\delta}$ =0.07, the figure shows around 1.2 percentage point larger dragon effect on the share of Asian students when initial Asian share is increased from 0 to 0.2. With $\boldsymbol{\delta}$ =0.15, the effect in this range more than doubles to around 3.5 percentage points. The fact that most observations in our data fall in the range where the function is increasing suggest a strong positive dragon effect on Asian share as a function of 2006 Asian share in our application.[16]

Figure 3 provides preliminary evidence of the disproportionate effect of the dragon cohort on Asian student share across high- and low-Asian-exposure areas in our data. It plots the fraction of Asian students by year of birth for schools with 2006 Asian share below and above the median, setting the 1996 cohort to zero. The figure suggests a considerable deviation in the Asian student share between these areas for the 2000 dragon cohort, while there is substantially smaller deviation for other cohorts.

IV. High-Achieving Asian Peers and School Achievement

We observe average test scores within school-grade-year-ethnicity cell and therefore cannot run regressions at the individual level. It is helpful, however, to consider first an individual level regression

$$S_{ijgt} = \alpha + \gamma a_{ijgt} + \xi A_i + \beta X_{jt} + \epsilon_{ijgt} \tag{2}$$

[16] The concavity of the formula in equation (1) motivates an over-identified IV model based on a second order polynomial of initial Asian share. This model generates estimates that are very similar compared to estimates from a just-identified model. Our results are also robust to using only observations with 2006 Asian share below or equal to 45%.

where S_{ijt} is the test score of a non-Asian student i in school j, grade g, and year t; A_i is an indicator function equal to one if student i is Asian and zero otherwise; a_{jgt} is the percentage of Asian students in school j, grade g, and year t equal to the average of A_i within a school-grade-year cell; and X_{it} is a vector of year-specific school characteristics. This model corresponds to a social returns model where student *i*'s test score is explained by the peer group average of a background characteristic of interest (see, e.g., Angrist 2014), which in our case is A_i. Note that in a sample of non-Asian students the binary indicator for Asian background is zero and is therefore redundant. Taking averages of both sides of equation (2) by school-grade-year cell within the non-Asian student population yields

$$s_{jgt} = \alpha + \gamma a_{jgt} + \beta X_{jt} + \nu_{jgt} \tag{3}$$

where s_{jgt} is the average non-Asian test score in school j, grade g, and year t. The OLS estimation of this equation will yield biased estimates if there are unobserved factors correlated with both Asian share and non-Asian achievement. For example, if non-Asian parents in areas with larger Asian population share are more education-concerned and invest more time at home to support their children's school work, the OLS estimates will be biased. This will also be a concerns if such unobserved factors vary across cohorts, grades, or years. Because we observe many cohorts and grades over many years in many schools, we can add school, grade, cohort, and year fixed effects to control for any persistent differences between groups defined by them:

$$\nu_{jgt} = \alpha_j + \alpha_g + \alpha_c + \alpha_t + u_{jgt} \tag{4}$$

However, even when controlling for a rich set of fixed effects, a major concern is that variation in s_{jgt} may drive variation in a_{jgt}, and not vice versa. This may be the case if, for example, Asian parents are more concerned about their children's educational environment, and partly select their residential location based on observed school quality, including published average test scores s_{jgt}.

In order to mitigate concerns about biases arising from selection and reverse causality, we exploit variation in Asian student share stemming from the larger effect of the dragon cohort on the fraction of

Asian students in areas with historically larger fraction of Asian inhabitants. To implement this strategy, we estimate the following TSLS procedure:

$$s_{jgt} = \alpha_1 + \rho_1 a_{j,2006} + \rho_2 dragon_{gt} + \gamma a_{jgt} + \beta_1 X_{jt} + \nu_{1,jgt} \quad (5a)$$

$$s_{jgt} = \alpha_2 + \tau_1 a_{j,2006} + \tau_2 dragon_{gt} + \tau_3 a_{j,2006} * dragon_{gt} + \beta_2 X_{jt} + \nu_{2,jgt} \quad (5b)$$

where $dragon_{gt}$ is a binary indicator for the dragon cohort taking the value one if pupils born in 2000 are in grade g in year t, and zero otherwise; $a_{j,2006}$ is the share of Asian students in school j in 2006, which approximates the historic share Asian population in the school's zone. We estimate the model over the years 2007-2012 for which the 2006 Asian share is pre-determined.

In this model, the interaction term between the dragon cohort and the 2006 Asian student share is used as an instrument for the current Asian student share. Because the model controls for the direct effect of the dragon cohort and 2006 Asian student share, the first-stage coefficient on the instrument recovers the disproportionately larger dragon effect in areas with larger historic Asian share. As discussed in the previous section, this variation arises due to the fact that in areas with larger historic Asian population, the dragon cohort induces a larger change in the share of Asian student than in areas with smaller historic Asian population.

The following simple example illustrates the source of variation exploited. Consider two types of school zones, one with high and one with low historic Asian student share. Then the reduced form coefficient on the interaction instrument recovers a difference-in-differences estimate on the average non-Asian test score where the first difference is across non-dragon and dragon cohorts and the second difference is across low- and high-Asian-exposure areas. This estimate will remove any underlying differences in test score that appear between the non-Asian students born in the dragon year and non-dragon year, provided that the average difference across cohorts in the low-Asian-exposure area is an unbiased estimate of the corresponding average difference in the high-Asian-exposure area if it experienced a similar dragon effect on Asian student share as the low-Asian-exposure area. The TSLS procedure will recover the estimate for γ by taking into account the change in Asian share due to the instrument. Finally, the TSLS procedure will facilitate employing the full range of values of the historic Asian share, which is a continuous variable in our data.

Effects of Asian Peers on non-Asian Student Achievement

This section shows the main results of the paper. Standard errors are clustered at the school level across all specifications and all regressions are weighted by the number of non-Asian students in the relevant school-grade-year cell. Table 3 shows results for OLS regressions of the average non-Asian student score on Asian student share. For the math score, the estimates indicate a positive effect of Asian student share on non-Asian achievement across specification, while for the ELA score the estimates in columns 1-5 are insignificant and increase considerably and become significant when concurrent ethnic composition and controls for class size are included in the model (columns 6 and 7). However, the OLS estimates may be biased if non-Asian student achievement affects Asian student share. This may be the case if, for example, Asian parents are, on the average, more education-concerned, and are more responsive to changes in the achievement of their childrens' co-students.

Table 4 shows reduced form estimates for average non-Asian math and ELA. Column 1 displays results for a pooled regression of average non-Asian student score on the dragon cohort dummy, 2006 Asian share the coefficient, and the interaction term between the dragon cohort dummy and 2006 Asian share, the latter of which is the instrument in the IV model. The specifications in columns 2 and 3 add school, grade, year, and cohorts fixed effects, while the specifications in columns 4 to 7 include school level variables on pupil background characteristics, number and qualification of teachers and staff, concurrent non-Asian ethnic composition, average class size and grade size.

Looking at the pooled model in column 1, the instrument has a significant negative coefficient for both outcomes suggesting that the performance of non-Asian students in the dragon cohort was poorer than in the non-dragon cohorts in areas with larger historic Asian population share. Adding school, grade, year, and cohort fixed effects (column 3) reduces the magnitude of the estimates, but they are still negative and statistically significant at the 5 percent confidence level. The results are very little affected when pupil background characteristics are added in the model (the confidence level for math score drops to 10 percent).

Columns 5-7 add concurrent school variables in the regression. These variables may be more susceptible to the disproportionate dragon effect than the pupil background characteristics and, to the extent that variation in them is caused by the disproportionate dragon effect, including them are likely to bias estimates of the causal effect of the instrument on non-Asian performance.[17] The estimates for

[17] For a theoretical discussion of this type of bias, see, e.g., Angrist and Pischke (2008).

ELA score are highly significant when these controls are added in the model, while the estimates for math score are still negative but no longer significant at conventional levels. Overall, these estimates suggest that non-Asian student performance declines in the dragon cohort relative to the non-dragon cohorts when historic Asian exposure increases.

Table 5 displays IV estimates corresponding to the reduced form estimates in table 4. It shows first-stage coefficients on the instrument and IV estimates of the effect of Asian student share on average non-Asian ELA and math test scores. The first-stage estimates are highly significant across all specifications and range from 0.0465 to 0.0490 in the FE specifications (columns 2-7). These coefficients suggest that the dragon cohort induces around 1 percentage point higher Asian student share when historic Asian population share increases from the average of the low-exposure area (1.2%) to the average of the high-exposure area (22.0%) (see table 1). The magnitude of these estimates is in line with the size of the relative Asian student share spike in the high-exposure area in figure 2 and the prediction from the theoretical calculation in section III when the dragon cohort is 7% larger compared to the non-dragon cohorts.[18]

The IV estimates indicate a significant adverse effect of Asian student share on the average non-Asian ELA test score. The estimates for ELA score suggest that a one percentage point increase in Asian student share reduces non-Asian test scores by around one point or 6.9% of its standard deviation. The estimates for math score are also negative, but only around one third of the corresponding ELA estimates, and significant only at 10 risk level in columns 1-4, while they become insignificant when concurrent school variables are included in the model (columns 5-7).

We next examine the effect of Asian student share on student achievement in different subsamples of the data. Table 6 displays IV estimates for the fixed effects model by grade and ethnicity. The estimates in the first column, first row of each panel replicates the IV estimates in column 7 of table 5. The other four rows in each panel display the results by grade. While the model employing data for all grades and non-Asian ethnicities recovered no statistically significant effects on math performance, the results by grade suggest large and highly significant negative effects on it in grades 4 and 5. The estimates for both Hispanic and black students are also significant in the fourth grade samples. Overall, these results suggest that the adverse effects of Asian student share on non-Asian math score is mainly

[18] Data provided by the US Census Bureau indicate that the birth rate among Asian population in the US was around 7% higher in the 2000 dragon year compared to the two consecutive years before and after it (1998-1999 and 2001-2002).

driven by large negative impacts in grades 4 and 5, and among Hispanic and black students, who are at the lower part of the achievement distribution.

Looking at panel B showing results for the ELA score, the specifications covering all grades (first row) indicate that the negative estimates from the full sample in column 1 are driven by adverse effects on the ELA performance of Hispanic and black students. There are significant negative estimates in the fourth and fifth grades, as for the math score, but, conversely, this adverse effect persists in the sixth grade. Notably, unlike for grades 4-6, the coefficient for all non-Asian students in grade 3 is positive and statistically significant. Overall, while the statistically significant coefficients are negative in most cases, these results suggest that peer effects are heterogeneous across grades and ethnic groups. The adverse effects on student performance in terms of math and ELA scores emerge in the fourth grade, and while they are persistent through grades four to six for the ELA score, they vanish by the sixth grade for the math score.

To examine the effects across the achievement distribution, we show IV estimates corresponding to the specifications in column 7 of table 5 in table 7, but replace the outcome by the percentage of students in four achievement levels based on the *Common Core Learning Standards* of the DOE (for details of the *CCLS,* see section II). The row panels show estimates for ethnic groups. For example, the coefficient in the first row, second column in panel A displays the effect on the percentage of Hispanic students in the lowest achievement group. Results in column 2 suggest that the adverse effect on ELA achievement is driven by the rise in the share of students in the lowest achievement group, in which students have insufficient skills for the expectations in their grade, and the decline in the share of students who are on track to meet school graduation requirements (level 2) and who have sufficient (level 3) and more than sufficient (level 4) skills to the expectations in the grade. The table displays also results for subsamples by ethnicity. The effect on the fraction of Hispanic students who have more than sufficient skills is negative and significant, while other coefficients are insignificant at conventional confidence levels. Looking at the results for the math score, we find broadly similar patterns with fraction of students with insufficient skills increasing and the fraction of students on track to graduate and with sufficient skills declining. Unlike for the ELA score, the coefficient for the highest-achieving math group is very small and insignificant in the first row. When looking at the specifications for ethnic groups, there is a significant rise in the fraction of black and Hispanic students in the group with insufficient skills. Overall, the results suggest that a rising share of Asian students, who are at the upper part of the achievement distribution, increases the fraction of non-Asian students who have insufficient skills for their age.

V. Interpretation of the Results as Peer Effects and Robustness Considerations

One may be concerned that in addition to affecting the racial composition the dragon cohort incudes congestion in school zones by increasing the number of Asian students. In this case, our estimates are not necessarily indicating peer effects, rather than the joint effect of higher share of Asian peers and larger number of Asian students. However, our specifications control for class size and pupil per teacher ratio the inclusion of which has very little impact on our estimates. This suggests that congestion is unlikely to drive our results. We believe that this is explained by the fact that principals tend to allocate resources evenly within a school, and therefore it seems unlikely that, within a school, resources available for the dragon cohort would be substantially different compared to the non-dragon cohorts. Moreover, the DOE allocates resources partly in accordance with student enrollment and special needs, which further facilitates equalization of resources across cohorts.

A second concern is that principals whose objective is to maximize student performance given the available resources may endogenously adapt to changes in student performance induced by the higher share of Asian students. If this was the case, our estimates will recover a joint effect of changes in principal's policy and peer composition. However, in the case of negative peer composition effects, such endogenous principal policies would aim to eliminate reductions in student performance and therefore bias our estimates towards zero.[19] It is also worth noting that even if endogenous principal responses to the dragon cohort attenuated our estimates, our reduced form model would still be unbiased.[20]

A third potential concern is that the effects identified by IV procedure are due to pre-school exposure of non-Asian children to the disproportionately larger dragon cohort in areas with large Asian population. While we cannot completely rule this out, the fact that we find no significant negative effects in the third grade suggests that exposure to larger Asian dragon cohort has no detectable adverse effects on children before the spring in the year they turn 9 (that is, when third grade testing takes place).

[19] Ballatore et al. (2015) make this argument in the context of immigrant peers.
[20] Abdulkadiroğlu et al. (2014) provide a theoretical discussion of this issue in the context of exam schools in Boston and New York.

A fourth potential source of bias is endogenous student allocation between schools. If non-Asian students who are adversely affected by the larger Asian dragon cohort switch to schools with lower Asian exposure, while students who are unaffected by or benefit from Asian peers stay, our IV estimates may be biased. However, such endogenous sorting would induce positive bias in our estimates and thus work against finding negative effects on non-Asian students.

To investigate whether non-Asian students exited schools that were most exposed to the Asian dragon cohort, table 8 displays estimates from regressions corresponding to the reduced form specification in column 7 of table 4 with a change in the number of students from grade g to grade $g+1$ as the outcome. We are unable to detect any statistically significant excess attrition of non-Asian students in the more exposed areas at conventional significance levels. Notably, the coefficient is small and insignificant for non-Asian students for changes from grades three to four, in the latter of which significant adverse effects on the average non-Asian math and ELA scores begin to appear. Moreover, the only significant coefficient at the 5 percent risk level is for Hispanic students in panel B, but this estimate is *positive*. These findings appeal to the fact that for a vast majority of students school switching is likely to have large frictions because it is based on place of residence, the changing of which incurs substantial costs.

VI. Concluding Remarks

This paper investigated the effects of Asian peers on the achievement of non-Asian students in New York City public primary schools. To address the concern that racial composition is endogenous, we employed as a source of identifying variation fertility shocks among Asian population stemming from the widespread belief that children born in the dragon year are superior. We exploited the interaction between the historical Asian population share and this dragon effect to draw exogenous variation in the fraction of Asian students across school zones.

Our results indicate heterogeneous effects across grades and ethnic groups. We detect negative impacts on math and ELA scores of black and Hispanic students from the fourth grade onwards, but no effects on white students on any grade. Because black and Hispanic students are at the lower part of the achievement distribution, while white and Asian students are comparable in terms of achievement and at the upper part of the achievement distribution, these findings suggest adverse effects of increasing the fraction of well-performing peers on students who are less-well performing. This finding is consistent with prior work providing some evidence that secondary school students at the lower end of the ability do worse in high-achieving peer environment (Abdulkadiroglu et al. 2014; Dobbie and Fryer 2014). Moreover, our results indicate that the negative effects on non-Asian students are driven by the rising share of students who have insufficient skills in math and ELA in terms of the expectations in their grade.

While it is important to note that students with Asian background perform relatively well in US schools, our study suggests that they may cause indirect adverse effects on students who are not performing as well. This finding is relevant for education policy, because the share of Asian students is likely to increase in the future as Asia has become a major immigrant-sending region in the US with China being the largest single country.

References (incomplete):

Angrist, Joshua D. "The perils of peer effects." *Labour Economics* 30 (2014): 98-108.

Angrist, Joshua D., and Kevin Lang. "Does school integration generate peer effects? Evidence from Boston's Metco rogram." *American Economic Review* (2004): 1613-1634.

Attewell, Paul. "The winner-take-all high school: organizational adaptations to educational stratification." *Sociology of education* (2001): 267-295.

Ballatore, Rosario Maria, Margherita Fort, and Andrea Ichino. "The Tower of Babel in the classroom: immigrants and natives in Italian schools." (2015).

S.E. Black "Do better schools matter? Parental valuation of elementary education." *Quarterly Journal of Economics* 114 (1999) 578–599.

Borjas, George. 1995. "Ethnicity, neighborhoods, and human capital externalities." *American Economic Review*, 85(3): 365-390.

Carrell, Scott, and Mark Hoekstra, 2010. "Externalities in the classroom: how children exposed to domestic violence affect everyone's kids." *American Economic Journal: Applied Economics*, 2(1): 211-28.

Case, Anne and Lawrence Katz. 1991. "The company you keep: the effects of family and neighborhood on disadvantaged youths." NBER Working Paper No. 3705.

Cicala, Steve, Roland Fryer, and Jorg L. Spenkuch. 2011. "A Roy model of social interactions." NBER Working Paper No. 16880.

Coleman, James, Ernest Campbell, Carol Hobson, James McPartland, Alexander Mood, Frederic Weinfeld, and Robert York. 1966. Equality of Educational Opportunity. Washington, DC: U.S. Government Printing Office

Fruehwirth, J. C. (2013). “Identifying peer achievement spillovers: implications for desegregation and the achievement gap.” *Quantitative Economics*, 4, 85–124

Cutler, David, and Edward Glaeser. 1997. “Are ghettos good or bad?" *The Quarterly Journal of Economics*, 112(3): 827-72.

De Giorgi, G., & Pellizzari, M. (2014). “Understanding social interactions: evidence from the classroom.” *The Economic Journal*, 124 (579), 917-953.

Dobbie, Will, and Roland G. Fryer Jr. "The impact of attending a school with high-achieving peers: evidence from the New York City exam schools." *American Economic Journal: Applied Economics* 6.3 (2014): 58-75.

Dobbie, Will, and Roland G. Fryer Jr. "The medium-term impacts of high-achieving charter schools." Forthcoming at the *Journal of Political Economy* (2015).

Duflo, Esther, Pascaline Dupas, and Michael Kremer. "Peer effects, teacher incentives, and the impact of tracking: evidence from a randomized evaluation in Kenya." *American Economic Review* 101.5 (2011): 173974.

Feld, Jan, and Ulf Zölitz. "Understanding peer effects: on the nature, estimation and channels of peer effects." (2014).

Gibbons, Steve, and Stephen Machin. "Valuing English primary schools." *Journal of Urban Economics* 53.2 (2003): 197-219.

Goodkind, Daniel M. "The significance of demographic triviality: minority status and zodiacal fertility timing among Chinese Malaysians." *Population Studies* 49.1 (1995): 45-55.

Hanushek, Eric A., John F. Kain, and Steven G. Rivkin. "New Evidence about Brown v. Board of Education: the complex effects of school racial composition on achievement." *Journal of Labor Economics* 27.3 (2009).

Hoxby, Caroline. “Peer effects in the classroom: learning from gender and race variation.” No. w7867. National Bureau of Economic Research, 2000.

Hoxby, Caroline, and Gretchen Weingarth. 2006. “Taking race out of the equation: school reassignment and the structure of peer effects." Unpublished Working Paper.

Imberman, Scott A., Adriana D. Kugler, and Bruce I. Sacerdote. "Katrina's children: evidence on the structure of peer effects from hurricane evacuees." *The American Economic Review* (2012): 2048-2082.

Kramarz, Machin, and Ouazad (2008). “What makes a test score? The respective contributions of pupils, schools, and peers in achievement in English primary education.” IZA Discussion Paper No. 3866.

Lau, Yan. "Step Up or Give Up: Student Response to Increased Competition from the Dragon Cohort." (2013).

Lavy, Victor, Olmo Silva, and Felix Weinhardt. "The good, the bad, and the average: evidence on ability peer effects in schools." *Journal of Labor Economics* 30.2 (2012): 367-414.

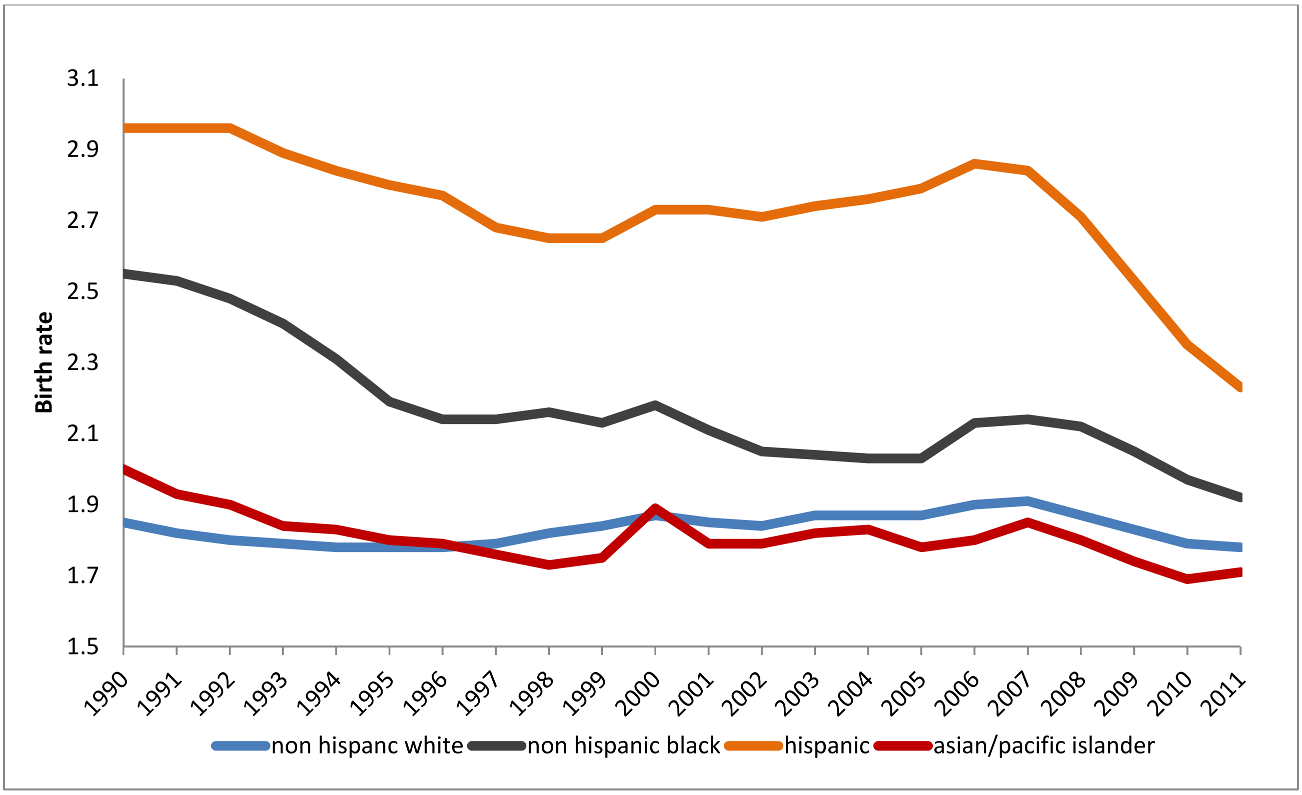
Lazear, Edward. 2001. “Educational Production." *The Quarterly Journal of Economics*, 116(3): 777-803.

Johnson, Noel D., and John VC Nye. "Does fortune favor dragons ?" *Journal of Economic Behavior & Organization* 78.1 (2011): 85-97.

Sim, Nicholas. "Astronomics in Action: The Graduate Earnings Premium and the Dragon Effect in Singapore." *Economic Inquiry* 53.2 (2015): 922-939.

Yip, Paul S.F, Joseph Lee, and Y.B Cheung (2002) “The influence of the Chinese zodiac on fertility in Hong Kong SAR,” *Social Science & Medicine*, Vol. 55, No. 10, pp. 1803 –1812.

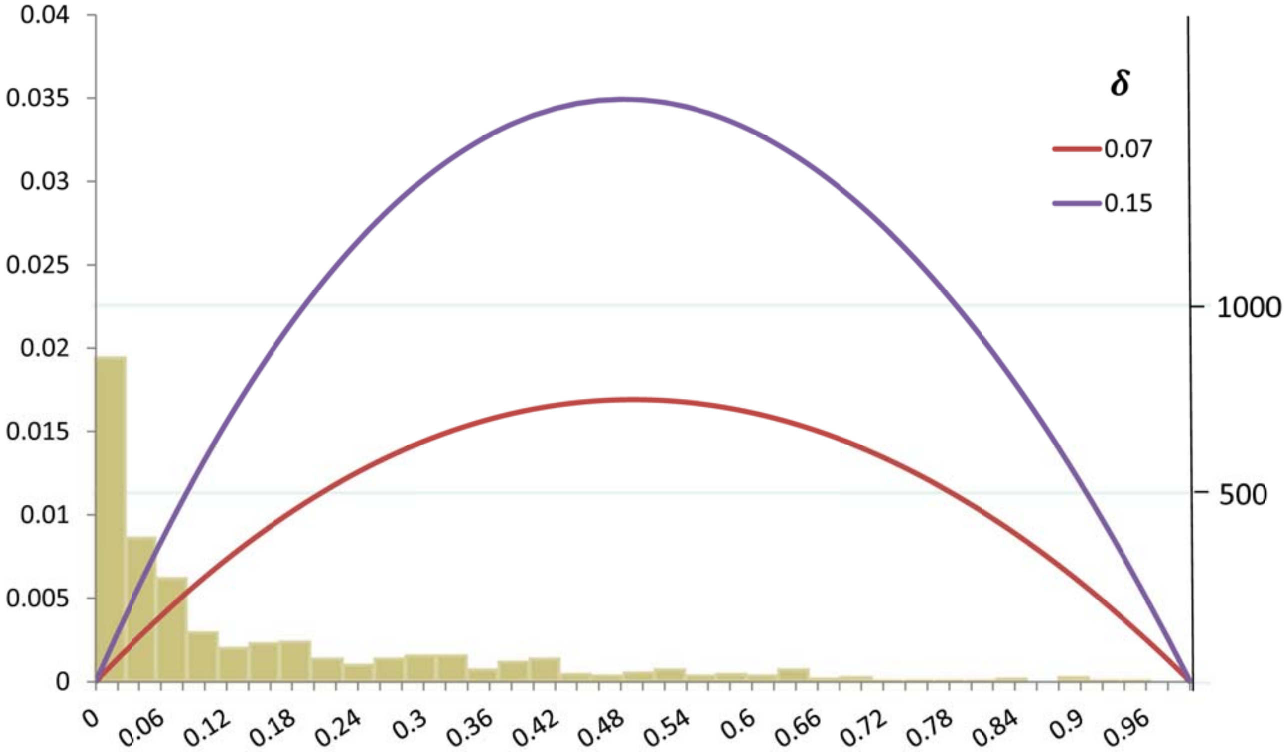
Figure 1: Birth Rate in the US by Ethnic Background, 1990-2011



Notes: Births per 1,000 woman.

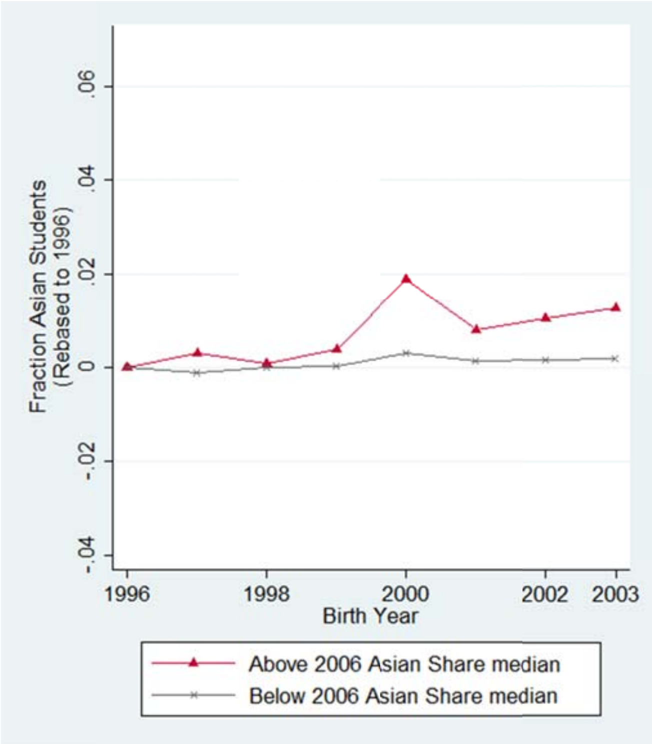
Data source: US Census Bureau.

Figure 2: The Dragon Effect on Asian Population Share



Notes: This figure plots equation shows the histogram of the 2006 Asian share and .

Figure 3: Asian Student Share by Birth Cohort in New York City Public Elementary Schools, 1996-2003



Data Source: BEDS files, Department of Education, New York

Table 1:
Summary Statistics

	Full Sample		Below 2006 Asian Population Share Median		Above 2006 Asian Population Share Median	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Test Scores						
Mean Math Score, All	675.6	(20.2)	666.3	(17.0)	683.8	(19.1)
Mean Math Score, Asian	699.6	(19.2)	684.4	(27.7)	701.1	(17.4)
Mean Math Score, White	689.9	(19.1)	681.5	(25.0)	691.2	(17.7)
Mean Math Score, Hispanic	671.2	(17.5)	665.5	(17.0)	676.0	(16.4)
Mean Math Score, Black	667.1	(17.1)	663.8	(16.6)	670.6	(17.0)
Mean Math Score, Non-Asian	673.3	(18.8)	666.2	(16.9)	679.6	(18.0)
Mean ELA Score, All	659.1	(14.9)	652.1	(12.2)	665.2	(14.4)
Mean ELA Score, Asian	673.3	(15.6)	664.0	(21.4)	674.1	(14.6)
Mean ELA Score, White	671.9	(15.8)	666.0	(19.7)	672.8	(14.9)
Mean ELA Score, Hispanic	655.4	(13.3)	650.3	(12.4)	659.8	(12.4)
Mean ELA Score, Black	654.7	(12.5)	651.5	(11.5)	658.0	(12.5)
Mean ELA Score, Non-Asian	658.1	(14.4)	652.1	(12.2)	663.4	(14.1)
School Characteristics						
Asian Share (%)	11.5	(16.9)	1.2	(1.0)	22.0	(18.9)
Black Share (%)	35.0	(30.0)	50.4	(30.4)	19.4	(19.8)
Hispanic Share (%)	39.4	(26.5)	43.8	(29.7)	34.9	(22.1)
White Share (%)	14.1	(21.2)	4.5	(14.6)	23.7	(22.4)
Grade Size	431.9	(319.5)	369.6	(239.7)	494.9	(373.5)
Pupils per Teacher	8.9	(4.0)	8.6	(3.9)	9.2	(4.1)
Free lunch (%)	69.1	(24.2)	77.9	(20.0)	59.8	(24.9)
Reduced Lunch (%)	8.8	(6.0)	6.7	(5.3)	11.1	(5.9)
Suspensions (%)	1.9	(2.8)	2.3	(3.2)	1.4	(2.3)
Limited English proficiency (%)	13.5	(12.0)	13.2	(12.5)	13.7	(11.4)
Teachers with no valid certificate (%)	5.1	(5.7)	7.1	(6.7)	3.1	(3.4)
Teachers with experience < 3yrs (%)	18.5	(12.2)	20.8	(13.9)	16.0	(9.5)
N	977		491		486	

Notes: Data for New Your City primary schools by grade and ethnicity over the years 2007-2011.

Table 2:
Panel A: Proficiency Groups By Ethnicity: Math Test

	Level 1	Level 2	Level 3	Level 4
A. math				
Asian	2.5%	9.8%	39.2%	48.3%
white	3.6%	14.5%	45.4%	36.3%
black	10.1%	32.1%	45%	12.6%
Hispanic	9%	28.3%	46.5%	16%
B. ELA				
Asian	4.4%	21.9%	61.9%	11.7%
white	4.6%	23.5%	60.5%	11.2%
black	10.2%	43.2%	43.8%	2.7%
Hispanic	10.8%	40.7%	45.2%	3.2%

Notes: Average percentage of students in each proficiency group by ethnicity for math and ELA.

Table 3:
Asian Student Share and Non-Asian Test Score, OLS Estimates

	(1) Pooled	(2) School, Grade, and Year FEs	(3) + Cohort FE	(4) + Pupil Background	(5) + Teacher & Staff Resources	(6) + Concurrent Ethnic Composition	(7) + Class & Grade Size Controls
A. Average math Score, Non-Asian Students							
Asian Student Share	0.0674	0.125***	0.0871**	0.0867*	0.0930**	0.159***	0.164***
	(0.108)	(0.0416)	(0.0414)	(0.0456)	(0.0454)	(0.0462)	(0.0466)
N	19,812	20,951	20,951	18,368	18,307	18,307	10,729
B. Average ELA Score, Non-Asian Students							
Asian Student Share	0.0757	0.0252	0.0328	0.0362	0.0417	0.0968*	0.110**
	(0.0767)	(0.0451)	(0.0448)	(0.0501)	(0.0501)	(0.0509)	(0.0497)
N	19,801	20,939	20,939	18,358	18,295	18,295	18,295
Year FE	NO	YES	YES	YES	YES	YES	YES
School FE	NO	YES	YES	YES	YES	YES	YES
Grade FE	NO	YES	YES	YES	YES	YES	YES
Cohort FE	NO	NO	YES	YES	YES	YES	YES

Notes: Estimations employ data on average math and ELA scores in New Your City primary schools grade and ethnicity over the years 2007-2011. Concurrent control variables include the log of grade size, and variables listed under the title "School Characteristics" in table 1. The 1, 5, and 10% confidence levels are denoted by ***, **, and *, respectively.

Table 4:
Reduced Form Estimates on Non-Asian Test Score

	(1) Pooled	(2) School, Grade, and Year FEs	(3) + Cohort FE	(4) + Pupil Background	(5) + Teacher & Staff Resources	(6) + Concurrent Ethnic Composition	(7) + Class & Grade Size Controls
A. Average math Score, Non-Asian Students							
Dragon * Asian Share 2006	-0.0648**	-0.0224*	-0.0254**	-0.0228*	-0.0172	-0.0172	-0.0167
	(0.0273)	(0.0124)	(0.0121)	(0.0126)	(0.0126)	(0.0122)	(0.0122)
Asian Share 2006	0.397***						
	(0.0374)						
Dragon	9.531***	-0.624***					
	(0.460)	(0.199)					
N	19,812	19,812	19,812	17,330	17,304	17,304	17,304
B. Average ELA Score, Non-Asian Students							
Dragon * Asian Share 2006	-0.0734***	-0.0580***	-0.0582***	-0.0523***	-0.0449***	-0.0450***	-0.0442***
	(0.0198)	(0.00966)	(0.00972)	(0.0102)	(0.0102)	(0.00993)	(0.00986)
Asian Share 2006	0.303***						
	(0.0279)						
Dragon	6.600***	0.176					
	(0.336)	(0.149)					
N	19,801	19,801	19,801	17,321	17,293	17,293	17,293
Year FE	NO	YES	YES	YES	YES	YES	YES
School FE	NO	YES	YES	YES	YES	YES	YES
Grade FE	NO	YES	YES	YES	YES	YES	YES
Cohort FE	NO	NO	YES	YES	YES	YES	YES

Notes: Estimations employ data on average math and ELA scores in New Your City primary schools grade and ethnicity over the years 2007-2011. Concurrent control variables include the log of grade size, and variables listed under the title “School Characteristics” in table 1. The 1, 5, and 10% confidence levels are denoted by ***, **, and *, respectively.

Table 5:
The Effect of Asian Student Share on Non-Asian Test Score, IV Estimates

	(1) Pooled	(2) School, Grade, and Year FEs	(3) + Cohort FE	(4) + Pupil Background	(5) + Teacher & Staff Resources	(6) + Concurrent Ethnic Composition	(7) + Class & Grade Size Controls
A. Average math Score, Non-Asian Students							
Asian Student Share	-2.555*	-0.458*	-0.520*	-0.479*	-0.369	-0.360	-0.352
	(1.511)	(0.277)	(0.276)	(0.286)	(0.285)	(0.273)	(0.274)
First-Stage							
Dragon * Asian Student Share 2006	0.0254**	0.0490***	0.0488***	0.0476***	0.0466***	0.0478***	0.0474***
	(0.0102)	(0.00915)	(0.00915)	(0.00951)	(0.00951)	(0.00903)	(0.00903)
N	19,812	19,812	19,812	17,330	17,304	17,304	17,304
B. Average ELA Score, Non-Asian Students							
Asian Student Share	-2.909**	-1.191***	-1.198***	-1.100***	-0.945***	-0.945***	-0.935***
	(1.458)	(0.316)	(0.319)	(0.324)	(0.300)	(0.300)	(0.300)
First-Stage							
Dragon * Asian Student Share 2006	0.0252**	0.0487***	0.0486***	0.0475***	0.0465***	0.0477***	0.0473***
	(0.0102)	(0.00915)	(0.00915)	(0.00951)	(0.00952)	(0.00903)	(0.00902)
N	19,801	19,801	19,801	17,321	17,293	17,293	17,293
Year FE	NO	YES	YES	YES	YES	YES	YES
School FE	NO	YES	YES	YES	YES	YES	YES
Grade FE	NO	YES	YES	YES	YES	YES	YES
Cohort FE	NO	NO	YES	YES	YES	YES	YES

Notes: Estimations employ data on average math and ELA scores in New Your City primary schools grade and ethnicity over the years 2007-2011. Concurrent control variables include the log of grade size, and variables listed under the title “School Characteristics” in table 1. The 1, 5, and 10% confidence levels are denoted by ***, **, and *, respectively.

Table 6:
The Effect of Asian Student Share on Student Achievement by Ethnicity and Grade, IV Estimates

	(1) Non-Asian	(2) Hispanic	(3) Black	(4) White
A. Average math Score				
All				
Asian Student Share	-0.352	-0.487*	-0.283	-1.052
	(0.274)	(0.285)	(0.392)	(0.976)
N	17,304	15,987	13,498	6,763
Grade 3				
Asian Student Share	0.368	-0.671	1.755	-0.556
	(0.495)	(0.635)	(3.373)	(1.300)
N	3,577	3,286	2,533	1,438
Grade 4				
Asian Student Share	-0.980**	-1.224**	-1.698**	-0.842
	(0.440)	(0.482)	(0.753)	(1.393)
N	3,571	3,270	2,568	1,432
Grade 5				
Asian Student Share	-0.909**	-0.416	0.238	-1.577
	(0.429)	(0.339)	(0.500)	(2.559)
N	3,593	3,286	2,600	1,409
Grade 6				
Asian Student Share	0.186	0.0994	-0.119	-0.103
	(0.452)	(0.512)	(0.604)	(0.816)
N	2,247	2,086	1,901	792
B. Average ELA Score				
All				
Asian Student Share	-0.935***	-0.872***	-0.735**	0.171
	(0.300)	(0.281)	(0.335)	(0.635)
N	17,293	15,952	13,501	6,704
Grade 3				
Asian Student Share	1.251**	0.488	0.473	0.147
	(0.552)	(0.617)	(1.993)	(1.025)
N	3,577	3,279	2,538	1,435
Grade 4				
Asian Student Share	-0.744*	-1.101**	-0.929	1.617
	(0.394)	(0.448)	(0.693)	(1.314)
N	3,572	3,267	2,568	1,422
Grade 5				
Asian Student Share	-1.862***	-0.950***	-0.683**	1.082
	(0.609)	(0.342)	(0.320)	(1.838)
N	3,592	3,278	2,598	1,400
Grade 6				
Asian Student Share	-1.141***	-0.663**	-0.872**	-0.0452
	(0.430)	(0.309)	(0.379)	(0.758)
N	2,244	2,085	1,900	787

Notes: The table shows estimates from an IV regression of average math/ELA score on Asian student share instrumented with the interaction term between the dragon cohort dummy and Asian student share in 2006. All specifications control for school, grade, year, and cohort fixed effects. Estimations employ data on average math and ELA scores in New Your City primary schools by grade and ethnicity over the years 2007-2011. The 1, 5, and 10% confidence levels are denoted by ***, **, and *, respectively

Table 7:
The Effect of Asian Student Share on the Fraction of Students in Achievement Levels by Ethnicity, IV Estimates

	ELA Achievement Group				math Achievement Group			
	Level 1 (Insufficient)	Level 2 (On Track)	Level 3 (Sufficient)	Level 4 (More Than Sufficient)	Level 1 (Insufficient)	Level 2 (On Track)	Level 3 (Sufficient)	Level 4 (More Than Sufficient)
A. Non-Asian								
Asian Student Share	0.0065***	-0.0062***	-0.0079***	-0.0049***	0.0064***	-0.0060***	-0.0075***	0.0001
	(0.0017)	(0.0020)	(0.0020)	(0.0017)	(0.00164)	(0.0019)	(0.0019)	(0.0032)
N	17,293				17,304			
B. Hispanic								
Asian Student Share	-0.373	0.527	0.223	-0.377***	0.398**	0.203	-0.316	-0.281
	(0.255)	(0.355)	(0.326)	(0.126)	(0.198)	(0.288)	(0.325)	(0.303)
N	15,952				15,987			
C. Black								
Asian Student Share	-0.0600	0.601	-0.379	-0.159	0.534**	0.217	-0.922*	0.169
	(0.326)	(0.558)	(0.632)	(0.151)	(0.243)	(0.467)	(0.490)	(0.461)
N	13,501				13,498			
D. White								
Asian Student Share	0.194	-0.0140	-0.0870	-0.0839	0.163	0.902	-0.0726	-0.997
	(0.494)	(0.754)	(0.897)	(0.553)	(0.290)	(0.815)	(0.832)	(1.202)
N	6,704				6,763			

Notes: The table shows estimates from an IV regression of average math/ELA score on Asian student share instrumented with the interaction term between the dragon cohort dummy and Asian student share in 2006. All specifications control for school, grade, year, and cohort fixed effects. Estimations employ data on average math and ELA scores in New Your City primary schools by grade and ethnicity over the years 2007-2011. The 1, 5, and 10% confidence levels are denoted by ***, **, and *, respectively

Table 8:
The Dragon Effect on Change in the Number of Students across Grades, Reduced Form Estimates

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Non-Asian	Asian	white	black	Hispanic
A. Grade 3 to 4						
Dragon * Asian Share 2006	0.0817***	0.00603	0.0757***	-0.00739	-0.00219	0.00924
	(0.0246)	(0.0143)	(0.0213)	(0.00758)	(0.00661)	(0.00919)
Mean number of students in grade 3	105.1	85.47	19.8	21.5	30.1	40.0
N	2,127	2,127	2,127	2,045	2,798	2,940
B. Grade 4 to 5						
Dragon * Asian Share 2006	0.00429	0.0250*	-0.0207*	-0.00739	0.00831	0.0245***
	(0.0171)	(0.0132)	(0.0111)	(0.00908)	(0.00698)	(0.00905)
Mean number students in grade 4	140.8	84.71	20.1	21.3	30.6	38.7
N	2,099	2,099	2,099	1,972	2,767	2,925
C. Grade 5 to 6						
Dragon * Asian Share 2006	-0.0386	-0.0297	-0.00882	-0.0114	-0.0146	0.000487
	(0.118)	(0.0724)	(0.0656)	(0.0233)	(0.0373)	(0.0396)
Mean number of students in grade 5	92.7	75.67	16.5	19.7	30.5	32.8
N	495	495	495	415	717	757

Notes: The table shows estimates from a reduced form regression of the change in the number of students from grade g to grade g+1 on the interaction term between the dragon cohort dummy and Asian student share in 2006. All specifications control for school, grade, year, and cohort fixed effects, dragon cohort dummy, Asian student share in 2006, and a full set of control variables. Estimations employ data on average math and ELA scores in New Your City primary schools by grade and ethnicity over the years 2007-2011. The 1, 5, and 10% confidence levels are denoted by ***, **, and *, respectively

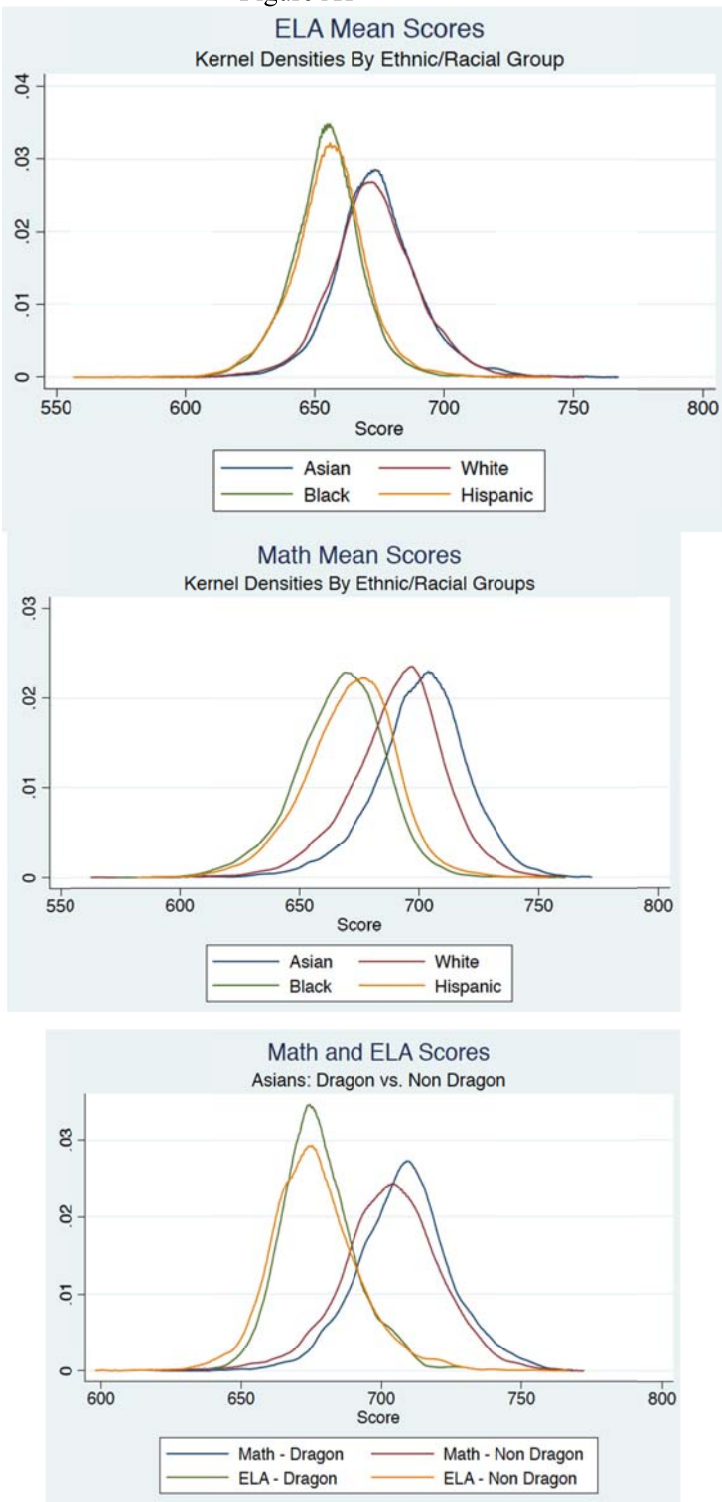
APPENDIX

Table A1:
The Effect of Asian Student Share on Average Peer Group Achievement, IV Estimates

	Peer Group				
	(1)	(2)	(3)	(4)	(5)
	Non-Hispanic	Non-black	Non-white	All	Asian
A. ELA Score					
Asian Share	-0.895***	-0.994***	-0.697***	-0.860***	-0.217
	(0.288)	(0.322)	(0.264)	(0.280)	(0.517)
N	16,596	16,340	17,129	17,293	6,888
B. math Score					
Asian Share	-0.159	-0.117	0.203	0.0144	-0.662
	(0.260)	(0.281)	(0.243)	(0.233)	(0.696)
N	16,614	16,363	17,142	17,304	6,964

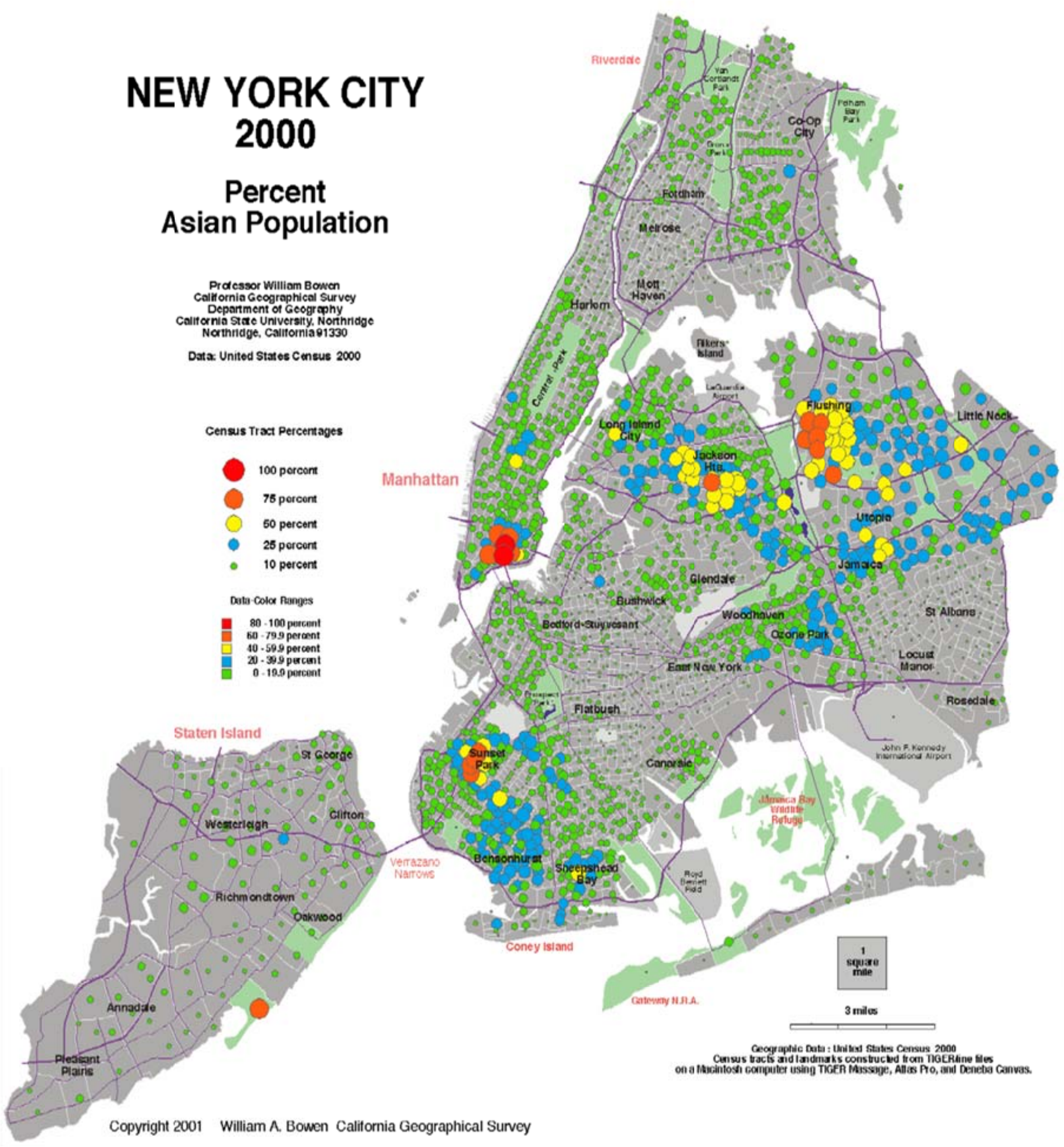
Notes: The table shows estimates from an IV regression of average math/ELA score on Asian student share instrumented with the interaction term between the dragon cohort dummy and Asian student share in 2006. All specifications control for school, grade, year, and cohort fixed effects. Estimations employ data on average math and ELA scores in New Your City primary schools by grade and ethnicity over the years 2007-2011. The 1, 5, and 10% confidence levels are denoted by ***, **, and *, respectively

Figure A1



Notes: this figure shows the Kernel distributions for Math and ELA tests for the four ethnic groups. The bottom figure compares dragon vs. non-dragon cohorts (only Asian students).

Figure A2: Distribution of Asian Percentage Population in New York City in 2000



Notes: Sources (William A. Bowen, California Geographical Survey, United States Census 2000).