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KATRINA'S CHILDREN:
EVIDENCE ON THE STRUCTURE OF PEER EFFECTS FROM HURRICANE EVACUEES

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ABSTRACT

In 2005, hurricanes Katrina and Rita forced many children to relocate across the Southeast. While schools quickly enrolled evacuees, receiving families worried about the impact of evacuees on non-evacuee students. Data from Houston and Louisiana show that, on average, the influx of evacuees moderately reduced elementary math test scores in Houston. We reject linear-in-means models of peer effects and find evidence of a highly non-linear but monotonic model - student achievement improves with high ability and worsens with low ability peers. Moreover, exposure to undisciplined evacuees increased native absenteeism and disciplinary problems, supporting a "bad apple" model in behavior.

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1. Introduction

On August 29, 2005, Hurricane Katrina made landfall in Southeast Louisiana. Katrina was one of the five deadliest hurricanes in the U.S. causing about 2,500 deaths. It was also the most destructive and costliest hurricane ever in the U.S., with a total estimated damage of over $80 billion (Knabb, Rhome and Brown, 2006). The storm surge caused flooding in 80% of New Orleans as well as large areas of the coasts of Mississippi and Alabama. Federal disaster declarations covered 90,000 square miles of the U.S. Just a few weeks later, Hurricane Rita hit Louisiana and East Texas. Rita was the most powerful storm ever recorded in the Gulf and while it hit a less populated area, there was still substantial damage as a result of the storm.

Katrina and Rita caused over a million people to evacuate from the Central Gulf coast to other areas of the U.S.; one of the greatest migrations of children and their families in U.S. history (Ladd, Marzalek and Gill, 2008). Some areas of Louisiana received large numbers of evacuees. Baton Rouge received over 15,000 evacuees and Hammond received over 10,000 evacuees, nearly doubling their populations. However, many evacuees left the affected states. Houston, Texas received 75,000 people, which was the largest number of evacuees received by any city (McIntosh, 2008).

As a result of the migration, many children were uprooted. Given that schools were probably the best way to bring back stability into children's lives, school districts mounted substantial efforts to enroll the evacuees in their schools as quickly as possible. Districts in Louisiana not affected by the hurricanes took in about 196,000 children (Pane et. al, 2007). Houston area schools took nearly 20,000 evacuee children since hurricanes

Katrina and Rita struck, with the Houston Independent School District enrolling over 5,000 students.

While Baton Rouge, Houston and other cities were seen as great examples of solidarity, the influx of large numbers of kids into the schools created concerns among the non-evacuee population. Evacuee children came from some of the worst-performing schools in the country and parents worried that their children would be negatively affected by the disruption caused by the influx of poor performing students. Disruption due to student turnover is a concern even under ordinary circumstances. For instance, Hanushek, Kain and Rivkin (2004) report that about a third of all students in Texas move at least once in elementary and middle school and that these moves adversely affect the academic performance of the movers' new classmates.[1] Moreover, the negative spillovers from disruptive behavior have been considered by Figlio (2005) and Carrell and Hoekstra (Forthcoming), who show (respectively) that the presence of boys with female sounding names or children exposed to domestic violence decreases the academic achievement of their peers.

In this paper, we use administrative data from the Houston Independent School District and the Louisiana Department of Education to examine whether the influx of Katrina and Rita students adversely affected the academic performance, attendance and discipline of their new peers.[2] Much of the literature on peer effects for higher education finds modest positive peer effects on GPA (e.g., Carrell, Fullerton and West, 2008; Lyle,

[1] Hanushek et al. (2004) also report that these moves are particularly prevalent among low income and minority students and that the adverse effects of turnover for black and Hispanic receiving students are about seven and five times larger, respectively, than the effect for whites.

[2] Other work has considered the impact of Hurricanes Katrina and Rita on evacuees themselves. Sacerdote (2008) shows that evacuee students had improved test scores in the medium-term from attending new schools. Vigdor (2008, 2007), Groen and Polivka (2008), and Belasaen and Polachek (2008) look at the economic impacts of the Hurricanes on New Orleans and evacuee labor supply. Paxson and Rouse (2008) look at what caused evacuees to return to New Orleans.

2007; Sacerdote, 2001; Stinebrickner and Stinebrickner, 2006; and Zimmerman, 2003), but results for elementary and secondary education are more mixed with some studies finding little or no effects (e.g., Angrist and Lang, 2004; Burke and Sass, 2008; Hanushek et al., 2003; Vigdor and Nechyba, forthcoming) and others finding large effects (e.g., Hoxby, 2000; and Hoxby and Weingarth, 2006; Lavy and Schlosser, 2007; Lavy, Paserman and Schlosser, 2008). In contrast, evidence on peer effects on social outcomes shows consistently large effects (e.g. Aizer, 2008; Carrell, Malmstrom and West, 2008; Case and Katz, 1991; Gaviria and Raphael, 2001; Lavy and Schlosser, 2007).

An advantage of our study is that we can exploit the exogenous influx of new students into the Houston and Louisiana schools to examine peer effects. In fact, many evacuees were evacuated on buses without knowing where they were going. Others were able to drive but had very limited options in terms of where to go, often residing in shelters, motels, or with friends and family. Thus, since the parents of Katrina children were hardly able to self-select into schools, our identification strategy helps overcome the usual selection problem present in peer effects specifications. Moreover, we are able to overcome the reflection problem, since evacuees' prior achievement is exogenous to native students.[3] Our natural experiment is closest to the studies by Boozer and Cacciola (2001), Hoxby (2000), Hoxby and Weingarth (2006), Lavy and Schlosser (2007) and especially to Angrist and Lang (2004), but has two advantages. First, the incoming students in our quasi-experiment are more alike in racial composition and economic status to the receiving students than the bused and receiving students in the Boston Metco study. Second, we have good measures of behavior (including discipline and attendance

[3] On the other hand, like most of the literature, we will be capturing both endogenous and exogenous peer effects, as defined by Manski (1993).

data), which allow us to examine the impacts of peers on behavior using administrative data rather than self-reported data, so that our results are less likely to be subject to measurement error bias.

On average, we find that the influx of evacuees had little impact on native student achievement or discipline - only math for Houston elementary students shows a statistically significant drop of 0.09 standard deviations for a 10 percentage point increase in Katrina/Rita share in the school. We also find drops in attendance rates of Houston middle and high school black natives of 1.3 percentage points for a 10 percentage point increase in Katrina/Rita share. These results are robust to validity tests using instrumental variables and placebo experiments.

In addition to establishing whether there are peer effects by exploiting exogenous changes in peer composition, an important contribution of this paper is our focus on the structure of peer effects. With the exceptions of Hoxby and Weingarth (2006) who consider various models of peer effects and Lavy, Paserman and Schlosser (2008) who investigate how having low-achieving peers affects teacher behavior, most of the previous literature focuses solely on the difficult task of establishing whether peer effects exist. Here, we, also examine the mechanisms through which peer effects work. In particular, we contrast monotonicity, linear-in-means, boutique, invidious comparison, and bad apple models of peer effects (see, e.g., Hoxby and Weingarth (2006), and Sacerdote (forthcoming)).

We find strong evidence in favor of the monotonicity model and against the invidious comparison model, in the sense that all students benefit from having higher quality peers and are hurt by having low quality peers. In addition, we establish that these monotonic effects are non-linear, thus rejecting linear-in-means models that are common in the literature. We also find some evidence, albeit weak, of the benefits of tracking students, or the so-called boutique model, since in some cases students appear to benefit from being with peers of the same academic level. These results are consistent with Hoxby and Weingarth (2006) who also find support of the boutique and monotonicity models and reject linear-in-means.

Moreover, we find support for the bad apple model in terms of behavior as described by Lazear (2001) - the presence of even a few disruptive students in the classroom can have large negative effects on discipline and attendance of native kids. On the other hand, we do not find evidence that children with disciplinary problems worsen academic performance of natives. Rather, peer effects on test scores seem to be working through the academic performance of peers, given the differential impacts of poor and highly performing peers.

Finally, we address some other potential avenues through which evacuees may affect native students. In particular, we consider the impact of Katrina/Rita share on class sizes, per-student expenditures, average teacher experience, and native student switching. These results, for the most part, show no statistically significant impacts with the notable exception that in Houston elementary schools average teacher education and certification rates seemed to *increase*. This evidence combined with the fact that we see very different impacts across achievement levels of natives and evacuees strongly suggest that our estimates are picking up peer effects rather than other changes.

2. Katrina's Children and School Responses

Hurricanes Katrina and Rita caused one of the largest displacements of children in the history of the U.S. About 400,000 students were forced to enroll in new schools as a result of these hurricanes (U.S. Department of Education, 2007). School districts across the country acted quickly to open their doors to evacuated students as required under the McKinney-Vento Homeless Assistance Improvement Act (Edwards, 2007).

Within Louisiana, people mostly evacuated to places where they had family and friends. However, evacuees to East Baton Rouge were mainly living on FEMA assistance and went to cheap hotels and apartments. While in 2005-06 many schools in Louisiana received no evacuees at all, the average and greatest evacuee enrollment in our analysis sample which excludes schools outside the affected areas and those with more than 70% evacuees were 3.1% and 56%, respectively. Figure 1 displays a map of the percentage of Katrina student evacuees in Louisiana schools, which shows substantial variation in terms of exposure to the evacuee children.

Many students, however, went outside of the state - Texas alone received 50,000 students. In Houston, many students and their families were housed in shelters, which included 30,400 residents housed in the Reliant Park complex (Reliant Center, News Release), the largest evacuation shelter in U.S. history. Many more evacuees were housed in the George R. Brown Convention Center and Red Cross shelters throughout the city. By August 31, 2005, just two days after Hurricane Katrina made landfall, HISD was already admitting evacuees into the district's schools while providing school bus stops at shelters to transport the children. Initially, displaced students in the stadium complex and convention center were placed in schools close to the shelters and with available spots.

Students residing in other locations were mostly sent to the school zoned to their address. Figure 2 shows the map of Houston ISD. This map shows that some schools in Houston received no evacuees at all, while in others evacuees comprised of up to 25% of the student population in October 31, 2005, showing substantial variation in the influx of Katrina students across the district. The mean percentage of evacuees in HISD at the time was 2.5%.

While the receiving school districts made a great effort to accommodate the thousands of new students, some worried about the financial burden on the taxpayers of the receiving areas. For example, one news report provided said that HISD would face an extra $20 million in costs over the 2005-2006 school year (Klein, 2006). However, given that districts were enrolling homeless students, they were eligible for federal education grants. Also, after three months Congress passed the Hurricane Education Recovery Act (HERA) to provide impact aid for districts enrolling displaced students and to provide aid to restore educational facilities which had been damaged by the hurricanes. The amount per student from HERA was set to cover $6,000 per displaced student (Radcliffe, 2006). With regards to reduced resources, a main concern was that schools receiving many evacuees would experience a sharp rise in the student/teacher ratio. However, below we present evidence showing that evacuees generated no statistically significant increase in class sizes or expenditures per student.

In addition to funding issues, teachers and parents of non-evacuee students were concerned that some evacuees were years behind in terms of academic achievement. In our interviews with teachers and principals in Houston, many indicated that Katrina students were on average one or several years below grade level. Aside from issues related to academic performance, in middle and high-school, there were reports that feuds between students became more common after the arrival of the evacuees. In response to this, in the 2006-2007 school year, police presence was increased by 10% in 18 secondary schools.

In what follows, we discuss the strategy we use to estimate peer effects of Katrina and Rita evacuees on the academic performance and discipline of non-evacuee students, and to uncover the structure and channels through which peer effects work.

3. Identification Strategy

We estimate the direct impact of the influx of Katrina and Rita evacuees into Louisiana's and Houston's schools on native students as follows,

$$Y_{igjt} = \alpha + \beta Katrina\_Fraction_{jt} + \Omega X_{igjt} + \Pi Grade_g + \Gamma Year_t + \Phi Grade_g \times Year_t + \kappa_j + \varepsilon_{igjt}, \tag{1}$$

where Y_{igjt} is the academic or disciplinary outcome of individual i in grade g attending school j at time t, $Katrina\_Fraction_{jt}$ is the number of Katrina and Rita evacuees divided by the total number of students in school j in March of year t+1 for Louisiana and in October of year t for Houston, where this fraction is zero before the 2005-2006 academic year. X_{igjt} are observable characteristics of individual i in grade g attending school j at time t, including indicators for whether the student is female, white, Black, Hispanic, Asian, Native American, and whether the student gets free-lunch, reduced-priced lunch or is classified as being otherwise economically disadvantaged.[4] $Grade_g$ and $Year_t$ are grade and year effects and κ_j are school-fixed effects. The addition of school and year effects makes this a difference-in-differences specification in which changes in outcomes before

[4] The other economic disadvantage and Native American categories are only available for HISD.

and after the storm for schools that received a lot of evacuees are compared to changes for schools that received few evacuees.

The impact of the influx of Katrina evacuees could capture externalities of the evacuees on native kids, but it could also capture reduced per-student resources or exiting of the best students from these schools. To check whether the effects of the evacuees on academic and disciplinary outcomes are due to reduced resources or attrition of the best students, we run a similar specification to regression (1) for the probability of moving to other schools one year later as well as for class size, expenditures per student, and teacher experience at the school level.

Throughout the paper we use the share of evacuees in the entire school rather than within grade as our measure of exposure. We do this for a two reasons. First, due to the limited number of grades tested in LA prior to 2005-06, using grade level evacuee share restricts our sample size considerably in non-linear models.[5] Second, it is likely that native students were exposed to many evacuees outside their grade especially in middle and high school where many classes have students from multiple grades. Nonetheless, results using grade-level Katrina/Rita share (available upon request) show the same patterns as school-level results.

In addition to estimating reduced-form models as in equation (1), we follow a similar approach to Hoxby and Weingarth (2006) to examine non-linear peer effects, but using quartiles rather than deciles since our data has less variation. For native students in both Houston and Louisiana, along with evacuees in Louisiana, we classify students by their pre-Katrina test-score quartiles. We do not have pre-Katrina test scores for Houston

[5] When generating the school-level Katrina/Rita share we extrapolate the share in the grades where students have pre-Katrina tests to the entire school so as not to lose observations.

evacuees, thus we use their 2005-2006 scores. We estimate specifications in which we regress fully saturated models of the test score of native students in each quartile, Q_{2004}=1,2,3,4, where the quartile is based on their test scores in 2004-2005, on the percentages of evacuees in their school who fall in each quartile on the basis of their test scores in 2004-2005 as follows,[6]

$$E(Y_{igjt}|Q_{2004})= \alpha + \beta_1 Katrina\_Fraction_{Q1\_2004jt} + \beta_2 Katrina\_Fraction_{Q2\_2004jt} + \beta_3 Katrina\_Fraction_{Q3\_2004jt} + \beta_4 Katrina\_Fraction_{Q4\_2004jt} + \Omega Xigjt + \Pi Grade_g + \Gamma Year_t + \Phi Grade_g \times Year_t + \kappa_j + \varepsilon_{igjt}. \quad (2)$$

This specification lets us compare differential effects of the influx of Katrina evacuees in each quartile on natives from each quartile. More importantly, this non-linear specification also allows us to test different models of peer effects. The monotonicity model posits that the higher the quality of the peers the greater the positive effect and the lower the quality of peers the bigger the negative effect on natives. Thus, our test of monotonicity requires that each quartile estimate is greater than all of the estimates for lower quartiles - $\beta_4 > \beta_3$, $\beta_4 > \beta_2$, $\beta_4 > \beta_1$, $\beta_3 > \beta_2$, $\beta_3 > \beta_1$, and $\beta_2 > \beta_1$,. An alternative, albeit weaker, test would also be to simply see if $\beta_4 > \beta_1$; i.e. that the extremes of the evacuee distribution produce monotonic effects. By contrast, the invidious comparison model says that having higher quality peers reduces the academic performance of other students who may loose confidence or enter in invidious comparisons. Likewise, having low performing peers may actually raise the academic performance of other students. Thus, a

[6] Since our pre-Katrina data in Louisiana is limited to grades 4, 8, and 10 in 2003-04 and 2004-05, we use pre-Katrina test-scores for whichever of those two years the student is observed to identify the student's quartile for all years.

test of the invidious comparison model is the opposite from the monotonicity model, i.e., $\beta_4 < \beta_1$, and so on.

Another popular model of peer effects is the boutique model which says that a student will do better when he is surrounded by peers with a similar level. The idea is that if the student is surrounded by similar students then teachers can best cater to their type. The boutique model, thus, emphasizes the potential benefits of tracking students by academic level.[7] A test of the boutique model thus requires that the impact of those in one's own quartile be greater than the impact of peers in any other quartile. Hence, we test whether $\beta_i > \beta_j$ for all $i \neq j$ where i is the native student's quartile. We also test the linear-in-means model by checking whether the impact for those in the lowest quartile is the opposite impact from that for those in the highest quartile of the native distribution, i.e., where β_{ij} is the estimate for native quartile i and evacuee quartile j, we test $\beta_{44} = -\beta_{14}$, $\beta_{43} = -\beta_{13}$, $\beta_{42} = -\beta_{12}$ and $\beta_{41} = -\beta_{14}$.

Since we have less variability in terms of the quality of the evacuees in Houston, we estimate a similar regression but splitting the evacuee shares only by whether they fall above or below the median in terms of test scores or attendance. Also, because we do not observe test scores or attendance for evacuees before Katrina, we use 2005-2006 data to determine this split. Thus, for Houston we estimate fully saturated models of test scores or attendance for native students in each quartile, Q_{2004}=1,2,3,4, where the quartile is based on their test scores in 2004-2005, on the percentages of evacuees in their school who fall below or above the median on the basis of their test scores in 2005-2006 as follows,

[7] The explicit benefits of tracking are still highly controversial and research in the US has generally not been able to establish causal estimates. Nonetheless, Duflo, Dupas, and Kremer (2008) conduct a tracking experiment in Kenya and find that it increases test scores at all levels of the ability distribution.

$$E(Y_{igjt}|Q_{2004}) = \alpha + \beta_1 Katrina\_Fraction_{BelowMedian\_2005jt} + \beta_2 Katrina\_Fraction_{AboveMedian\_2005jt} + \Omega Xigjt + \Pi Grade_g + \Gamma Year_t + \Phi Grade_g \times Year_t + \kappa_j + \varepsilon_{igjt}. \tag{3}$$

Like the quartile regressions for LA, we also use these results to test the models described above.

We also test a version of the "bad apple" model which suggests that a small number of disruptive kids can generate large negative effects on other students. In particular, we check whether the increase in the share of evacuees with disciplinary problems have negative effects on academic performance and behavior of natives over and above the effect of the increase in the share of all evacuees. That is, we estimate the following regression:

$$Y_{igjt} = \alpha + \beta Katrina\_Fraction_{jt} + \gamma Katrina\_Fraction{*}Avg\_Evac\_Infraction_{jt} +_{jt} + \Omega X_{igjt} + \Pi Grade_g + \Gamma Year_t + \Phi Grade_g \times Year_t + \kappa_j + \varepsilon_{igjt}, \tag{4}$$

where $Katrina\_Fraction{*}Avg\_Evac\_Infraction_{jt}$ is the interaction of evacuee share with the average evacuee infraction rate in 2004-05 for Louisiana and in the current year for Houston. In Houston, where we have information about evacuee allocation to different classrooms, we also test whether the presence of only a few disciplined evacuees in the classroom has a substantial effect on native students.

Given the initial chaos and uncertainty facing the evacuees, the initial assignment to schools was plausibly exogenous, so we interpret the coefficient on "Katrina_Fraction" as capturing the causal effect of the influx of Katrina and Rita evacuees on non-evacuee students. However, after a few months some evacuees moved to apartment complexes and more permanent residences and may have also moved schools. While this may generate endogenous selection into schools, many students remained in temporary residences and those that found permanent residences often moved to places that would allow their children to attend their initially assigned schools. Given that we are exploiting within school variation over time, to address this concern we use the initial fraction of Katrina/Rita evacuees in a school on September 13, 2005 as an instrument for the fraction of Katrina evacuees in the last week of October of each year in Houston which may be contaminated by self-selection of students to schools over time.[8] Using this instrumental variable strategy, the first-stage is

$$\text{Katrina\_Fraction}_{jt} = \delta_0 + \delta_1 \text{Initial\_Katrina\_Fraction}_{j2005} + CX_{igjt} + P\text{Grade}_g + T\text{Year}_t + У\text{Grade}_g \times \text{Year}_t + \lambda_j + \nu_{igjt}, \tag{5}$$

And where the second stage is as in equation (1), but the fraction of Katrina evacuees is substituted for the predicted fraction of Katrina evacuees based on initial assignment to schools. The exclusion restriction imposes that, conditional on school fixed-effects and student characteristics, academic performance and disciplinary measures are independent of the initial fraction of displaced students.

Also, since one may worry that Katrina evacuees may be moving to school with pre-existing negative trends in the academic performance of the native kids, we perform a placebo experiment in which we regress pre-Katrina test scores and attendance on the future share of Katrina evacuees in a school.

[8] "Initial_Katrina_Fraction" excludes students who were residing at the stadium complex or convention center, as almost all of these students switched to new schools within two weeks. Unfortunately, we do not have similar instruments for Louisiana, so the IV analysis is limited to HISD data.

4. Data Description

4.1. Louisiana Department of Education Data

Louisiana testing data comes from the Department of Education Division of Standards, Assessment and Accountability via Data Recognition Corporation and covers all students in the state who took the state criterion-referenced exams from the 2003-2004 year to the 2006-2007 academic year. The data are at the student-level and include information on gender, race/ethnicity, free\reduced price lunch status and, most importantly, achievement. Test scores are available for grades 3 - 10 after Katrina, but only for grades 4, 8 and 10 before Katrina. In addition, we obtained data from the Louisiana Department of Education on the number of both in-school and out-of-school suspensions and expulsions - which we combine into a single measure of disciplinary infractions - for all students who take the LEAP/iLEAP exam.

The Louisiana data allows us to describe where evacuees came from and where they went. The parishes most affected by Hurricane Katrina were Orleans, Jefferson, Plaquemines, and Saint Bernard. These parishes comprise most of the Greater New Orleans Metropolitan Statistical Area. Ninety percent of the students in the affected parishes become evacuees and, of the Katrina evacuees, 93% come from the most affected parishes. Even after the hurricanes, the bulk of Katrina evacuees who remain in Louisiana attended a school in one of the four most affected parishes. The percentage of evacuees who attend schools in the affected parishes is 93% in the 2003-2004 and 2004-2005 school years, before the hurricanes. However, the following academic year, this dips to 68% in the spring, but rises back to 76% by the 2006-2007 school year.

In our analysis, we exclude schools in the areas directly affected by hurricanes Katrina and Rita. Thus, we exclude schools in the parishes of Orleans, Jefferson, Saint Bernard, and Plaquemines, which were directly affected by hurricane Katrina, as well as the parishes of Cameron and Calcasieu which were affected by hurricane Rita. We also exclude all schools with more than 70% evacuees, since these were likely schools in the affected areas or so close to the affected parishes that they essentially became schools exclusively for evacuee children. We further exclude observations in 2006-07 for students who are not observed in 2005-06 as their evacuee status is unknown for these students. This leaves us with 341,179 observations, including 14,628 evacuee observations.

Table 1 shows descriptive statistics for evacuees and non-evacuees in the both the Louisiana and Houston samples. It is noteworthy that evacuees in LA are more likely to be black and economically disadvantaged. Non-evacuees are 44% African-American while evacuees are 59% African-American. Also, evacuees are more likely to be economically disadvantaged. Of the evacuees 81% are eligible for free lunch, while 57% of non-evacuees qualify.

Our main outcome measures are test results for math and English language arts (ELA) which combines reading and language.[9] Under Louisiana's accountability program, students in grades 4, 8, and 10 were tested in March of each year prior to 2005. These tests are known as the LEAP or Louisiana Educational Assessment Program (grades 4 and 8) and the GEE or Graduation Exit Examination (grade 10). The LEAP and

[9] Science and social studies are tested as well; however as is common in the literature we only consider math and reading.

GEE tests are high stakes tests which must be passed to be promoted to the next grade.[10] High stakes testing policies were suspended for all 4th and 8th grade students during the 2005-2006 school year due to the hurricanes.

In 2005-06, in response to the No Child Left Behind Act of 2003, Louisiana expanded the testing regime to include grades 3, 5, 6, 7 and 9 for math and ELA.[11] Unlike LEAP these exams are based on the Iowa Test of Basic Skills and with questions added to align the test to criterions required by state and Federal law. In addition, while the iLEAP contributes to determining whether the school meets "adequate yearly progress" under the NCLB act, it is a "low-stakes" exam for students in that their scores do not affect grade advancement. We include LEAP, iLEAP, and GEE in our analysis.

Test scores are measured as standard deviation within a grade and year, including all test-takers. Table 1 shows that LA evacuees are about one-quarter of a standard deviation below non-evacuee students. Table 2 reports differences in test scores after controlling for individual characteristics and school effects. Pre-Katrina math and ELA test scores of evacuees in primary schooling are 0.12 and 0.14 of a standard deviation lower than those of non-evacuees with similar post-storm scores. In middle-school and high-school, pre-storm test scores of evacuees are 0.07 and 0.11 standard deviations lower than those of non-evacuees again with post-storm scores showing similar differences. Figure 3 shows the position of evacuees relative to natives in the same schools in 2004-2005. This figure shows that evacuees are much more likely to be in the

[10] To be promoted to the next grade, students in grades 4 and 8 must score "Basic" on at least one of the math and ELA tests and at least "Approaching Basic" on a specified subject exam. In order to be eligible for a standard high school diploma, high school students must receive "Approaching Basic" or better on both the ELA and math exams and "Approaching Basic" or better on either of the science or social studies exams.

[11] Grades 3, 5, 6, and 7 were also added for science and social studies

first decile compared to their native counter-parts, while they are as likely or less likely to be in deciles 2 through 10. This is important especially when we consider the non-linear models below.

Table 1 also shows that LA evacuees are more likely have disciplinary problems, although Table 2 shows a more nuanced picture after controlling for individual characteristics and school effects. In particular, evacuees have more disciplinary infractions before the hurricanes, lower or the same in the year the hurricanes hit, and higher again in 2006-2007. A likely explanation for this is that in the year of the hurricanes, schools were more lax in terms of discipline with the evacuee children.

4.2. Houston Independent School District Data

HISD provided us with student-level administrative records from 2003-2004 to 2006-2007. The data includes basic demographic characteristics, including race, gender, economic disadvantage status, and immigration status, and whether they qualify as gifted and talented, as having limited English proficiency, or require special education. In addition, we have information on math and reading scores from the Texas Assessment of Knowledge and Skills (TAKS) Exam, which is the exam used in Texas for accountability purposes.[12] Students in grades 3 - 11 take TAKS and, as in Louisiana, TAKS is "high stakes" in certain grades and subjects and "low stakes" in others.[13] In addition, while evacuees had to take the TAKS exams in 2005-06, their performance did not count towards the school's accountability rating, although by 2006-07 evacuees scores were

[12] Less than 1% of students have multiple math and 4% have multiple reading scores in a given year due to retakes. Since we cannot identify which score refers to a student's first exam we instead use the student's lowest score in each subject for that academic year.

[13] State law requires that students must pass the reading test in 3rd grade as well as both reading and math in 5th and 8th grades to be promoted. HISD also requires students in grades 4, 6, and 7 to pass math and reading TAKS for promotion. Students also need to pass the 11th grade exit-level exams in math, English and language arts, science, and social-studies in order to graduate.

included in accountability calculations.[14] Moreover, we also have information for each student in grades 1 - 12 on the number of disciplinary infractions resulting in an in-school suspension or more severe punishment and the attendance rate. As in LA, we drop students in 2006-07 who are not observed in 2005-06 leaving us with 171,659 native and 4,986 evacuee observations in grades 1 - 12.

Returning to Table 1 we see that, as in Louisiana, evacuees in Houston are more likely to be African-American and economically disadvantaged. The majority of non-evacuee students are Hispanic and African-American, with these two groups accounting for 88% of the student population and White and Asian students accounting for the remainder. By contrast, about 90% of the evacuees are African-American, and only 10% White, Hispanic and Asian combined. This is important to keep in mind if one believes that displaced students are more likely to interact and generate peer effects for non-evacuees of their same race/ethnicity. About 69% of the HISD native students are identified as receiving free lunch and as being at-risk. This fraction contrasts with about 97% of the evacuees who qualify for free lunch and 94% who are identified as being at-risk.[15]

The scores for TAKS, which we convert from scale scores to standard deviations within grade and year using information on all non-evacuee test-takers during that year, show evacuees with substantially lower scores than natives in both reading and math. Evacuees also have far lower attendance rates - the average attendance rate of natives is around 95%, while it is only 83% for evacuees. Disciplinary infractions are also

[14] One principal we spoke with noted that, while the evacuee scores did not count, the schools still put substantial effort into bringing the evacuees up to proficiency in anticipation of their scores counting the following year.

[15] At-risk status is defined as being over-aged for your grade, having a difficult situation at home (e.g., pregnant, foster child) or having low academic performance (below the 40th percentile).

considerably higher amongst Houston evacuees. Table 2 shows that the test scores of Houston evacuees are one-fifth to two-fifths of a standard deviation lower in elementary and about half a standard deviation lower in middle and high school compared to native students in the same schools and with the same characteristics.[16] Moreover, the influx of evacuees did not simply reduce average test scores but also increased heterogeneity within schools. Figure 4 shows the evacuees position relative to natives in the same school in 2005-2006. This figure shows that evacuees are greatly over-represented in the three lowest deciles of the test-score and and attendance distributions and under-represented in the upper deciles.

In addition, Table 2 shows that, controlling for school effects and observables, the attendance rate for Houston evacuees is 6 percentage points and 13 percentage points lower among primary and secondary evacuee students, respectively. In terms of disciplinary infractions, Houston evacuees follow a similar pattern to those in Louisiana - they tend to have fewer infractions initially then more the subsequent year. This coincides with interviews of school administrators and teachers indicating that school officials were initially more lenient with students who were viewed as going through a process of adaptation.

5. Effects of Evacuees on Native Students' Academic Performance

We begin by examining the effect of the influx of Katrina and Rita students on the academic performance of their peers. This is a reduced form regression, since there are a number of possible reasons why the academic performance of non-evacuees students may be affected by the arrival of evacuees at a school. The first is a peer effect story, where

[16] It is interesting to point out that the differences between evacuee and non-evacuee test scores were a lot bigger in Houston than in Louisiana.

one's classmates influence the learning process of each student. We consider peer effects to encompass an achievement effect that works through peer test scores; a behavior effect that works through peers' disruptive behavior in the classroom as in Figlio (2005) and Carrell and Hoekstra (Forthcoming), and a disruption effect from students entering and exiting the classroom as in Hanushek, Kain, and Rivkin (2004).

The second reason why the influx of evacuees may reduce native performance is if the entry of new students takes resources away from native students. Third, it could be that schools hired new teachers to help absorb the evacuees and that these teachers were of lower quality than the existing teachers. Finally, native students may respond to the influx of evacuees by moving to another school or leaving the school district and this would change average test scores by simply changing the composition of the remaining students. While in this section we present reduced form results that could capture any of these four channels, in section 7 we present results from regressions of class size, expenditures per student, teacher experience and the probability of moving schools or leaving the district on the share of Katrina evacuees which provide evidence that our reduced-form estimates are likely capturing the first channel.

This section also presents results of non-linear models, which allow us to test different models of peer effects. In addition, since non-linearities are more consistent with peer effects than with the other three stories which should generate similar effects throughout the distribution of natives, these models further help us to separate peer effects from the alternative explanations.

5.1. Reduced-Form Models

We use both HISD and Louisiana data to estimate equation (1). Table 3 presents the estimates of the evacuee share on math and language scores of non-evacuee students. Panels A and B present results for Louisiana and Panels C and D present results for HISD, for elementary schools and middle and high schools, respectively. Column (1) reports the results for the overall sample, while Columns (2), (3), (4) and (5) report results of fully saturated models for African-Americans, Hispanics, boys and girls. These results show mainly negative but insignificant effects in Louisiana.

The results for Houston, reported in Panels B and C, instead show significantly negative effects on math test scores for elementary students. Column (1) of panel C shows that for all elementary students an increase of 10 percentage points in the influx of Katrina students reduces math test scores for all non-evacuee children by 0.09 of a standard deviation. Measuring this effect in the schools that received the highest share of evacuees (i.e., 25%) suggests that the influx of evacuees reduce average test scores of a native student's peers by 0.19 of a standard deviation and this, in turn, generates a decline in native test scores of 0.23 of a standard deviation. The results show even bigger effects for blacks and girls. An increase of 10 percentage points in the influx of Katrina students reduces math scores by 0.12 and 0.11 for blacks and girls, respectively, with only the latter being significant. Similarly, reading test scores of non-evacuee elementary school children decrease with the influx of Katrina children but the decrease is not significant. By contrast, the results in Panel D show that test scores of middle- and high-school students show no statistically significant effects from the entry of evacuees into their schools.

5.2. Robustness Checks

5.2.1. Placebo Experiment: Pre-Katrina Impacts

In Column (6) of Table 3 we present the results from a falsification test in the spirit of Angrist and Krueger (1999) by regressing the pre-Katrina outcomes on the post-Katrina shares of evacuees in the schools as if these shares corresponded to 2004-2005. The idea is that if we are simply capturing pre-existing trends in the schools, then the coefficients in the share of evacuees should show up as being significant. Thus we set Katrina share to zero in 2003-04 and to the 2005-06 value for observations2004-05, then estimate using only data from 2003-04 and 2004-05. The results from this falsification test show that the coefficients on the evacuee shares are not significant for elementary nor for middle-school and high-school in either Louisiana or Houston, suggesting that we are not simply capturing pre-existing differences in trends before the actual influx of the evacuees.

5.2.1. IV Results: Houston

Since there is some movement across schools as evacuees settle into more permanent residences, we address the potential self-selection of evacuees by exploiting the initial exogenous allocation and the fact that many people stayed in their initially assigned schools. We believe that, even if there is resorting, this initial allocation is exogenous conditional on school fixed-effects because of the uncertainty and chaos under which evacuees found housing. Indeed, a large proportion of evacuees were living in shelters and many continued to live in shelters months after the storm.

Column (7) of Table 3 reports second-stage results for Houston where the instrument used is the Katrina/Rita share on September 13, 2005 - only two weeks after

Katrina - excluding students from the stadium complex and convention center.[17] As with the difference-in-difference results presented above, the second-stage results in Column (7) of Table 3 only show a negative effect of the influx of Katrina children on the math test scores of elementary school children in Houston. The IV estimate is slightly bigger in magnitude and significant at the 10% level. Nonetheless, none of the estimates are statistically significantly different from each other, thus providing further evidence of the validity of the difference-in-differences specifications.

5.3. Non-Linear Models

Panels A and B of Table 4 report results of non-linear models as in equation (2) for elementary and middle and high schools in Louisiana, respectively. The results show that the arrival of low academic performance Katrina evacuees hurt natives in all quartiles of the pre-Katrina test score distribution in terms of their math and language scores. Curiously, the results also show that the ones hurt the most by the presence of low achieving evacuees were those at the higher end of the distribution, while natives at the lower end of the ability distribution were hurt the least by the arrival of low achieving peers. Our findings suggest that an increase of say 6.1 percentage points in bottom quartile evacuees - the 95th percentile of schools in 2005-06 - decreases native ELA test scores by 0.17 and 0.24 of a standard deviation for native elementary and middle/high school students at the top quartile of the achievement distribution, but has no statistically significant effect on those at the lowest quartile of the achievement distribution. The results for elementary math results are not as clear cut, but the effect of a similar increase

[17] Almost all evacuees in the stadium and convention center were relocated to other shelters and temporary housing by October 2005, thus we exclude them to increase the power of the instrument. The first-stage results (not shown here) show that the Katrina/Rita share on September 13, 2005 is significant at the 1% level. An increase in Katrina/Rita children of 10% on September 13, 2005 increases the share Katrina/Rita on October 28, 2005 by 9.8% in elementary and by 9.6% in middle- and high-school.

in low achieving evacuees would cause an insignificant decline of 0.05 a standard deviation for math test scores of top-quartile native students in elementary school and a significant decline of 0.12 of a standard deviation for middle/high-school. A possible explanation for these results is that the arrival of low achieving evacuees forced teachers to focus their teaching time to help low achieving students and this hurt high ability more than low ability students.

By contrast, the arrival of evacuees in the top quartile of the academic distribution benefits natives regardless of their previous performance, but the effects are bigger as natives move up in the ability distribution. Thus, these results suggest complementarities between high-achieving peers. For example, having a top quartile evacuee share in the 95th percentile (2.5%) generates an increase in ELA test scores of 0.06 of a standard deviation for both elementary and middle and high school natives in the top quartile of the achievement distribution, but no significant effect on those in the bottom quartile. A similar increase in the share of high achieving evacuees generates an increase in math test scores of 0.11 and 0.06 for high achieving natives in elementary and middle and high-school, but by only 0.05 for low-achieving natives in middle and high-school with no significant impact on low-achieving natives in elementary school. A likely explanation for this is that the increase in high achieving evacuees in the class forced teachers to raise the level of the class more towards high-ability students. This may be consistent with a "boutique" model of peer effects as described by Hoxby and Weingarth (2006) where students benefit from having similar peers in their classroom regardless of their own abilities. At the same time, the fact that low ability natives benefited more from having high-ability than low-ability evacuees suggests that a monotonicity model where peer impacts are increasing in peer ability is also occurring at the same time.

We test these and other models formally. As explained above, we conduct a "strong monotonicity" test by testing whether all estimates of higher quartiles are greater than the estimates of the lower quartiles, i.e., $\beta_i > \beta_j$. The invidious comparison model is the mirror image of this model, i.e., $\beta_i < \beta_j$. Figure 5 shows a histogram of the frequency of t-statistics from pair wise tests of equivalence of higher and lower quartiles using the regressions in Table 4. We consider t-statistics that exceed 1.645, so that the higher quartile is significantly greater than the lower quartile at the 10% level, as providing support for monotonicity. Likewise, for tests where the t-statistics are between 1.645 and -1.645 we cannot reject the null hypothesis of equality. Finally, tests where the t-statistics are lower than -1.64 provide support for the hypothesis of invidious comparisons at the 10% level. Figure 5 shows that the distribution is skewed towards t-stats above 1.645. In particular in 42% of the cases we find t-stats above 1.645, which far exceeds the 10% that we would expect to find at random. In addition, the fact that 83% of the tests have positive t-statistics provides further evidence of monotonicity. We also reject the alternative hypothesis of invidious comparisons since only 2% of the cases have t-stats below -1.64. An alternative test, which we refer to as "weak monotonicity" is whether exposure to evacuees in the top quartile generates a significantly greater impact on natives of all quartiles than exposure to evacuees in the bottom quartile. In this case, we fail to reject the null that the two estimates are the same in 75% of cases at the 5% level and in 81% cases at the 10% level, far exceeding the expected failure rate under random chance and again providing strong support for the monotonicity model of peer effects.

Next, we provide a formal test of the boutique model by testing whether the impact of peers in the same quartile as the native student is greater than the effect when peers are in other quartiles. Figure 6 shows the histogram of the counts of t-statistics of from pair wise tests of equality between exposure to evacuees from natives' own and other quartiles. T-statistics larger than 1.645 provide support for the boutique model at the 10% significance level. While the evidence here is less conclusive than the evidence of monotonicity, 27% of all cases have a t-stat greater than 1.64, although most of these are for natives in the 3rd and 4th quartile where the boutique and monotonicity models overlap.

Finally, we do a test of the linear-in-means model. An implication of linear-in-means is that the impact of evacuee share from a given quartile on a native student in the 1st quartile should be exactly opposite to the impact on a native student in the 4th quartile. Thus, using a seemingly unrelated regression combining the regressions in each panel of Table 4, we test the null that $\beta_{i1} = -\beta_{i4}$ where i is the evacuee quartile and "1" and "4" are the lowest and highest native quartiles, respectively. For this test, accepting the null for 90% of all cases would be consistent with a linear in means model at the 10% level of statistical significance, but we can only accept the null in 44% of the cases. Thus, we interpret this to be a clear rejection of the linear-in-means model.

Table 5 shows results for Houston.[18] These are also consistent with a monotonicity story, but less so with a boutique model and clearly reject the invidious

[18] We must make a note of caution with regards to the Houston results, however, as we do not have pre-Katrina test scores on the evacuees. This forces us to use the concurrent scores for evacuees to determine whether they are above or below median, which may introduce bias. Nonetheless, the fact that the Houston results are consistent with the LA results makes us confident that we are indeed identifying true models of peer effects.

comparison model.[19] In Houston, the arrival of low achieving peers hurts all native students, but this effect is more negative for low achieving natives in elementary and high achieving natives in secondary schools. By contrast, the arrival of high achieving evacuees benefits everyone, though the biggest benefit is for the low achieving natives. In this case, we test monotonicity by checking whether exposure to above median evacuees has a larger impact than being exposed to below median evacuees. The null for this test can be rejected at the 5% level in 50% of the cases providing clear support for the monotonicity model. On the other hand, none of the point estimates are negative, hence we can clearly reject the invidious comparison model. These tests also provide us with a boutique story similar to that in LA. We only find evidence of boutiqueing in higher native quartiles, a result that overlaps with monotonicity. Finally, we also conducted the Houston equivalent of the linear-in-means test described above. We are able to reject linear-in-means at the 10% level in 3 out of 8 cases. While this is not as strong as the results for LA, they nonetheless exceed random chance.

The results from non-linear models also show patterns which are more consistent with peer effects than with alternative stories of the impact of Katrina evacuees on schools. For example, if the influx of Katrina evacuees reduced school resources (either by increasing class size, by reducing expenditures per student, or by reducing the quality of teachers), both high achieving and low achieving evacuees should reduce native performance. Instead, we find that high achieving evacuees increase native performance and low achieving evacuees reduce native performance.

[19] We also conducted a classroom level analysis with student fixed-effects which had qualitatively similar results and is available upon request.

6. Effects of Evacuees on Native Students' Behavior

Our detailed administrative data also allows an examination of the effects of peers on attendance and discipline. Moreover, the data on behavioral outcomes allows us to examine whether the impact we observe on academic performance is working through peer achievement or through disciplinary disruptions.

6.1. Peer Effects on Attendance

Aside from the impact that students may have on others' academic performance, they may also affect behavior and willingness to accept and follow rules. Our interviews with principals and teachers in Houston, indicated that even basic rules such as showing up to school on time or at all were problematic with some of the evacuees. News reports at the time indicated that while many evacuee students may have been enrolled in schools, they may not have been attending regularly (Garza, 2006) and, indeed, our results in Table 2 for Houston suggest this. Moreover, news reports as well as our own interviews pointed to bigger behavioral problems related to the evacuees. For example, in our interviews with elementary school teachers, some indicated that the evacuees were more likely to "talk back to the teachers" and that some of the non-evacuee children imitated this behavior. At the secondary school level, the differences in behavior between evacuee and non-evacuee students, according to the teachers, manifested more in terms of truancy, fighting and engaging in risky behaviors.

The HISD data allows us to measure the impact of the influx of hurricane evacuees on attendance. Table 6 presents difference-in-differences results of the effects of the influx of Katrina students on the attendance rate. Panel A presents results for elementary students and Panel B presents results for middle and high school students.

The results in Table 6 show a clear increase in absenteeism in middle and high-school. An increase in the influx of Katrina students of 10 percentage points reduces attendance in secondary schools by 0.7 percentage points.[20] Attendance is a particularly substantial problem for African-American native students after the influx of Katrina students, with a 10 percentage point influx of Katrina students generating a reduction in the attendance rate of 1.3 percentage points in middle and high-schools.[21]

6.2. Effects of Misbehaving Peers

Aside from asking if the arrival of hurricane evacuees affected adversely the behavior of native kids, we also ask whether the presence of "problematic" kids and, in particular, kids with disciplinary problems generates the adverse effects on academic performance and behavior of native kids. That is, low native academic achievement may be due to the presence of low-performing evacuees who lower the level of the class or require more attention from the teacher or due to the presence of disruptive kids who simply do not allow for the regular class functioning to continue. To explore this latter channel through which peer effects may be working, we estimate regressions like equation (4) for test scores, attendance and counts of disciplinary infractions.

Table 7 presents the results of these regressions. Surprisingly, the presence of undisciplined kids does not seem to make a difference in terms of academic achievement and disciplinary infractions in Louisiana.[22] Similarly, for Houston, we do not find any effect of having poorly behaving kids on math and ELA test scores. This suggests that

[20] While the IV coefficient in Column (7) is positive it is also very imprecise. Results from the placebo experiment are also insignificant.

[21] Similar regressions of disciplinary infractions for Houston and Louisiana (not shown here but available upon request) show no statistically significant average effect of the influx of hurricane evacuees on the discipline of their peers except for Hispanics and boys in Houston middle and high-school, though this is only significant at the 10% level. However, below we show that having a larger share of disciplined evacuees does affect native discipline.

[22] We find similar results (available upon request) in non-linear specifications.

peer effects in our context are working through academic achievement rather than through disciplinary disruptions. On the other hand, we do find that having more misbehaved children increases disciplinary problems in both elementary schools and in middle and high schools.[23] This suggests that peer effects in terms of discipline are only relevant when the peers are misbehaved and the natives can learn these behaviors.

In Table 8 we further explore the impact of having undisciplined children in a classroom by using the Houston data, in which we can identify the students in each classroom.[24] In particular, we try to get at the "bad apple" model by testing whether the presence of even 1 or 2 disruptive evacuee children affect the academic achievement and behavior of natives. Since this analysis is done at the classroom level, we may be concerned about endogenous sorting across classrooms. Thus, to address this issue we have added student fixed-effects to the regressions. The results for academic achievement only show that having many undisciplined children in a classroom lowers math test scores. By contrast, the results for discipline and attendance do show that it is enough to have 1 or 2 misbehaving evacuee children to worsen the attendance and behavior of native kids in elementary schools. In middle- and high-schools, only having many undisciplined kids in a classroom worsens native behavior. Thus, we take this as supportive evidence of the "bad apple" model for elementary school kids but only in terms of behavior and not in terms of achievement.

[23] One caveat to this analysis is that we are limited to using concurrent infractions as our behavior measure in Houston. Thus it is, admittedly, possible that these results reflect school specific policies on how they disciplined evacuees and natives after the storms.

[24] HISD high schools operate on a semester schedule. Thus, for middle- and high-schools, we average evacuee shares across students' classes in both semesters. In addition, the estimates for math and reading in middle- and high-school are identified using only exposure in math and reading/English classes, respectively. Attendance and discipline use exposure in all classes. Further, the middle- and high-school regressions are limited to 2004-05 and 2005-06 due to data limitations.

7. Effects of Katrina Evacuees on Resources and Student Attrition

The reduced-form effects of the influx of Katrina evacuees on test-scores, attendance and discipline could be due to the externalities of evacuees on natives. However, another possibility is that the influx of evacuees reduced the resources available for natives or that the best native students were leaving the schools and districts with evacuees.

7.1. Effects on Resources

The influx of evacuees could have affected the resources available to evacuees by increasing class-size, reducing operating and instructional expenditures per employee and reducing teacher quality if the composition of teachers changed.

Table 9 reports results of regressions like equation (1), but where the dependent variable is class size at the school level.[25] Panel A reports results for Louisiana while Panel B reports results for Houston. For Louisiana we do not have the exact average class-size in each school but rather the percent of classes with sizes between 1 and 20, between 21 and 26, or higher than 26. These results for Louisiana show little change in class sizes for elementary students. For middle-school and high-school there is a shift from classes of 20 or fewer students to classes of 21 - 26 students. However, this shift is relatively small. A 10 percentage point increase in evacuee share only shifts between 2 and 3 percent of classrooms to the higher category. In addition, there is no evidence of an increase in the share of classes that are over 26 students. By contrast, for Houston we have the exact average class size per grade in elementary school and by subject for

[25] Since we cannot include grade fixed effects in these regressions, as schools span multiple grades, in Houston we include the percent of students in the school in each grade as covariates and interact with year dummies. We also include the percent black, Hispanic, Asian, Native American, and economically disadvantaged as covariates. These variables are not available for Louisiana.

middle-school and high-school. These results show no statistically significant effect of the fraction of evacuees on class-size in elementary schools. In middle and high-schools there is little evidence that the influx of evacuees significantly increased class-size, except for class-sizes in social studies which shows a marginally significant effect.

Table 10 shows results of regressions of operating and instructional expenditures per student and average teacher experience on the evacuee share in Houston.[26] The results once again show no statistically significant effect of the influx of evacuees on either operating or instructional expenditures per student. This is likely because the Federal and State Governments seemed to have reimbursed schools and districts almost fully. Also, interviews with principals in Houston, suggested that schools received substantial aid from a number of foundations around the country.

Since class-size increases in response to the evacuees were, at worst, minor, it is likely that new classes were being created as students came in. This means that the quality of teachers could have changed as a result. Thus, we look at how evacuees affected average teacher experience, education, and certification. While there is no significant effect on these teacher quality measures in middle/high schools or on teacher experience in elementary schools, the graduate education and certification rates of teachers actually improve in elementary schools. A 10 percentage point increase in evacuee share increases the share of teachers with a graduate degree and the share certified by 3 percentage points each. This could be explained by HISD likely having more applicants for jobs from amongst the evacuees than spaces available, and thus the district chose more experienced and certified teachers. Nonetheless, if anything this result would bias us against finding peer effects which we find in both linear and non-

[26] This data is not available for Louisiana.

linear models in Houston elementary schools, thus it is unlikely that these changes in teacher characteristics would have a meaningful impact on our estimates.

Another concern is that one may worry that evacuees were all assigned to the same classes together so that there may had been little room for spillovers. However, when we looked at the distribution of the number of evacuees by class in Houston, where we have classroom level data, virtually all classrooms with evacuees also had native students and the vast majority of classrooms with evacuees had between one and four evacuees.

7.2. Effects on Native Student Mobility

Another reason why test scores and behavior could have changed in response to the influx of Katrina evacuees is if the best students moved in response to the arrival of evacuees. To test this we run a regression like equation (1) but in which the dependent variable is the probability of switching school the following year as well as the probability of leaving the district in the case of Houston.[27]

Panel A of Table 11 shows results for mobility in Louisiana, while Panel B shows results of mobility for Houston. The results show no statistically significant change in the mobility of students from schools with a high share of evacuees to schools with a low share of evacuees in either Louisiana or Houston.[28] Similarly, we find no effect on mobility out of the district for middle-school and high-school students in Houston. We do find a reduction in HISD district leavers at the elementary level, but it is only marginally significant.

[27] To avoid switching and leaving due to normal progression to middle and high-school and due to graduation, we limit the school switching estimates to students who are not in the maximum grade for their school. We also limit the district leaver regressions to students in grades 1 - 11.

[28] Due to only grades 4, 8, and 10 being available prior to Katrina in LA, and to grade 8 being a transition year from middle to high school, we are limited to grades 4 and 10 in this analysis for LA.

Thus, overall we find little evidence that the impacts from the influx of Katrina evacuees is likely to have worked either through reduced resources or through changes in the composition of native students.

8. Conclusion

In this paper we examine the impact of an exogenous influx of low-socio-economic background students on the academic performance and behaviors of their peers. We exploit the influx of evacuees from Hurricanes Katrina and Rita into school districts in Louisiana that were unaffected by the storms and into the Houston Independent School District to estimate their impact on non-evacuee (native) peers.

We use student-level data from Louisiana's Department of Education and from the Houston Independent School District to estimate the impact on math and language test scores as well as on disciplinary infractions and absenteeism in the case of Houston. We find that, on average, evacuees had little impact on native outcomes with the exception of a negative impact on math scores in elementary schools and attendance in middle/high schools in Houston. However, linear models hide a substantial amount of variation across achievement levels of natives and evacuees. Non-linear models show that high achieving natives are significantly positively affected by high achieving evacuees and significantly negatively impacted by low achieving evacuees. Low achieving natives also generally benefit from high achieving evacuees and are hurt by low achieving evacuees in terms of their own test scores, though this effect is muted in Louisiana.

Using these non-linear models we are able to explicitly test a variety of peer effects models identified in Hoxby and Weingarth (2006). We find strong evidence in support of monotonic peer effects where students benefit more from having higher achieving peers. We also see some, albeit weaker, evidence that students benefit from being around peers of the same achievement level - a boutique model. Nevertheless, we clearly reject the linear-in-means model and the invidious comparison model where students benefit from being amongst lower performing peers. Moreover, we test the “bad apple” theory where having a only a handful of disruptive peers in a classroom is detrimental to other students. While we see no evidence of this in terms of test scores, we do find that having a few misbehaving evacuees in an elementary classroom appears to worsen behavior of native students both in terms of attendance and disciplinary infractions.

We interpret these results as being largely due to peer effects, since we find no statistically significant effects of the influx of Katrina/Rita evacuees on class size except for a small increase in middle/high schools in Louisiana, on expenditures per student, on average teacher quality or on mobility of students, which would be the other potential explanations. In addition, the fact that evacuees of various achievement and behavior levels affect natives differently is consistent with peer effects driving our results and inconsistent with the alternative explanations described above.

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Table 1: Characteristics of Evacuees and Native Louisiana & Houston Students - 2005-06

	A. Louisiana		B. Houston	
	Natives	Evacuees	Native	Evacuees
Demographics				
Female	0.489	0.483	0.490	0.492
	(0.500)	(0.500)	(0.500)	(0.500)
White	0.537	0.379	0.093	0.039
	(0.499)	(0.485)	(0.290)	(0.192)
Hispanic	0.015	0.018	0.585	0.039
	(0.121)	(0.133)	(0.493)	(0.193)
Black	0.439	0.588	0.290	0.903
	(0.496)	(0.492)	(0.454)	(0.296)
Asian	0.010	0.015	0.032	0.019
	(0.097)	(0.122)	(0.177)	(0.137)
Free/Reduced Price Lunch	0.567	0.807	0.787	0.968
	(0.495)	(0.394)	(0.409)	(0.175)
At-Risk	-	-	0.691	0.941
	-	-	(0.462)	(0.235)
Fraction Katrina/Rita Evacuee in School	0.041	0.089	0.027	0.066
	(0.042)	(0.072)	(0.031)	(0.051)
Observations	326,551	14,628	171,659	4,986
Test Scores, Discipline, and Attendance				
Math (Standard Deviations)	0.026	-0.240	0.000	-0.742
	(0.996)	(1.040)	(1.000)	(1.026)
Observations	300,216	10,708	112,241	2,151
English & Language Arts (Standard Deviations)	0.018	-0.205	0.000	-0.582
	(0.994)	(1.049)	(1.000)	(1.063)
Observations	301,797	10,760	113,977	2,307
Disciplinary Infractions	0.295	0.335	0.629	0.893
	(0.585)	(0.624)	(1.698)	(1.987)
Observations	302,640	10,776	171,659	4,986
Attendance	-	-	94.55	83.30
	-	-	(8.97)	(18.00)
Observations	-	-	171,659	4,986

Standard deviations in parentheses. Includes students in grades 3 - 10 for LA and 1 - 12 for Houston. Houston testing only covers grades 3 - 11. The sample in LA is limited to schools where there are < 70% evacuees and excludes schools in Orleans, Jefferson, St. Bernard, Plaquemines, Cameron, and Calcasieu parishes. Disciplinary infractions total number of suspensions and expulsions in a year in LA and the total number of infractions resulting in an in-school suspensions or more severe punishment in Houston.

Table 2: Regressions of Katrina/Rita Evacuee Status on Test Scores

	A. Louisiana			B. Houston	
	Elementary				
	2005-06 (lagged)	2005-06	2006-07	2005-06	2006-07
Math (LEAP & TAKS)	-0.12***	-0.14***	-0.09***	-0.41***	-0.15***
	(0.03)	(0.02)	(0.02)	(0.05)	(0.05)
Observations	40,601	120,901	118,377	43,886	38,345
English Language Arts/	-0.14***	-0.11***	-0.07***	-0.22***	-0.19***
Reading (LEAP & TAKS)	(0.03)	(0.02)	(0.02)	(0.05)	(0.06)
Observations	40,611	120,903	118,351	45,073	39,149
Disciplinary Infractions	0.043	-0.023***	0.038***	-0.03	0.02
	(0.028)	(0.007)	(0.014)	(0.03)	(0.03)
Observations	37,614	120,934	118,416	83,455	71,058
Attendance	-	-	-	-6.00***	-2.19***
	-	-	-	(0.33)	(0.29)
Observations	-	-	-	83,455	71,058
	Middle / High				
	2005-06 (lagged)	2005-06	2006-07	2005-06	2006-07
Math (LEAP & TAKS)	-0.07**	-0.11***	-0.09***	-0.49***	-0.26***
	(0.03)	(0.02)	(0.02)	(0.06)	(0.05)
Observations	40,674	190,020	186,622	70,506	61,404
English Language Arts/	-0.11***	-0.08***	-0.06***	-0.53***	-0.41***
Reading (LEAP & TAKS)	(0.03)	(0.02)	(0.01)	(0.08)	(0.06)
Observations	39,621	191,651	186,892	71,211	61,954
Disciplinary Infractions	0.14***	-0.005	0.040***	-0.12*	0.41***
	(0.05)	(0.010)	(0.009)	(0.07)	(0.13)
Observations	35,748	192,479	187,200	93,190	79,254
Attendance				-12.90***	-4.05***
				(1.17)	(0.64)
Observations				93,190	79,254

Standard errors are provided in parentheses and clustered by school. Regressions include student's race, gender, free/reduced price lunch status, and school fixed-effects. LEAP scores are standard deviations of scale scores within grade and year for all students. TAKS scores standard deviations of scale scores within grade and year excluding evacuees. *, **, and *** reflect significance at the 10%, 5%, and 1% levels, respectively.

Table 3: Difference in Differences Estimates of Evacuee Share of Enrollment in School on Native Test Scores

	All	Black	Hispanic	Boys	Girls	Placebo	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
			A. Louisiana - LEAP Exams, Elementary				
Math	0.16	-0.20	-	0.18	0.14	-0.10	-
	(0.12)	(0.17)	-	(0.14)	(0.14)	(0.34)	-
Observations	315,719	141,232	-	162,266	153,453	83,287	-
English & Language Arts	-0.03	0.22	-	0.02	-0.08	-0.00	-
	(0.10)	(0.17)	-	(0.12)	(0.12)	(0.23)	-
Observations	315,710	141,242	-	162,253	153,457	140,866	-
			B. Louisiana - LEAP Exams, Middle/High				
Math	-0.13	0.07	-	-0.19	-0.08	0.11	-
	(0.14)	(0.17)	-	(0.15)	(0.14)	(0.40)	-
Observations	505,543	209,474	-	251,013	254,530	83,302	-
English & Language Arts	-0.09	-0.18	-	-0.22	0.03	-0.09	-
	(0.12)	(0.17)	-	(0.14)	(0.13)	(0.17)	-
Observations	504,131	208,164	-	250,762	253,369	137,620	-
			C. Houston - TAKS Exams, Elementary				
Math	-0.91**	-1.22	-0.17	-0.71	-1.07**	-0.21	-1.02*
	(0.45)	(0.75)	(0.50)	(0.48)	(0.46)	(0.56)	(0.60)
Observations	170,727	45,921	104,831	85,611	85,116	89,207	170,727
Reading	-0.37	-0.70	-0.03	-0.40	-0.36	0.00	-0.00
	(0.28)	(0.51)	(0.38)	(0.35)	(0.28)	(0.38)	(0.45)
Observations	171,520	47,903	103,261	86,712	84,808	146,062	171,520
			D. Houston - TAKS Exams, Middle/High				
Math	0.40	0.22	0.52	0.55	0.23	0.03	0.79
	(0.37)	(0.61)	(0.38)	(0.46)	(0.32)	(0.47)	(0.65)
Observations	276,378	81,790	155,919	137,064	139,314	88,084	267,378
Reading	0.06	-0.14	-0.16	0.10	-0.02	-0.30	0.72
	(0.40)	(0.53)	(0.48)	(0.48)	(0.34)	(0.34)	(0.56)
Observations	278,606	82,217	157,461	138,159	140,447	147,140	278,606

Standard errors are provided in parentheses and clustered by school. Regressions cover 2003-04 - 2006-07 and include student's race, gender, free/reduced price lunch status, and school fixed-effects. TAKS scores are standard deviations of scale scores within grade and year excluding evacuees. When students have multiple scores for a single subject in a given year we use the lowest score. LEAP scores are standard deviations of scale scores within grade and year for all students. Placebo regresions are limited to pre-Katrina years and apply the 2005-06 evacuee shares to 2004-05 observations. 2SLS regressions use Katrina/Rita share on 9/13/05 as an instrument for evacuee share. Elementary is defined as any student in grades 3 - 5. Middle/High is any student in grade 6 - 11 for Houston or 6 - 10 for Louisiana. Prior to 2005 only grades 4, 8, and 10 were tested in Louisiana. *, **, and *** reflect significance at the 10%, 5%, and 1% levels, respectively.

Table 4 - Nonlinear Models of Evacuee Share in School and Evacuee Achievement on Native Achievement - Louisiana

	A. Elementary				B. Middle/High			
2003 or 2004 LEAP Quartile	1	2	3	4	1	2	3	4
				Math				
Katrina/Rita Share in Quartile 1	-0.36	-0.16	-2.03**	-0.82	-0.78*	-1.44***	-1.20	-2.00**
	(0.32)	(0.43)	(0.87)	(1.07)	(0.41)	(0.53)	(0.76)	(0.83)
Katrina/Rita Share in Quartile 2	-0.31	-1.86**	-2.03	-4.04**	-0.18	-1.93***	-1.84**	-0.46
	(0.61)	(0.91)	(1.25)	(1.63)	(0.69)	(0.73)	(0.87)	(1.01)
Katrina/Rita Share in Quartile 3	-0.66	0.25	0.53	1.45	-0.44	0.87	1.10	0.37
	(0.89)	(1.07)	(1.36)	(1.59)	(0.81)	(0.61)	(0.77)	(0.84)
Katrina/Rita Share in Quartile 4	0.94	2.18**	4.95***	4.54***	1.80**	2.36***	1.52	2.29***
	(0.99)	(1.07)	(1.28)	(1.16)	(0.89)	(0.77)	(0.94)	(0.85)
Observations	30,674	30,970	31,647	32,483	58,534	79,443	89,686	95,586
				ELA				
Katrina/Rita Share in Quartile 1	0.09	-0.55	-2.57***	-2.83***	-0.28	-1.72***	-2.42***	-3.99***
	(0.36)	(0.42)	(0.88)	(0.94)	(0.62)	(0.46)	(0.71)	(0.80)
Katrina/Rita Share in Quartile 2	-1.09**	-1.13	-1.76*	-0.15	0.96	-0.80	-1.31	-0.59
	(0.55)	(0.82)	(1.00)	(1.16)	(0.99)	(0.61)	(0.86)	(0.84)
Katrina/Rita Share in Quartile 3	-1.98***	-0.62	-1.04	-0.67	-0.41	0.03	0.23	0.84
	(0.72)	(0.88)	(1.12)	(1.28)	(1.02)	(0.67)	(0.81)	(0.96)
Katrina/Rita Share in Quartile 4	0.95	1.09	1.96**	2.35***	0.48	1.77***	2.19***	2.26***
	(0.76)	(0.82)	(0.85)	(0.73)	(1.04)	(0.67)	(0.73)	(0.70)
Observations	30,853	30,774	31,629	32,543	59,085	79,340	88,123	94,606

Standard errors are provided in parentheses and clustered by school. Regressions cover 2003-04 - 2006-07 and include student's race, gender, free lunch status, and school fixed-effects. LEAP scores are standard deviations of scale scores within grade and year for all students. Elementary is defined as any student in grades 3 - 5. Middle/High is any student in grade 6 - 11 for Houston or 6 - 10 for Louisiana. Quartiles for both evacuees and natives are within grade across the state data and determined from their 2003-04 or 2004-05 score depending on which is available since prior to 2005-06 only grades 4, 8, and 10 were tested. *, **, and *** reflect significance at the 10%, 5%, and 1% levels, respectively.

Table 5 - Nonlinear Models of Evacuee Share in School and Evacuee Achievement on Native Achievement in Houston

	A. Elementary				B. Middle/High			
2004 Quartile	1	2	3	4	1	2	3	4
				Math				
Katrina/Rita Share Below Median Score in Grade	-0.77	-1.07**	-1.08*	-0.11	-0.89	-0.66	-0.75	-1.28
	(0.77)	(0.45)	(0.59)	(0.31)	(1.31)	(0.75)	(0.50)	(0.80)
Katrina/Rita Share Above Median Score in Grade	3.17	2.25	-0.83	0.02	22.20***	8.20**	8.03***	8.88**
	(6.32)	(3.78)	(4.75)	(4.43)	(8.03)	(3.95)	(2.89)	(3.42)
Observations	29,837	30,554	30,688	27,858	54,980	61,872	61,196	62,431
Share Above Median - Share Below Median	3.94	3.31	0.24	0.13	23.09**	8.86**	8.77***	10.15**
	(6.53)	(3.84)	(4.78)	(4.39)	(8.87)	(4.49)	(3.23)	(4.01)
				Reading				
Katrina/Rita Share Below Median Score in Grade	-0.85	-0.79*	-0.09	0.31	-1.13	-0.75	-2.03***	-2.26***
	(1.30)	(0.40)	(0.44)	(0.72)	(1.63)	(0.61)	(0.48)	(0.59)
Katrina/Rita Share Above Median Score in Grade	3.38	5.48***	3.86	0.24	15.96*	6.84***	9.12***	8.05***
	(4.93)	(1.97)	(2.57)	(5.38)	(9.42)	(2.49)	(1.69)	(2.29)
Observations	27,975	31,081	28,034	24,675	55,266	64,024	61,849	61,050
Share Above Median - Share Below Median	4.23	6.27***	3.95	-0.07	17.08	7.59**	11.15***	10.32***
	(5.81)	(2.21)	(2.89)	(6.00)	(10.48)	(2.97)	(2.06)	(2.78)

Standard errors are provided in parentheses and clustered by school. Regressions cover 2003-04 - 2006-07 and include student's race, gender, free/reduced price lunch status, and school fixed-effects. TAKS scores are standard deviations of scale scores within grade and year excluding evacuees. When students have multiple scores for a single subject in a given year we use the lowest score. Quartiles for natives are from 2004-05. Above and below medians for evacuees are calculated from 2005-06 data based on the district-wide distribution within each grade. Elementary is defined as any student in grades 1 - 5. Middle/High is any student in grade 6 - 12. *, **, and *** reflect significance at the 10%, 5%, and 1% levels, respectively.

Table 6 - Difference-in-Difference Estimates of Evacuee Share of Enrollment on Native Attendance Rates in Houston

	All	Black	Hispanic	Boys	Girls	Placebo Test	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
			A. Elementary				
Attendance Rate	-0.82	-1.16	-0.42	-1.44	-0.14	-0.39	0.84
	(0.83)	(1.89)	(0.86)	(1.10)	(0.79)	(0.78)	(1.28)
Observations	322,524	88,005	197,948	165,651	156,873	170,092	322,524
			B. Middle/High				
Attendance Rate	-6.95*	-13.05***	-3.82	-6.67	-7.06**	-4.84	-3.38
	(3.90)	(3.75)	(6.48)	(4.83)	(3.33)	(2.92)	(6.25)
Observations	353,484	108,778	196,031	178,644	174,840	184,408	353,484

Standard errors are provided in parentheses and clustered by school. Regressions cover 2003-04 - 2006-07 and include student's race, gender, free/reduced price lunch status, and school fixed-effects. 2SLS estimates use Katrina/Rita share on 9/13/05 excluding students living at the stadium complex or covention center as the excluded instrument. The placebo test in column (7) include 2003-04 and 2004-05 only and apply 2005-06 Katrina/Rita share to 2004-05 observations. Elementary is defined as any student in grades 1 - 5. Middle/High is any student in grade 6 - 12. *, **, and *** reflect significance at the 10%, 5%, and 1% levels, respectively.

Table 7 - Impact of Evacuee Behavior on Native Outcome

A. Louisiana

	I. Elementary			II Middle/High		
	LEAP Math	LEAP ELA	Disciplinary Infractions	LEAP Math	LEAP ELA	Disciplinary Infractions
Katrina/Rita Share	0.190	-0.054	0.005	-0.106	-0.067	-0.032
	(0.135)	(0.113)	(0.103)	(0.141)	(0.121)	(0.115)
Katrina/Rita Share *	-0.013	0.213	0.145	-0.001	-0.006	-0.120
Avg Evac Infracs in 2004-05	(0.074)	(0.179)	(0.098)	(0.105)	(0.083)	(0.085)
Observations	293,011	292,998	293,102	497,295	495,885	501,234

B. Houuston

	I. Elementary				II Middle/High			
	TAKS Math	TAKS Reading	Disciplinary Infractions	Attendance	TAKS Math	TAKS Reading	Disciplinary Infractions	Attendance
Katrina/Rita Share	-0.590	-0.372	-0.623*	-0.843	1.526	0.304	-3.57*	-10.383**
	(0.765)	(0.451)	(0.364)	(1.419)	(1.015)	(0.917)	(2.004)	(4.935)
Katrina/Rita Share *	-0.598	0.008	1.005**	0.048	-0.557	-0.122	2.55***	1.727
Avg Evac Infracs	(0.883)	(0.586)	(0.471)	(1.593)	(0.396)	(0.917)	(0.646)	(2.529)
Observations	170,727	171,520	322,524	322,524	276,378	278,606	353,484	353,484

Disciplinary infractions in LA is the number of suspensions or expulsions a student incurs in a year. Disciplinary infractions in Houston is the number of times in a year the student was given an in-school suspension or more severe punishment. Standard errors are provided in parentheses and clustered by school. Regressions cover 2003-04 - 2006-07 and include student's race, gender, free/reduced price lunch status, and school fixed-effects. LEAP scores are standard deviations of scale scores within grade and year for all students. TAKS are standard deviations within grade excluding evacuees. Elementary is defined as any student in grades 1 - 5. Middle/High is any student in grade 6 - 12. *, **, and *** reflect significance at the 10%, 5%, and 1% levels, respectively.

Table 8 - Tests of "Bad Apple" Models Using Houston Classroom Level Data

	A. Elementary				B. Middle/High			
	Math	Reading	Attendance Rate	Disciplinary Infractions	Math	Reading	Attendance Rate	Disciplinary Infractions
> 1 and < 3 Evacuees with Any Infraction	-0.016	-0.015	-0.162**	0.068***	0.001	0.008	-0.33	0.03
	(0.025)	(0.021)	(0.065)	(0.022)	(0.016)	(0.015)	(0.21)	(0.08)
>= 3 Evacuees with Any Infraction	-0.100*	0.020	0.002	0.103	0.053	0.026	-1.27	0.93**
	(0.057)	(0.060)	(0.495)	(0.085)	(0.037)	(0.048)	(1.02)	(0.45)
> 1 and < 3 Evacuees	0.006	0.012	0.031	0.002	0.005	-0.031***	-0.48**	-0.06
	(0.016)	(0.012)	(0.033)	(0.008)	(0.016)	(0.011)	(0.20)	(0.07)
>= 3 Evacuees	-0.024	0.025	0.198**	-0.013	-0.034	-0.026	-1.51***	-0.09
	(0.033)	(0.021)	(0.083)	(0.022)	(0.036)	(0.023)	(0.43)	(0.14)
Class Size	-0.004**	-0.000	0.002	-0.000	-0.000	-0.001	0.00	-0.00
	(0.002)	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)	(0.01)	(0.00)
Observations	160,687	160,547	296,899	296,899	128,420	129,989	167,379	167,379
Test of >= 3 Evacuees with Any Infraction	-0.083*	0.035	0.164	0.035	0.052	0.017	-0.93	0.91**
vs. > 1 and < 3 Evacuees with Any	(0.050)	(0.052)	(0.496)	(0.086)	(0.036)	(0.043)	(1.00)	(0.42)

Evacuee counts and shares in middle and high school are averages over all math classes a student takes for math regressions, all reading and english classes for reading regressions, and all reading, math, science, social studies, and english classes for attendance and discipline. Standard errors are provided in parentheses and clustered by school. Elementary regressions cover 2003-04 - 2006-07 and middle/high regressions cover 2004-05 and 2005-06. Regressions include student's race, gender, free/reduced price lunch status, and school fixed-effects. Student fixed effects are added to address potential sorting across classrooms. TAKS scores are standard deviations of scale scores within grade and year excluding evacuees. When students have multiple scores for a single subject in a given year we use the lowest score. Disciplinary infractions are the number of times in a year the student was given an in-school suspension or more severe punishment. Elementary is defined as any student in grades 1 - 5. Middle/High is any student in grade 6 - 12. *, **, and *** reflect significance at the 10%, 5%, and 1% levels, respectively.

Table 9: Effect of Evacuee Share on Class Sizes

	A. Louisiana - % of Classes in Given Size Range		
	Elementary 1 to 20	Elementary 21 - 26	Elementary 27+
Katrina/Rita Fraction	0.18	-0.17	-0.01
	(0.11)	(0.13)	(0.08)
Observations	2191	2191	2191
	Mid/High 1 to 20	Mid/High 21 - 26	Mid/High 27+
Katrina/Rita Fraction	-0.27*	0.22**	-0.01
	(0.14)	(0.09)	(0.09)
Observations	1571	1571	1571

	B. Houston - Average Class Size By Grade or Subject			
	Kindergarten	Grade 1	Grade 2	Grade 3
Katrina/Rita Fraction	0.30	-12.77	-0.39	-13.61
	(9.11)	(7.78)	(8.17)	(10.33)
Observations	695	706	713	713
	Grade 4	Grade 5	Grade 6 (Elem)	Mid/High English
Katrina/Rita Fraction	0.94	-14.69	1.08	48.83
	(8.84)	(14.20)	(33.04)	(33.23)
Observations	713	701	273	327
	Mid/High Math	Mid/High Science	Mid/High Social Studies	Mid/High Foreign Lang
Katrina/Rita Fraction	19.40	23.17	34.99*	-34.71
	(18.29)	(20.62)	(19.72)	(36.15)
Observations	328	326	318	265

Unit of observation is the school-year. Regressions cover 2003-04 - 2005-06 and include school fixed-effects and year dummies. Houston regressions also include % of school at each grade level as well as % black, Hispanic, asian, Native American, and economically disadvantaged. Elementary is defined as any school covering at least one of grades KG - 5. Middle/High is any covering at least one of grades 6 - 12. *, **, and *** reflect significance at the 10%, 5%, and 1% levels, respectively.

Table 10: Effect of Evacuee Share on School Resources and Staffing in Houston

	Operating Expenditures	Instructional Expenditures	Avg Teacher Experience	% of Teachers w/ Grad Degree	% of Teachers w/ Certification
Elementary					
Katrina/Rita Fraction	-1,787	342	-3.02	0.337**	0.313*
	(5,087)	(3,856)	(5.86)	(0.169)	(0.168)
Observations	791	791	763	763	763
Middle/High					
	Operating Expenditures	Instructional Expenditures	Avg Teacher Experience	% of Teachers w/ Grad Degree	% of Teachers w/ Certification
Katrina/Rita Fraction	12,748	8,411	-1.66	-0.567	0.602
	(13,717)	(9,764)	(13.00)	(0.345)	(0.561)
Observations	492	492	464	464	464

Unit of observation is the school-year. All expenditures are per-student. Regressions cover 2003-04 - 2005-06 and include school fixed-effects and year dummies, % of school at each grade level as well as % black, Hispanic, asian, Native American, and economically disadvantaged. Elementary is defined as any school covering at least one of grades KG - 5. Middle/High is any covering at least one of grades 6 - 12. *, **, and *** reflect significance at the 10%, 5%, and 1% levels, respectively.

Table 11: School Switching in Response to Evacuee Shares

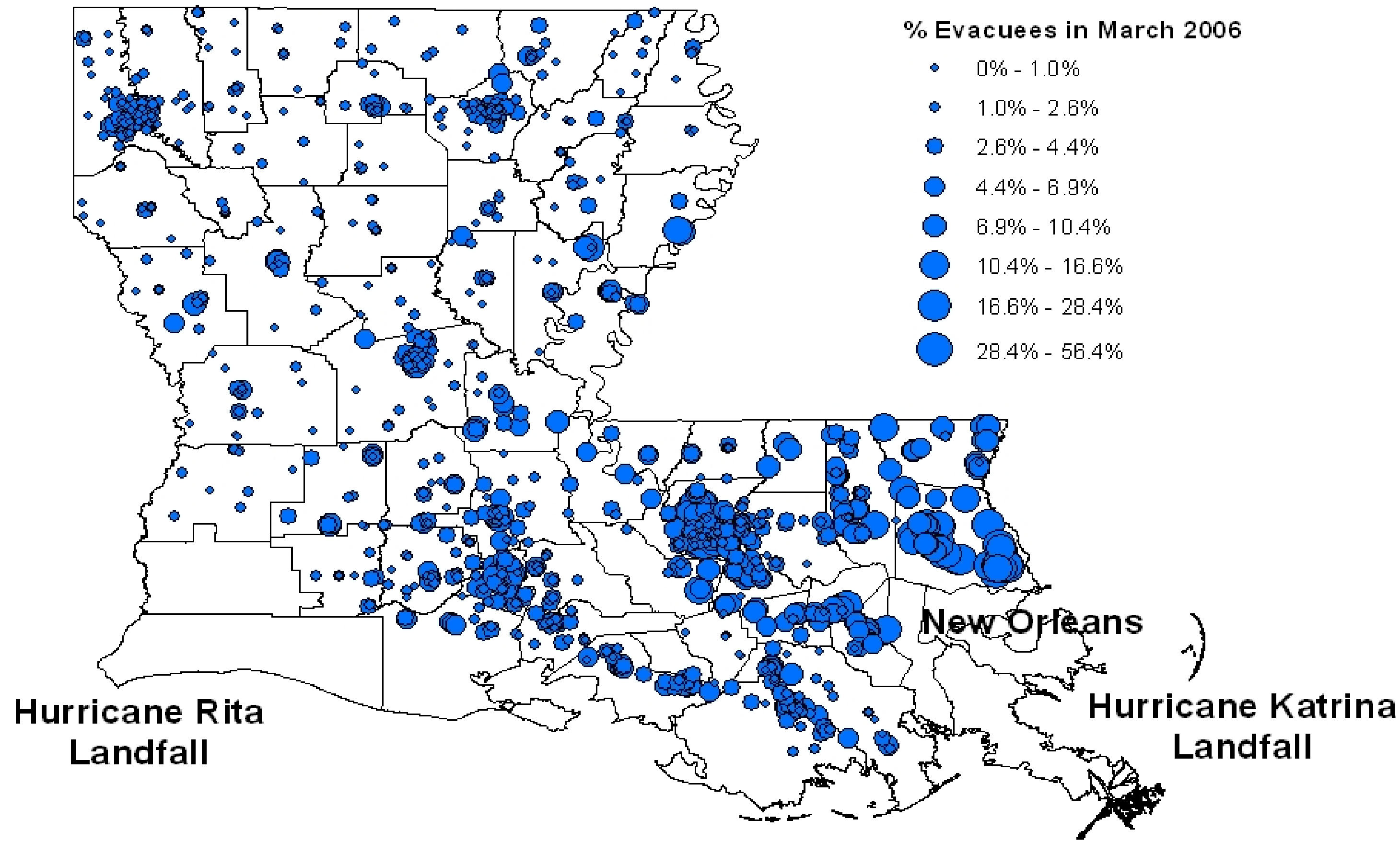
	A. Louisiana	B. Houston	
	Grade 4	Elementary	Middle/High
	Switches in year t + 1	Switches in year t + 1†	Switches in year t + 1†
Katrina/Rita Fraction	0.204	0.293	0.064
	(0.414)	(0.234)	(0.073)
Observations	51,047	209,302	206,205
	Grade 10	Elementary	Middle/High
	Switches in year t + 1	Leaves HISD in year t + 1‡	Leaves HISD in year t + 1‡
Katrina/Rita Fraction	0.433	-0.099*	-0.032
	(0.486)	(0.055)	(0.092)
Observations	38,282	252,239	248,456

† Limited to students not in the maximum grade for a school in year t.

‡ Excludes grade 12.

Standard errors are provided in parentheses and clustered by school. Regressions cover 2003-04 - 2006-07 and include student's race, gender, free/reduced price lunch status, and school fixed-effects. Elementary is defined as any student in grades 1 - 5. Middle/High is any student in grade 6 - 12. *, **, and *** reflect significance at the 10%, 5%, and 1% levels, respectively.

Figure 1: Hurricanes Katrina and Rita Evacuees in Louisiana by School, 2005 - 06



Map shows Katrina and Rita evacuees as of March 2006 LEAP testing. Schools with more than 70% evacuees and those in Cameron & Calesciu Parishes (Rita landfall area) and Orleans, St. Bernard, Placquemines & Jefferson Parishes (Katrina landfall area) are excluded as these schools were likely directly affected by the storms.

Figure 2: Hurricane Katrina and Rita Evacuees in HISD by School, 2005-06

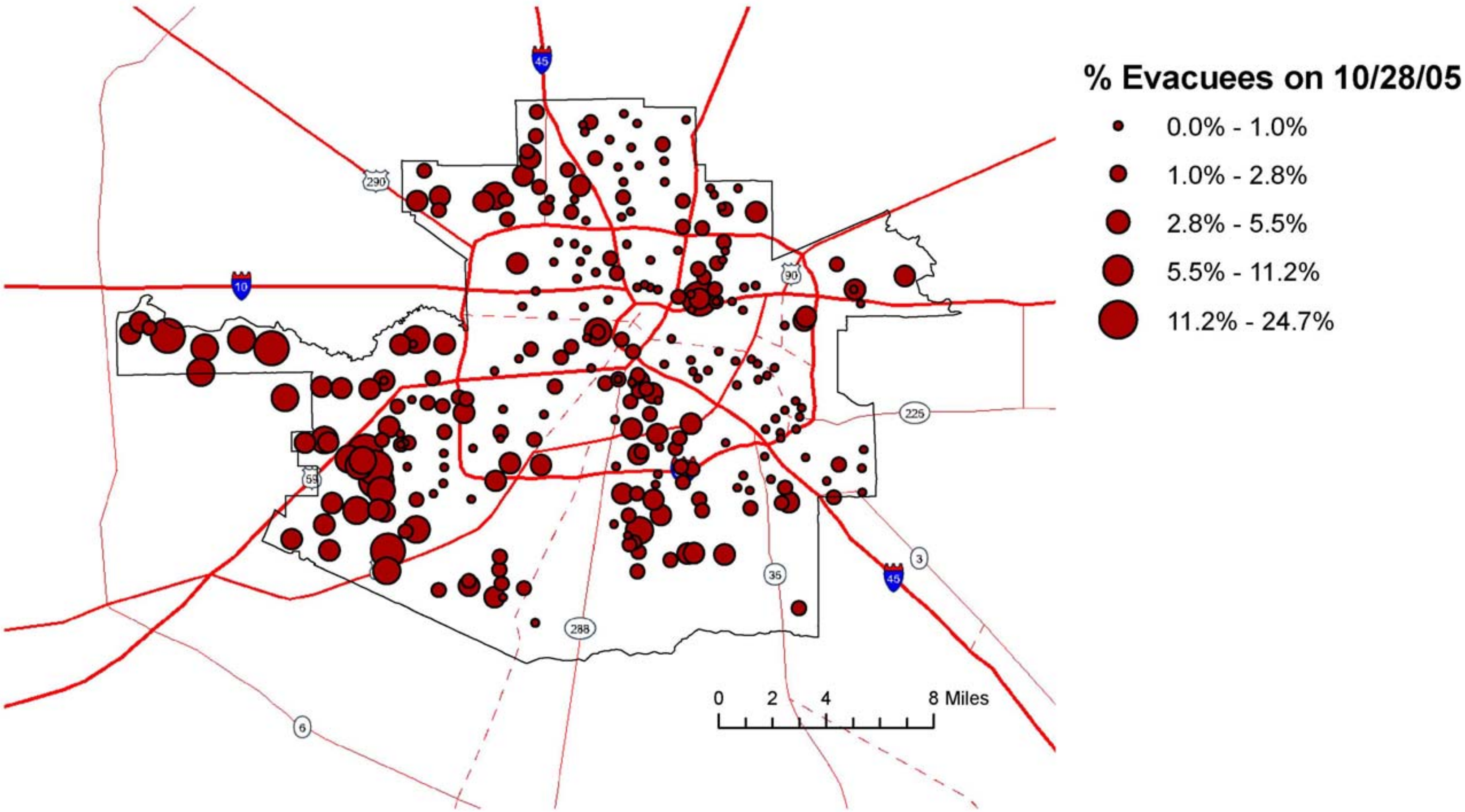
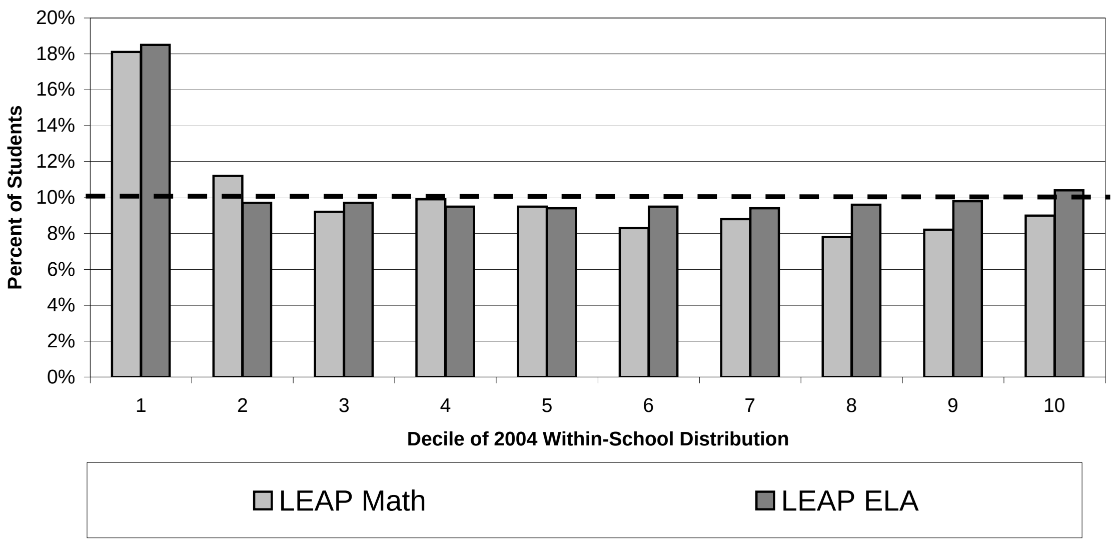
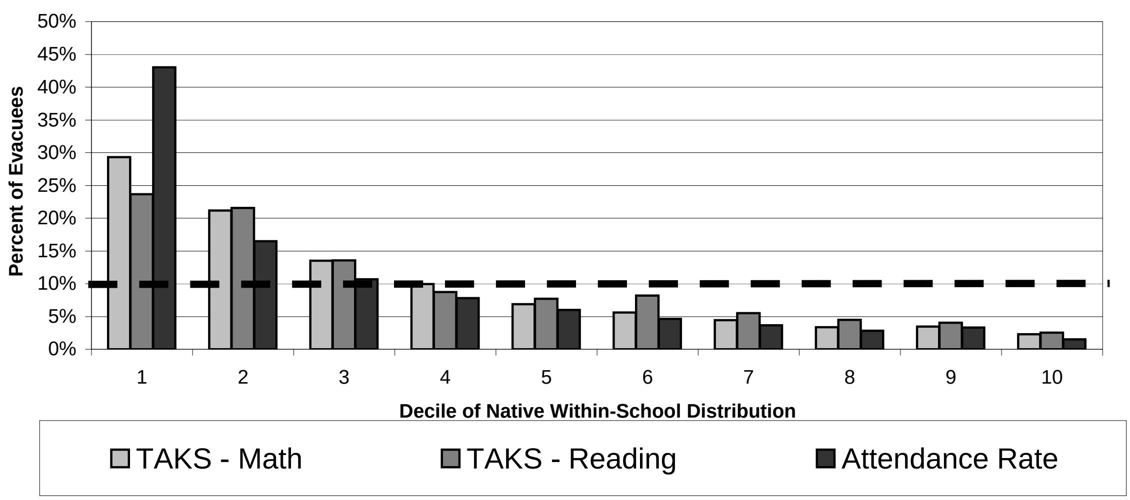


Figure 3: Distribution of Evacuees's Lagged Test Scores in Same School Native Distribution - Louisiana, 2005-06



Each bar shows the percent of evacuee students in 2005 who's 2004-05 test scores are in the listed decile of the native distribution of 2004-05 test scores in the 2005-06 school.

Figure 4: Position of Evacuees in Same-School Native Test Score and Attendance Distributions - Houston, 2005-06



Each bar shows the percent of native or evacuee students in 2005-06 who are in the listed decile of the within-school native students' distribution in their 2005-06.

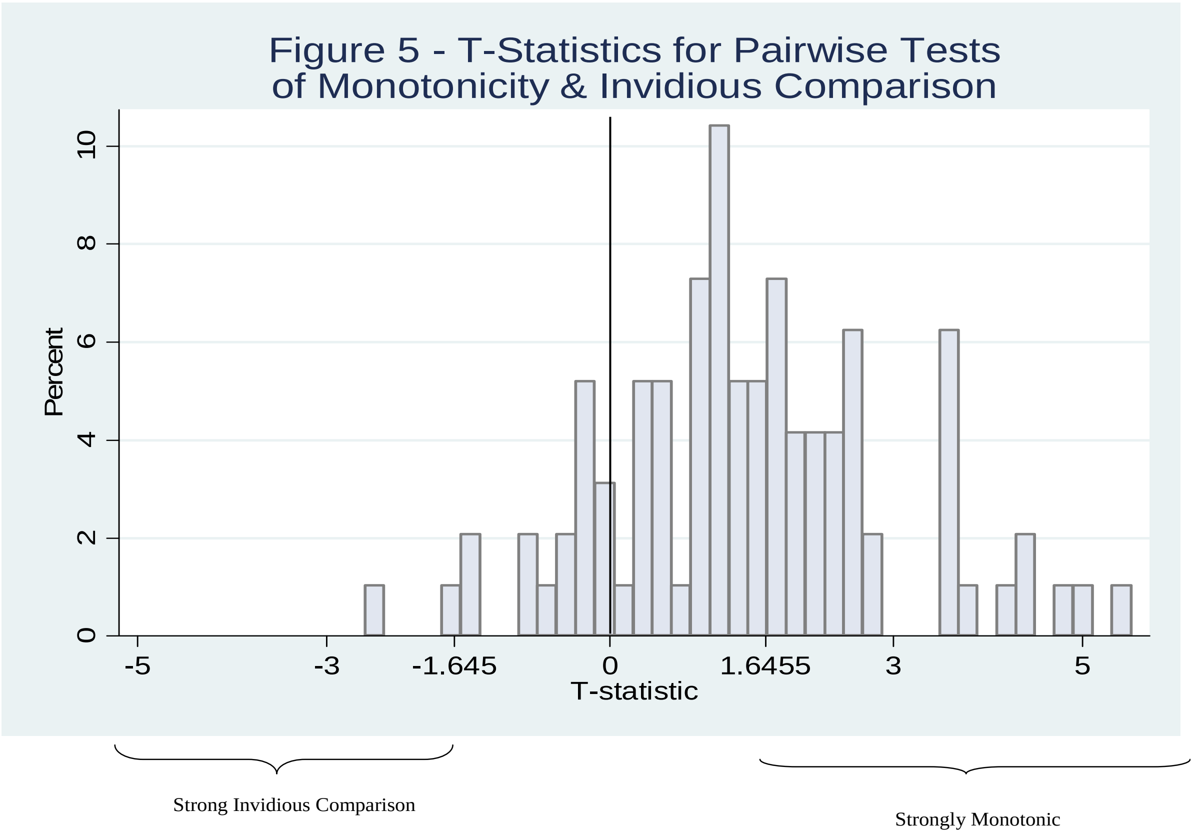


Figure 5 - T-Statistics for Pairwise Tests of Monotonicity & Invidious Comparison

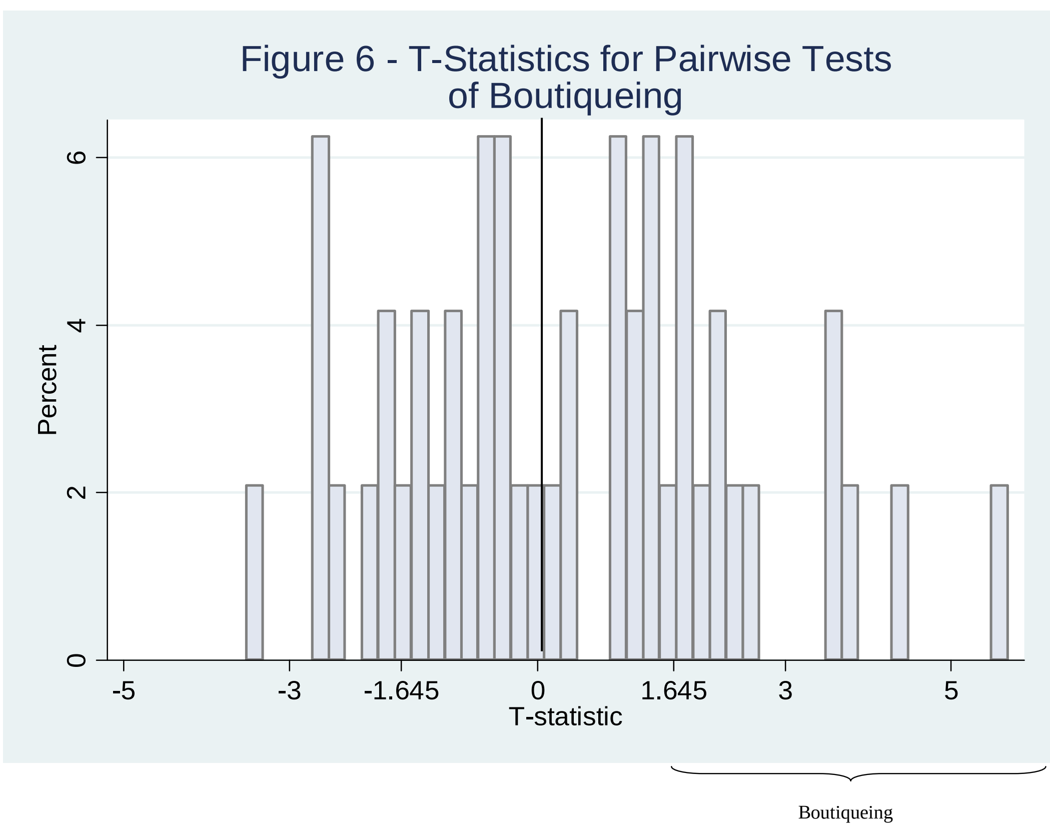


Figure 6 - T-Statistics for Pairwise Tests of Boutiqueing