Gender and Race Heterogeneity: The Impact of Students with Limited English on Native Students' Performance

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Abstract

The influx of immigrants has shifted the ethnic composition of public schools in many states including North Carolina. Recent evidence from North Carolina suggests that a larger share of Limited English students is associated with a slight decline in performance solely for students at the top of the achievement distribution. The heterogeneous peer effects by achievement level lead us to explore in this paper whether the increased immigration has differential effects by gender and race. Utilizing fixed effect methods that allow us to address possible endogeneity with respect to the schools students attend, we find evidence of heterogeneous peer effects of limited English students on natives. Specifically, we find no immigrant peer effects on female's achievement in math and reading but significant negative effects on males and black students on average.

Keywords: Immigrants, Student Achievement, Peer Effects, Education, Race, Gender, Limited English Students

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From 1980 up until the recession in 2008, immigrant inflow into the U.S. (both legal and undocumented) increased dramatically. Data from the Census Bureau show that the nation's immigrant population reached 40 million in 2010 and the decade from 2000 to 2010 had the highest level of immigration in U.S history. The rise in immigrants, particularly from Latin America, has sparked debates on U.S immigration policy and concerns over possible negative effects of immigration. North Carolina, the state on which we focus our analysis, is one of the many states who have eyed a tougher stance against illegal immigration. Between 1990 and 2000, North Carolina ranked highest among all states in the change in its immigrant population and the percentage of the population that is foreign born increased from just 1 percent in 1990 to 7 percent by 2008.

Prior research reported that Limited English (LE) students affect native born students in North Carolina and additional research has found group differences in peer effects.[1] In this paper we test for possible heterogeneity across gender and racial groups by examining two questions. First, do significant increases in LE students into a school affect the academic performance of boys and girls differently? Second, do increases in LE children create similar effects on the academic achievement of black and white students as well as across gender within racial group? These questions are important given the possible differential effects on students from demographic changes and the need for policymakers and educators to be better informed of such heterogeneity. Using education data from North Carolina between 1998 and 2006 and employing school-year fixed effects methods to control for potential selection into schools and over time, we estimate Limited English student (LES) peer effects on native students. Our results suggest no significant effect on females in reading and math. In contrast, we find negative LES peer effects for both black and white males.

I. Literature Review

There is a large literature on student academic performance and how it is influenced by innate ability, family, socioeconomic status, peers, neighborhoods, teachers, and schools.[2] Among these factors, the influence of peers—especially Black peers and peers from lower socio-economic backgrounds—has been evaluated

[1] See Diette and Uwaifo Oyelere (2013) for evidence of LE students impacting native students and for peer effects see Angrist and Lang (2004), Cho (2012), Haushek, Kain and Rivkin (2009), Hoxby (2000), Lavy and Schlosser (2011), and Santiallo (2009).
[2] See Todd and Wolpin (2003) for an early review of the literature. For a recent review of this literature see Bifulco et al. (2011).

extensively. In general these papers provide evidence of peer effects although effects are typically small.[3] Within the peer effects literature, a subgroup of studies have focused on potential heterogeneity based on ethnicity, socioeconomic status, and gender. For example, Hanushek, Kain, and Rivkin (2009) find that among Black students, having a higher percentage of Black schoolmates reduces achievement for Blacks but not for White classmates. Angrist and Lang (2004) also finds heterogeneous peer effects across race in the effect of Metco, a program that sends students from Boston schools to more upper class suburban schools.[4]

There is also a growing literature that considers the education effects of immigrants on all students while others studies focus specifically on immigrant peer effects on natives' achievement.[5] Studies focused on the effect of immigrants on native students' achievement find inconclusive trends.[6] Betts (1998) investigates whether immigrants affect the probability of high school graduation of American born minorities. His results suggest strong negative effects of immigrant concentration on African Americans and Hispanics but not for white students. These results provide further motivation to consider heterogeneous racial effects of immigrant peers on natives.[7]

Another indirect way of estimating immigrant peer effects is by focusing on the subset of immigrant students with limited proficiency in the primary language used in a country. The potential for language barriers in the classroom represents one specific channel through which immigrants can negatively affect native students. Using different econometric approaches and covering different grades, Santillano (2009) and Diette and Uwaifo Oyelere (2013) both search for peer effects in North Carolina focused on this subset of immigrants. They both find significant heterogeneity in the effects of LE students on natives. The latter study only finds negative effects on native students in the top quartile of the achievement distribution. Cho (2012) also focuses

[3] Examples of papers documenting peer effects include Hoxby (2000), Hanushek et al (2003), Ammermueller and Pischke (2006), Rumberger and Palardy (2005), and Armor and Duck (2007).
[4] See also Bifulco et al. (2011) who note heterogeneity in peer effects based on socioeconomic status.
[5] See Borjas (2007), Betts and Fairlie (2003), Santallino (2009), and Cascio and Lewis (2012).
[6] For example, Jensen and Rasmussen (2011), using data from Denmark, note significant negative effects of immigrant concentration in math using an IV strategy. While Ohinata and Ours (2013) report no significant effect from their analysis of the share of immigrant children in the classroom on the educational attainment of native Dutch children. See also Geay, McNally, and Telhaj (2013) for U.K and Gould, Lavy, and Paserman (2009) for Isreal.
[7] See also Conger (2012) who finds positive immigrant peer effects in Florida and Cortes (2006) who considers immigrant peer effects on immigrants in Miami and San Diego noting no significant effects.

on students with limited English proficiency, those classified as English Language Learners (ELL) in the U.S. She examines the effect of ELL students on academic achievement in math and reading for non-ELL students in kindergarten and first grade using a nationally representative sample. She finds negative effects for reading but not math when school fixed effects are included. She also finds that the negative effects are concentrated among females and those from families with less than $25,000 in annual income.

The major contribution of this study to the literature is the investigation of possible racial and gender differences in the impact of immigrant peer effects using an identification strategy that is less prone to producing estimates that are not consistent. Cho (2012) also considers gender effects but with a different identification strategy and for younger children. Specifically, Cho (2012) makes use of school, grade and child fixed effects to identify the impact of exposure to ELL on test scores. This strategy has two potential limitations. First, exposure to ELL students as captured by the dummy variable does not allow for differences in impact based on the ELL student concentration which will provide a compelling pathway for how ELL students can affect native students. Second, child fixed effects can be affected by time varying omitted variables which could be correlated with a child's exposure to ELL students. Santillano (2009) is most closely linked with our paper because he searches for heterogeneous impacts across race and gender. Our paper differs from his paper in two important ways. First, we focus on 4th to 8th grade outcomes which create the opportunity to employ a more robust identification strategy, school-year fixed effects while he focus solely on 4th and 5th grade using a matching estimator. The weakness of matching estimators is the estimated effect is sensitive to the variables used in the match.

II. Data and Methodology

A. Data

For this analysis we make use of administrative records created by the North Carolina Department of Public Instruction.[8] These data contain detailed and reliable information on both students and teachers across school years. Students are required to take tests in Reading and Math at the end of each year from third to eighth

[8] This data is cleaned and maintained by the North Carolina Education Research Data Center (NCERDC) at Duke University.

grade.[9] For our analyses we use data from 1998 to 2006 because the state used a consistent definition for LE across these years. A change in 2007 makes it difficult to consistently identify potential LE students after 2006. In order to identify native students, the focus of our analysis, we only include students who have never been identified as LE at any point in their third through eighth grade career. We define the share of LE students in their grade as the share of peers who are currently classified as LE. We measure LE shares at the grade level instead of the classroom level because classroom composition is endogenous.

B. Methodology

We address both questions using fixed effects methods. First we estimate a value added empirical model including school level fixed effects. This specification will help us address the non-random selection into schools and hence control for unobserved school attributes that correlate with grade-level LES shares. This technique, while common, could still potentially create biased estimates of our variable of interest in an analysis combining data over time. This will occur if there are time varying unobservables within a school that are correlated with LE shares and student achievement. Our preferred identification strategy addresses this problem. We estimate a value added empirical model with school-by-year fixed effects (see equation 1). Where α_{st} is a school-by-year fixed effect. This approach allows us to identify the impact of LE share on native achievement. Even though the total number of LE students in a school at a particular time is non-random, the number of LE in a specific grade with the school at time t is due to random factors.

$$(equation\ 1) \qquad Z_{igst} = \beta_0 + \gamma Z_{is(t-1)} + \beta_1 LE_{gst} + \delta X_{igst} + \mu T_{st} + \delta S_{sgt} + \alpha_{st} + \varepsilon_{igst}$$

In equation 1 Z_{igst} is the z-score in math or reading for student i in grade g and school s in time period t. LE_{gst} is the LE students' share of the student population in grade g in school s in time period t. X is a matrix of individual characteristics and T is the matrix of observable teacher variables. S is a vector of school related variables and $Z_{i(t-1)}$ captures an individual's achievement in period t-1. In the standard value-added model this variable characterizes the knowledge or skills students have at entry to a grade and represent the cumulative effect of all factors. We estimate equation 1, our preferred specification, with all the controls highlighted above

[9] For additional details on the administrative data we use see Clotfelter, Ladd, Vigdor (2009).

for Math and reading.[10] We first do so separately for boys, girls, black, and white native students for reading and Math and compare the estimates of β_1 across gender and race. Second we examine the 4 subgroups (boys, girls, black, and white) separately to avoid constraining the school, year and grade fixed effects or effects of other control variables for these various groups to be equal. In each model the standard errors are corrected for heteroskedasticity.

There are other estimation approaches that have been used in the past literature to deal with the potential endogeneity in the variable of interest such as including individual level fixed effects or including school by grade fixed effects. These approaches, though sometimes preferred to a simple OLS regression, could still potentially lead to biased estimates and are not preferred to the school-year fixed effect approach which we focus on in this paper. Hence, estimates of LE peer effects using these methods are not presented in this paper.[11]

III. Results

A. Results by Gender

The estimated impact of LE students on natives using school level fixed effects are summarized in Table 1. The results for Math are in column (1) and the results for reading are in column (3). Panel A summarizes the results for girls and Panel B the results for boys. These results suggest negative impacts of LE students on girls and no significant impacts on boys. Can we conclude there are causal impacts with this specification? No. As mentioned above, though a school level fixed effect can deal with a substantial part of the possible bias in our coefficient of interest, β_1, it is still possible that if we look within schools over time, there may be time-varying or non-varying unobservables that are correlated with LE share and also affect attainment. Our preferred school by year fixed effects specification deals with this kind of issue. One weakness common to this method is the loss of variation given the inclusion of a within school and year fixed effect. This could lead to large standard errors and loss of significance.

[10] Specifically we control parent education, race/ethnicity, student eligibility for free lunch and reduced price free lunch, racial composition of peers in the grade, share of students eligible for free or reduced priced lunch in the grade, pupil-teacher ratio, status as a charter or magnet school, school level free and reduced price lunch eligibility, urbanicity of the school, year fixed effects and grade fixed effects.
[11] Results using individual fixed effects and school by grade fixed effects specifications are available on request.

Table 1: Effect of Increases in Immigrant shares on achievement by gender

	(Estimates for Math)		(Estimates for Reading)	
	School Fixed Effects	School by Year Fixed Effects	School Fixed Effects	School by Year Fixed Effects
	(1)	(2)	(3)	(4)
	Panel A : Female			
Share of Limited English	-0.0289**	-0.0248	-0.0488***	-0.0412
	-0.01	-0.03	-0.01	-0.04
Observations	1,543,554	1,543,554	1,539,292	1,539,292
R-squared	0.747	0.755	0.686	0.691
	Panel B: Male			
Share of Limited English	-0.0199	-0.0742**	-0.0233	-0.0719*
	-0.01	-0.03	-0.02	-0.04
Observations	1,550,726	1,550,726	1,538,226	1,538,226
R-squared	0.748	0.756	0.686	0.691

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10
Controls included in School Fixed effect regression: Previous Year Reading Z-Score, Pupil Teacher ratio, Magnet School, Charter School, Previous Year Reading Z-Score, Share of Limited English, Average no female teachers Average no first year teachers , Average no teacher with masters, Teacher test mean, Grade Fixed Effects ,Race dummies, Year Fixed Effects, Parent Education dummies, lunch program status dummies, Share of students by race dummies, School location Dummies,\% of school free/reduced lunch Share of free lunch students, Share of pupils on reduced lunch, Average Teacher race dummies. School-year fixed effect regression also includes all the above variables except those that do not vary within a school in a given year

The advantage with this specification is that it eliminates most plausible kinds of selection and casual impacts can be inferred. The only possible type of selection that it does not address is if there is selection across grades within a school. While it is hard to tell a story of selection across grades at a given period in time, we cannot rule it out entirely. The estimates including school-by-year fixed effects for boys and girls are summarized in columns (2) and (4) of Table 1. The results seemed to be the reverse of what the earlier models suggest and reinforce the need to control for potential time varying unobservables. First, we find that there is no significant impact of LE student shares on females' reading and math scores but a significant impact exists for males although the magnitude is small. Specifically, an increase in LE shares by one percentage point is associated with a decline in male students' math Z scores by 0.00074 of a standard deviation and a decline in reading scores by 0.00072.

The results suggest significant heterogeneity across gender in the impact of LES shares. Legewie and Di Prete (2012), using data from Germany, provide a plausible explanation for our negative peer effects on boys. They argue that boys are more sensitive than girls to school resources that create a learning-oriented environment. They show boys are more influenced than girls by their measure of such a resource, the socioeconomic status of their peers. Their finding is a plausible explanation for our results. Higher LE student shares likely require teachers to devote at least some attention away from male native students and therefore a reduction in the resource, in this case time with the teacher, devoted to them. According to their model this would affect boys' academic achievement more severely than girls and is reflected in the negative peer effects we note solely for boys. Next we search for heterogeneity in the impact of LE students by race.

B. Results with Heterogeneity across Race

We apply the methods above to the question of whether there are heterogeneous effects of LES across race. Columns (2) and (4) of Table 2 summarizes our preferred model, the school by year fixed effect It suggests on average no LE student peer effect on white's achievement in either reading or math and a significant negative LE student peer effects on black achievement in both reading and math.

Table 2: Effect of Increases in Immigrant Shares on Achievement by race (Fixed Effects)

	Panel A (Math)		Panel B (Reading)	
	School Fixed Effects (1)	School by Year Fixed Effects (2)	School Fixed Effects (3)	School by Year Fixed Effects (4)
	Panel A		Panel B	
	Black			
Share of Limited English	-0.0442**	-0.0844**	-0.0525***	-0.104**
	(0.02)	(0.04)	(0.02)	(0.05)
Observations	939,173	939,173	931,381	931,381
R-squared	0.647	0.66	0.611	0.62
	White			
Share of Limited English	-0.0385***	-0.0346	-0.0571***	-0.0393
	(0.01)	(0.03)	(0.01)	(0.03)
Observations	1,983,408	1,983,408	1,975,386	1,975,386
R-squared	0.73	0.737	0.659	0.664

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10
Controls same as in Table 1.

These findings are similar to those of Hanushek, Kain and Rivikin (2009) who find negative effects on achievement for blacks of having more black peers in Texas while noting no effect on whites of having more black peers. Similarly when looking at the impact of Metco students on those in the receiving districts, Angrist and Lang (2004) found little evidence that white students were affected but black students appeared more sensitive to this change. Both findings are consistent with the broader result in the literature that disadvantaged students are more sensitive to school level resources such as class size. Black students are more likely to be disadvantaged even after controlling for income because they likely come from homes with significantly lower levels of wealth than their white peers. Other possible explanations include behavioral, social and peer culture differences and the "acting white" phenomena (see Tyson, Darity, and Castellino (2005) and Fryer (2006, 2010) for a discussion of some of these views).The main conclusion from these results is that while the differences in effect across groups are not always significant, the above results suggests heterogeneity across gender and race in the impact of LE shares on native students' achievement.

Table 3: Effect of Increases in LES on Achievement by race (Fixed Effects)

	Panel A (Math)		Panel B (Reading)	
	School Fixed Effects	School by Year Fixed Effects	School Fixed Effects	School by Year Fixed Effects
	(1)	(2)	(3)	(4)
Panel A: Female Black				
Share of Limited English	-0.0564**	-0.0627	-0.0630**	-0.0687
	(0.02)	(0.06)	(0.03)	(0.06)
Observations	478,613	478,613	476,620	476,620
R-squared	0.656	0.672	0.615	0.627
Panel B: Female White				
Share of Limited English	-0.0343*	0.0337	-0.0715***	-0.0153
	(0.02)	(0.04)	(0.02)	(0.05)
Observations	978,221	978,221	976,173	976,173
R-squared	0.731	0.74	0.656	0.663
Panel C: Male Black				
Share of Limited English	-0.0344	-0.0969	-0.0433	-0.127*
	(0.03)	(0.06)	(0.03)	(0.07)
Observations	460,560	460,560	454,761	454,761
R-squared	0.637	0.654	0.597	0.61
Panel D: Male White				
Share of Limited English	-0.0435**	-0.0933**	-0.0467**	-0.0535
	(0.02)	(0.04)	(0.02)	(0.05)
Observations	1,005,187	1,005,187	999,213	999,213
R-squared	0.729	0.737	0.659	0.665

Controls same as in Table 1 included in School Fixed effect regression: Previous Year Reading Z-Score, Pupil Teacher ratio, Magnet School, Charter School, Previous Year Reading Z-Score, Share of Limited English, Average no female teachers Average no first year teacher , Average no teacher with masters, Teacher test mean, Grade Fixed Effects ,Race dummies, Year Fixed Effects, Parent Education dummies, lunch program status dummies, Share of students by race dummies, School location Dummies,\% of school free/reduced lunch, Share of free lunch students, Share of pupils on reduced lunch, Average Teacher race dummies. School-year fixed effect regression also includes all the above variables except those that do not vary within a school in a given year.

In Table 3 we summarize the estimated LE share effect when breaking down the population into black females, black males, white females and white males. The results provide insight into who exactly are negatively affected by increases in LES students. We find that although Table 2 suggests that black natives experience negative LES peer effects, on average, however, these effects are only felt by black males. That the estimated effect is only significant at the 10% level, comes as no surprise given our identification strategy which depends on variation within school and year.

Our results suggests that black females do not seem to experience any negative LES effect on average in reading and Math which is consistent with our finding no effects on females summarized in Table 1. Our results also suggest no significant effect on white females which is consistent with the no effect on whites in table 2. Also although table 2 suggests that on average there are no significant effects on whites, we find that when we consider white males solely we find negative LES peer effects in math (-0.09) and no effects in reading.

IV. Inferences and Conclusions

In this paper we focus on two questions. First, do higher shares of LE students in a school affect the academic performance of native boys and girls differently? Second, do more Limited English students create similar effects on academic achievement of blacks and whites? Our findings show that LE student shares have no effect on girls' performance in math and reading and have negative effects on males (both white and black). Why are these results important? First, these results provide some evidence that increased exposure to LE students do create modest peer effects and these effects are not homogenous within the population. Our results suggest boys are affected negatively by LE student shares though the effect is not substantial and that girls are not affected. Our findings are in contrast to Angrist and Lang (2004) who find negative peer effects on girls but not boys from the METCO program in Massachusetts. These differences in the impact of disadvantaged peers on other students suggests that additional research is needed to understand how these effects may differ by context and the response within schools to the presence of disadvantage students. Further, the presence of heterogeneous peer effects highlights the importance of further research that examines these differences. Moreover there is need for policymakers to be mindful of these potential effects in the design and study of public policy.

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