Do Cyclical Fluctuations in Local Economic Conditions Lead to Changes in Student Achievement on Standardized Tests? Evidence From County Panel Data

Abstract: In this paper, I study whether cyclical variation in local economic conditions leads to changes in student achievement on standardized tests or in achievement gaps. Existing literature suggests that job loss and parental time use are correlated with children's well-being and academic achievement, particularly in low-socioeconomic status families, implying that aggregate economic downturns may affect both absolute and relative test scores. Separate from labor market shocks, cyclical changes in school funding have also been found to have significant effects on student achievement. However, few studies have focused directly on whether changes in local aggregate economic conditions lead to contemporaneous transitory changes in student performance on standardized tests. This paper uses standardized nationwide achievement data from the Stanford Educational Data Archive to systematically examine the association between unemployment rates and achievement levels and gaps in US counties. While there is a clear negative association between local unemployment and test scores in the cross-section, I find that when I estimate models that exploit variation in unemployment rates within counties over time, the association between unemployment and student test scores is near zero or slightly positive. Raw data and regression models both reveal that student scores and gaps have followed steady trajectories over time during the period spanning the recovery from the Great Recession of 2007-2009, even as local economic conditions changed sharply and then converged across local areas. I do not find evidence of any adverse effects of within-county increases in unemployment rates on the relative achievement of minority and economically disadvantaged students. I do find evidence that downturns are associated with small *improvements* in relative test scores for non-disadvantaged students in urban and suburban areas.

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1. Introduction

Historically, there have been substantial achievement gaps at the elementary and secondary school levels in the United States between economically-disadvantaged students and their more-advantaged peers, as well as between white and minority (Black and Hispanic) students. Those achievement gaps exist in nearly every community in the nation (Reardon, Kalogrides and Shores, 2019) and have been a core area of focus among academic researchers and policymakers. The No Child Left Behind Act (NCLB), passed in 2002, scaled up the federal role in elementary and secondary education and sought explicitly to reduce achievement gaps by socioeconomic status, race, and ethnicity. However, recent cohort-based research suggests that, despite these efforts, achievement gaps have remained nearly constant for almost half a century, despite overall improvements in average achievement in recent decades (Hanushek et al., 2020).

The magnitudes of socioeconomic and racial/ethnic gaps in academic achievement vary widely across localities within the United States and are associated, in the cross-section at least, with the progressivity of state school-aid formulas, neighborhood socioeconomic factors, racial/ethnic segregation, and income disparities across groups (Reardon, 2016; Reardon, Kalogrides and Shores, 2019; Hung et al., 2020; Bradbury, 2020). Recently, the literature has turned its attention to identifying the effects of exogenous shocks and time-varying local factors on the trajectories of achievement levels and gaps over time within a given neighborhood and student population in the US. On this front, a handful of recent studies have made advances using natural experiments, studying the effects of time-varying local factors including public school funding (Jackson, Wigger and Xiong, 2021), weather (Park et al., 2020), pollution (Heissel, Persico and Simon, 2019), violent crime (Torrats-Espinosa, 2020) and immigration enforcement (Bellows, 2019) on student achievement. These studies have found that exposure to exogenous adverse shocks has especially-strong negative effects on the test scores of low-income students and Black and Hispanic students.

This paper examines the contributions of cyclical variation in local labor market conditions to changes in academic achievement levels and gaps during the period spanning the recovery from the Great Recession of 2007-2009 in US counties. I use nationwide county-level achievement data from the Stanford Educational Data Archive (SEDA, see Reardon et al. 2016). The SEDA includes achievement measures that have been compiled from a variety of state-specific exams and carefully standardized in order to be comparable across districts and over time, allowing for panel fixed effects analysis. The SEDA includes measures of academic

achievement in grades 3-8, overall and for specific subgroups of students, as well as measures of achievement gaps between White and Black students, between White and Hispanic students, and between economically advantaged and disadvantaged students, for almost all US counties. The data also include information on county race/ethnicity composition, segregation, and socioeconomic status.

The Great Recession—the largest economic downturn of the postwar era in the United States—caused dramatic and persistent reductions in employment, earnings, and hours for US workers, as well as reductions in wealth and property values. Theoretically, there are two possible mechanisms that mediate the direct effects of an economic downturn on student academic achievement. On one hand, decreased family income and increases in stress are likely to lead to a decline in student performance. Research on fathers' job losses supports this theory—Stevens and Schaller (2011) and Rege, Telle and Votruba (2011) document that paternal job loss leads to poorer academic achievement, and Schaller and Zerpa (2019) find that paternal job loss leads to a decline in children's mental health and an increase in medical visits related to mental health. On the other hand, parental unemployment also potentially leads to increases in parental time spent with children and thus increased parental investment or involvement in children's school progress. These two competing effects make the overall association ambiguous.[2] There are also possible indirect effects of the recession on school achievement that operate through changes in school quality. Recent work by Jackson, Wigger and Xiong (2021), Shores and Steinberg (2019), and Evans, Schwab and Wagner (2019) highlights the importance of changes in public school funding and education employment during the Great Recession.

Importantly, there is likely heterogeneity in the individual severity of an aggregate economic shock by student race/ethnicity and family economic status, in which case economic downturns should not only alter achievement levels but also would affect gaps in achievement between more- and less-advantaged groups of students. For example, we know that the cyclicality of economic outcomes is more severe for poor families and for Black and Hispanic workers (Bitler and Hoynes, 2015; Hoynes, Miller and Schaller, 2012), so achievement may be more adversely impacted among disadvantaged and minority students. This could cause

[2]Using panel survey data, Levine (2011) finds that parental unemployment status is in fact not significantly associated with children's academic progress and posits that this may be the result of the two opposing mechanisms discussed above. Meanwhile, several studies have found evidence that the effects of parental unemployment on child outcomes differ by the gender of the displaced parent (see, for example, Page, Schaller and Simon (2019), Lindo, Schaller and Hansen (2018), and Rege, Telle and Votruba (2011), which implies that the effect of aggregate downturns will reflect the sum of two opposing effects.

the *gaps* in achievement by race/ethnicity and socioeconomic status to be responsive to changes in local economic conditions. Meanwhile, Evans, Schwab and Wagner (2019) find that inequality in school spending rose sharply during the Great Recession, and Jackson, Wigger and Xiong (2021) find that when states reduced public school spending levels during the recession that test score declines were most pronounced for low-income and Black students.

Rather than focusing on specific mechanisms like job loss or public school funding, this paper instead looks broadly to see whether counties that experienced more severe labor market (unemployment) impacts of the Great Recession showed disproportionate contemporaneous changes in student scores on standardized tests relative to counties that experienced less-severe impacts of the recession. In order to study the effects of local economic conditions on student achievement, I link SEDA test score and demographic data to annual county-level unemployment rates from the Bureau of Labor Statistics. I take advantage of the broad coverage and panel nature of the SEDA data by using a generalized difference-in-differences approach, estimating the association between local unemployment rates and test scores and gaps using regressions that include county fixed effects to account for fixed county-level differences in academic achievement and year fixed effects to control for aggregate shocks that may affect the test scores of all students. Because my data span the recovery from the Great Recession, I identify in particular whether counties with a particularly high peak unemployment rate in 2010 or a particularly steep decline in unemployment rates thereafter experienced test score patterns that follow or mirror those same patterns.

Perhaps surprisingly, given previous findings on the impacts of job losses on academic achievement, I find that changes in local unemployment rates are *not* negatively correlated with changes in student achievement in any grade or subgroup, or with racial and ethnic achievement gaps. The lack of strong correlations is apparent even in the raw data. For example, while unemployment rates and achievement measures are clearly negatively correlated in the pooled cross-section, there is no visible correlation at all between two-year *changes* in unemployment rates and two-year *changes* in either test scores or achievement gaps. Looking at unadjusted time series, I see that average test scores and achievement gaps generally remained steady or continued on their secular trends as unemployment rates reached their peak in the aftermath of the

Great Recession in 2010 and then reversed trend and declined.[3] The results from fixed-effects regressions, which exploit variation in unemployment within counties over time and control for aggregate shared factors, show that increases in local unemployment are associated with small *improvements* in some test scores, particularly math and English language arts (ELA) scores among economically advantaged urban and sub-urban students. I also find that the gaps in math and ELA achievement between economically advantaged and disadvantaged students and between white and Hispanic students increase when unemployment rates are high, but this is does not seem to be due to declining achievement by disadvantaged students, but rather to improvements in achievement for more-advantaged students during an economic downturn. I see some evidence of improvement in test scores among black 3rd grade students with increased unemployment, but I find that white-Black achievement gaps are not responsive to changes in local economic conditions.

Taken together, results from both my raw data and regression models that exploit local variation in the timing and severity of the Great Recession and its recovery, suggest that changes in the state of the labor market between 2009 and 2016 did *not* spur significant changes in contemporaneous achievement, which instead followed a steady trend over much of the period. My results are striking when considered in light of existing literature on the *cross-sectional* determination of test scores and gaps. Previous research, much of which uses the same achievement data, shows dramatic disparities in academic performance and in test-score gaps between white and Black and Hispanic students across schools, districts, and geographic areas and establishes that these disparities are strongly correlated with measures of demographic composition and socioeconomic status. This paper reveals that, despite the strong cross-sectional associations, variation in aggregate economic conditions within counties over time is *not* in fact contemporaneously correlated with changes in achievement or widening disparities between subgroups.

My results are consistent with results of Hung et al. (2020) who find that it is adult educational attainment, rather than household unemployment status, that matters more for student achievement gaps, and with recent research suggesting that family socioeconomic factors affect educational outcomes for children, including achievement gaps, through their impacts on residential and school segregation patterns (Reardon,

[3] An eventual decline in average test scores, which does not begin until 2014, was most significant in urban areas and, anecdotally, has been linked to changes in teaching and testing related to implementation of Common Core standards. See, e.g. "Test Scores Decline as New Jersey Aligns Exams with Common Core, *NY Times*, Oct 2015, "Md. student test scores drop significantly as state shifts to Common Core" *Washington Post*, July 2014.

Kalogrides and Shores, 2019). My results are complementary to and informative about the work of Shores and Steinberg (2019) who find that prolonged cohort-level exposure to a particularly severe local downturn during the Great Recession does result in worse test scores, particularly for disadvantaged students, and to the recent work of Jackson, Wigger and Xiong (2021), who find that test scores decline, particularly for disadvantaged students, as a result of especially-severe local cuts to public school spending during the Great Recession. This paper documents that despite those associations, we do not see that counties that experienced stronger labor market downturns experienced measurable contemporaneous transitory deviations in their overall average test scores or in achievement gaps between advantaged and disadvantaged students. This paper is also, to my knowledge, the first to document that higher unemployment rates are associated with measurable *improvements* in relative test scores for advantaged students in urban and suburban areas.

2. Background

2.1. Cross-Sectional Determinants of Achievement

A large literature examines cognitive achievement gaps by race, ethnicity, and socioeconomic status, including many recent studies that use the SEDA data. Reardon, Kalogrides and Shores (2019) examine a wide variety of local factors that correlate with achievement gaps. They find that achievement gaps vary substantially across geographic areas, ranging from nearly zero in some places to larger than 1.5 standard deviations in others. They find that more advantaged districts and metropolitan areas—those with higher socioeconomic status (SES) composite scores, higher median incomes, higher rates of college completion, and fewer single-mother-headed households have larger differences in achievement between white and minority students. They find that segregation is an important predictor of achievement gaps; metropolitan areas with higher levels of racial and economic segregation have larger achievement gaps than less segregated places. Differences in measured socioeconomic status between race and ethnicity groups are also found to correlate with differences in average test scores. Finally, although some measures of educational policies and practices are correlated with achievement gaps, they find that these correlations are generally small and inconsistent across groups and geographic units of analysis.

A number of other studies have examined the cross-sectional determinants of achievement gaps. Gagnon

and Mattingly (2018) find that rural achievement gaps are smaller than those in the city, noting that while urban districts are more racially diverse, they also exhibit the largest white-Black and white-Hispanic disparities in socioeconomic status. Hung et al. (2020) find that the percent of special-education students in a school district, total per pupil expenditure, average per grade enrollment, city/urban locale, economic inequality, the degree of racial segregation in schools, household unemployment status, and adult educational attainment are all significantly correlated with the student achievement gaps between white and Black students across school districts. They also find that household adult educational attainment was the strongest correlate of the white-Black achievement gap. Reardon (2016) reports that the disparity in average school poverty rates between white and black students' schools is consistently the strongest correlate of achievement gaps, and finds that school-level poverty composition matters more than residential composition. Finally, Bradbury (2020) finds that states with more-progressive state school-aid distribution formulas—those that allocate a larger share of funding to disadvantaged schools—have smaller achievement gaps.

2.2. Time-Varying Determinants of Achievement

A related literature has examined the effects of various time-varying local factors, including immigration enforcement, environmental shocks, and crime, on test scores and achievement gaps. Bellows (2019) uses SEDA to examine how immigration enforcement impacts student performance. Her study found that the implementation of the Secure Communities program and its associated deportations had a negative impact on both Hispanic and Black students' scores in English language arts, as well as Black students' scores in math. Kirksey et al. (2020) use deportation data to show that immigration enforcement impacts achievement gaps primarily in math scores.

One of the most-studied time-varying factors that impacts test scores is air pollution. For example, Zhang, Chen and Zhang (2018) find that contemporaneous air pollution adversely affects test scores, with a stronger impact on verbal tests than math tests, and that the effect of air pollution becomes more pronounced with age, especially for the less educated. Lavy, Ebenstein and Roth (2014) estimate the effect of pollution exposure on scores from a high-stakes Israeli standardized test used in high schools. They find that pollution impacts afternoon examinations more than the morning ones and identify likely non-linearity in pollution's relationship with cognitive performance. Another environmental factor that has been found to affect test

scores is temperature; Park et al. (2020) and Park (2020) study how heat impacts learning, finding that Black and Hispanic students' learning is far more inhibited by heat exposure compared to the learning of white students.

Finally, several studies have looked at how exposure to violence impacts student achievement. Torrats-Espinosa (2020) examines how violence impacts achievement, and finds that Black boys are most severely impacted by exposure to violence, and this resulted in greater inequality in their ELA test scores. Sharkey et al. (2014) look at how exposure to violent crimes impacts test scores in New York City public schools, finding that exposure to violence reduces the passing rates of Black students by approximately 3 percentage points and has no impact on other groups. For Black students, this reduction in test scores is equivalent to over 30 percent of the white–Black test score gap.

2.3. Economic Conditions and Academic Achievement

A number of recent studies have considered the association between local economic conditions and academic outcomes with an emphasis on the effects of the Great Recession. The paper most closely linked to this paper is by Shores and Steinberg (2019), who use both cross-district variation in the size of the Great Recession and within-district variation across cohorts in the duration of school-aged exposure to the recession and find that the Great Recession reduced student achievement in both math and ELA. They additionally find that the impacts of the recession were concentrated in school districts that serve more economically disadvantaged students. Ananat et al. (2011) study the effects of state-level job losses on state-level student achievement measures and find that job losses lead to substantial decreases in eight-grade math scores, with smaller effects on fourth grade scores and on reading scores. They find that the aggregate effects are much larger than the sum of individual effects for job losers, which suggests large spillover effects to students with non-displaced parents.[4]

One recent area of focus in the literature has been on the role of changes in school funding during recessions. For example, Shores and Steinberg (2019) show that the adverse recessionary effects that they find are likely driven by reductions in teacher personnel and other impacts on school resources. Evans,

[4]Additional studies by Knight (2017) and Knight and DeMatthews (2017) find that high-poverty school districts were disproportionately impacted by state funding cuts in the aftermath of the Great Recession.

Schwab and Wagner (2019) closely examine the ways that the Great Recession affected public schools and show that nearly 300,000 school employees lost jobs during the recession, leading to lasting increases in class sizes. They also find that schools in states where school districts depend heavily on state funding were particularly vulnerable to recessions—a fact corroborated by Jackson, Wigger and Xiong (2021) who study that phenomenon directly. However, they also show that property tax revenues actually rose over the course of the recession due to increases in rates, and find that federal funding entirely offset local funding reductions to public schools during the 08-09 and 09-10 school years.

A separate literature considers the effects of labor market shocks, including individual parental job loss and unemployment, on children's academic achievement. Using data from the American Time Use Survey, Levine (2011) finds little evidence of an association between parental unemployment and children's academic achievement in the cross-section. However, Stevens and Schaller (2011) find that fathers' job losses are associated with increased likelihood that children repeat grades, particularly for children in disadvantaged families, and Rege, Telle and Votruba (2011) find that father's job losses have negative impacts on children's school performance (though mothers' job losses do not[5]).

This study considers the association between changes in local unemployment rates as a proxy for the impact of the Great Recession in a local area, and the magnitude of contemporaneous changes in student test scores. SEDA's standardized format allows me to conduct a systematic difference-in-differences analysis using fixed effects regressions to estimate this association across the entire United States. I use a different source of identifying variation from Shores and Steinberg (2019), who focus on linking a county's peak-to-trough change in unemployment rates with later test scores in the cross-section and exploit variation in exposure to the recession across cohorts of students. I also emphasize the effects on test scores *gaps* between white and minority (Black and Hispanic) students and between advantaged and disadvantaged students. Generally, the research summarized in this section suggests the I might expect to find that economic downturns lead to declining student performance and increases in achievement gaps. However, the nature of these associations is not definitively predicted from any theoretical model, since any change in economic

[5]This pattern is echoed by the findings of Lindo, Schaller and Hansen (2018); Schaller and Zerpa (2019); Page, Schaller and Simon (2019), who all find opposite-signed effects of shocks to male and female labor market opportunities on children's outcomes.

opportunities will have heterogeneous impacts and opposing income and time use effects.

3. Data

The Stanford Education Data Archive (SEDA) is the largest and most comprehensive database of its kind. The database, which resulted from a multi-year undertaking by researchers and Stanford and Harvard universities, includes test score data for US students over the period 2009-2017, covering more than 12,000 school districts in more than 3000 counties across the country. The creators of SEDA derived transformations linking each state test score scale to the scale of the National Assessment of Educational Progress (NAEP)—a federal yardstick. They applied these transformations to local test score distributions so that those distributions can be expressed on the NAEP measurement scale, allowing for large-scale studies of national variation in district- and county-level achievement (Reardon et al., 2016).

The data focus on racial, socioeconomic and gender disparities in academic performance and educational attainment within the U.S. educational system. The SEDA includes a range of detailed data on education conditions, contexts, and outcomes in schools and school districts across the United States. Specifically, it includes measures of academic achievement, achievement gaps, school and neighborhood racial and socioeconomic composition, school and neighborhood racial and socioeconomic segregation patterns, and other features of the schooling system. The data include assessment outcomes for eight consecutive school years from the 2009-10 school year to the 2016-17 school year in grades 3 to 8 in English language arts (ELA) and math. Public school districts where there were less than 20 white and 20 black students made it impossible to calculate a white/black achievement gap, so data is missing in instances where an a county observation would have fewer than 20 students in either subgroup. There are over 3000 counties included, and there are more than 300 million tests taken by more than 45 million students included in the data.

Academic achievement is measured by standardized test scores administered in 3rd through 8th grade in mathematics and ELA. These are available at various levels of aggregation, for my purpose including at the county level, by year, grade and race. There is no individual-level data, everything is the mean of the students in the given district at the given level of aggregation. The test score gap variables are constructed by simply subtracting the Black or Hispanic means from the white test score means and by subtracting the mean for economically disadvantaged students from the mean for non-economically-disadvantaged students.

The data also include measures of total enrollment, the percentage of students in the district who are Asian, Black, or Hispanic; the percentage of students in the district who received free or reduced-price lunch, the percentage of students who had a disability, the percentage of students who were English learners, the student-teacher ratio, and the percentage of students in charter schools. It includes school district–level means and standard deviations of mathematics and reading achievement scores. The data include an SES composite that is the comprised of the following variables: 1) median family income; 2) percent of adults with a bachelor's degree or higher degree; 3) poverty rate; 4) unemployment rate; 5) SNAP eligibility rate; 6) the percent of families headed by a single parent. Each of these is available separately by race/ethnicity (for racial/ethnic groups of sufficient local population size).

A key source for SEDA is the Common Core of Data (CCD). This is a comprehensive, annual survey of all public elementary and secondary schools and school districts in the United States. The nonfiscal CCD data are collected by the U.S. Department of Education's EDFacts office. It is the Department of Education's primary database on public elementary and secondary education in the United States. The EDFacts data system is housed by the U.S. Department of Education (USEd), which collects aggregated test score data from each state's standardized testing program as required by federal law. The data include assessment outcomes in grades 3 to 8 in ELA and math. Most states use a testing window in the spring, while a few states use a testing window in the fall. The EDFacts database reports the number of students, disaggregated by subgroup, scoring in each of the ordered performance categories, for each grade, year and subject; no individual student-level data is reported. The student subgroups include race/ethnicity, gender, and socioeconomic disadvantage. This EdFacts data was provided to SEDA by the National Center for Education Statistics. Another key source for the additional variables is the five-year samples from the American Community Survey (ACS), which includes demographic and socioeconomic characteristics of individuals and households. This survey data is collected from households on a yearly basis by the U.S. Census Bureau.

Data used to link state assessments to a nationally comparable measure comes from the National Assessment of Educational Progress (NAEP), which provide estimates of 4th and 8th grade test score means and standard deviations for each state on a common scale, as well as their standard errors. The NAEP is a congressionally mandated project administered by the National Center for Education Statistics (NCES)

within the U.S. Department of Education and the Institute of Education Sciences (IES). NAEP is given to a representative sample of students across the country. Results are reported for groups of students with similar characteristics (e.g., gender, race and ethnicity, school location), not individual students.

4. Economic Conditions, Test Scores, and Achievement

4.1. Average achievement, gaps, and changes over time

We begin by examining the economic and demographic composition of my sample, paying special attention to disparities in socioeconomic status by race/ethnicity among students. Table 1 presents variable means for my SEDA data, pooled for the 3rd grade math sample over the full sample period, 2009-2016. As the sample period spans the recovery from the Great Recession, it is not surprising that the average county unemployment rate is high at 7.7 percent. There are also large peak-to-trough changes in unemployment over the period, averaging 4 percentage points across counties. In the average county-year observation, 12 percent of students are Black, 12 percent of students are Hispanic, and 57 percent of students receive free or reduced price lunch. Average socioeconomic characteristics are different for white, Black, and Hispanic students. Black and Hispanic students are more likely to live below the poverty line, and less likely to have college-educated parents. Black students face particularly striking disadvantages in terms of socioeconomic status—41 percent live in single-mother households and 14 percent have unemployed parents, so that the measured gap in an SES composite index between white and Black students is nearly double that between white and Hispanic students.

In my analysis, I will study the association between local unemployment rates and math and ELA scores, as the two types of exams have been found to respond differently to external factors in the previous literature. While I have data for all grades from 3 through 8, I focus on grades 3 and 8 in order to estimate effects separately for younger and older children without reporting too many coefficients. Table 2 presents county math and ELA test score means and gaps among 3rd and 8th grade test takers. The table shows that achievement gaps between groups are similar in 3rd and 8th grade. The gaps between white and Black students in test scores are also similar between math and ELA. However, Hispanic students face a large gap in ELA test scores than in math test scores, likely because more Hispanic students are English language

learners. For both math and ELA, the white-Black gap in test scores is much larger than the white-Hispanic gap, with the economic disadvantage gap falling about halfway in between.

Figure 3 shows changes in test scores for each subgroup of students over the sample period from 2009 to 2016. Consistent with previous findings in the literature, the figure shows that the gaps in performance between the groups remain steady over time. Notably, performance in both subjects declined across the board towards the end of the sample period, around 2014. In both math and ELA, Hispanic students experienced a steeper improvement in relative scores leading up to the 2014 decline. Figure 3 does not show any apparent cyclical pattern at all in test scores for any group, as there is no turning point around the 2009 unemployment peak. Meanwhile, the timing of the 2014 decline is in line with anecdotal evidence of a shift in school curriculum to align with new national academic standards (the Common Core State Standards) that did not align with the tests.[6]

One thing that I need to be mindful of in my analysis is that test scores might be changing over time for different groups because the composition and characteristics of that group might be changing over time. For example, demographic trends or immigration might alter the shares of Black and Hispanic student test takers and economic conditions might lead to changes in the fraction of children who are economically disadvantaged in the class. If those shares are changing over time, selection into, and thus characteristics of, those groups may be changing as well. To explore this possibility, I examine whether the composition of student test takers is changing over the sample period in Figure A1. I find that the share of black students remains relatively steady around 12 percent but the share of Hispanic students does appear to increase over the sample period. For example, in the 3rd grade math sample, the share Hispanic increases from just over 10 percent to almost 14 percent from 2009 to 2016. The share of free and reduced-price lunch students also increases over the period. These trends are important to keep in mind as I consider changes in average test performance among these groups across my sample period and I will control for the socioeconomic makeup and demographic composition of test takers in my analysis in order to address this issue.

[6] See, for example, Wiggins and George (2014) for the Washington Post and Nelson (2014) for Vox.

4.2. Local unemployment rates and achievement in the pooled data

We begin my exploration of the association between local unemployment rates and academic achievement gaps by first documenting the variation in local unemployment rates over time and across counties in my sample. In Figure 1, I divide counties into four quartiles by the size of their trough-to-peak change (decrease) in unemployment rates over the sample period and display average county unemployment rates over time for each of those quartiles. This graph shows that unemployment rates during the period peaked in 2010 following the Great Recession, and declined steadily after that. However, the graph reveals that the magnitude of the peak and the steepness of the decline varies widely across US counties, with the widest variance in the peak year (2010) and convergence across quartiles after that.

Figure 1 illustrates the primary sources of identifying variation for my fixed effects models; I will exploit variation in the severity of the Great Recession and the steepness of the subsequent recovery across counties. In particular, I examine whether counties with particularly large increases in unemployment during the recession and/or particularly steep declines afterward experienced parallel (or mirror) changes in academic achievement over the sample period. In order to eyeball whether this is true, I construct a similar figure, Figure 2, which compares changes in achievement means over time for the same four quartiles of trough-to-peak unemployment change. I am looking, in this figure, to see whether there were any peaks or troughs in achievement near the 2010 unemployment peak and whether there was convergence or divergence across the four quartiles as their unemployment rates converged later in the sample period. Figure 2 does not show either of those patterns. In fact, achievement increased steadily and in parallel in all four quartiles of unemploymnent change, and for each group levels off instead around 2013-2014. Taken together, my first two figures do not support a strong association between variation in unemployment rates over time and academic achievement.

Next, I examine changes in test scores between 2009 and 2016 for four subgroups of students: white, Black, Hispanic, and economically-disadvantaged students. I do this because the labor market outcomes of minority and lower-skilled workers are more sensitive to business cycle fluctuations than those of white and more-advantaged workers, so it is possible that adverse effects of unemployment on academic achievement might be concentrated in those groups. However, figure 3 does not reveal any cyclical patterns in math or ELA achievement for any subgroup. Instead, the lines generally move in parallel with one another, with the

exception of accelerated improvement in test scores for Hispanic students relative to the other groups in 3rd grade math and 3rd and 8th grade ELA.

Figure 4 directly examines changes in achievement gaps between white and Black and Hispanic students and between more and less-economically-advantaged students during my sample period. As with Figure 3, Figure 4 does not show much of an apparent correlation between achievement gaps and local economic conditions—none of the achievement gap lines seem to reflect any sharp trend changes around 2010. Instead, the gaps in scores between white and Black students and between economically advantaged and disadvantaged students are large and growing over time and the gap in scores between white and Hispanic students, which is smaller to begin with, continues getting smaller over time.

Finally, I directly examine the correlation between local unemployment rates and local average test scores in the raw data with scatter plots. Figures 5 and 6 show scatter plots with the county unemployment rate, on the x-axis, and county-level 3rd grade math and ELA scores on the y-axis, respectively. The upper left-hand-side panels of both figures show a clear negative association between contemporaneous unemployment rates and test scores in the pooled sample of county-year observations. Notably, however, the upper right-hand panel shows that when I consider the association between two-year *changes* in unemployment rates and two-year *changes* in test scores in the pooled sample, the association disappears entirely. This suggests that the associations shown in the first graph between unemployment rates and academic achievement are likely due to fixed characteristics of local areas, rather than to time-varying effects of local unemployment rates. The bottom two panels of Figures 5 and 6 show the analogous scatter plots of unemployment rates and the white-Black achievement gap in 3rd grade math and ELA scores. Again, there is almost no visible association, which suggests that achievement gaps between white and Black students are also not sensitive to changes in local economic conditions.

4.3. Regression estimates

4.3.1. Unemployment rates and test score levels in the full SEDA sample

In order to formally estimate the association between local economic conditions and student test scores and achievement gaps, I estimate regressions of the following form:

$$Score_{cy} = \alpha_c + \beta * Unemp_{cy} + \gamma * X_{cy} + \phi_y + \psi_c * t + \epsilon_{cy} \quad (1)$$

where $Score_{cy}$ is the test score outcome for county c in year y, α_c represents a set of county fixed effects, $Unemp_{cy}$ is the annual county unemployment rate from the Bureau of Labor Statistics, X_{cy} represents a set of controls for the socioeconomic and demographic makeup of student test-takers, ϕ_y represents a set of year dummies, ψ_c are county-specific coefficients on a linear time trend, and ϵ represents an individual error term. My coefficient of interest is β, which represents the association between a one percentage-point increase in the local unemployment rate and the test score outcome, controlling for fixed county characteristics, aggregate shocks, and county-specific time trends. The estimates are weighted by the number of student test-takers in each grade, subject, and county. Standard errors are clustered at the county level to account for errors that may be correlated within a county over time.

Table 3 presents results from estimating Equation 1 with math and ELA scores for 3rd and 8th grade test takers as the outcome variables, adding in sets of control variables one at a time. The first column of results shows estimates based on a sample with no fixed effects, demographic controls, or trends—representing simply the associations between unemployment and test scores both across and within counties in the SEDA panel. In the unadjusted data, as in the first panels of scatter plots in Figures 5 and 6, there is a strong negative association between local unemployment rates and test scores. This negative association persists, and even grows, when year fixed effects are added to account for changes in test scores that are common across all counties so that identification comes only from cross-sectional variation within years.

The addition of county fixed effects in the third column of Table 3 changes the identifying variation from *across-county* variation to *within-county* variation (above and beyond shared aggregate shocks). Notably, this addition substantially alters the estimated association between unemployment rates and test scores, changing the coefficient from negative to a positive value and shrinking its size. For 3rd grade math scores,

the coefficient in the full model remains marginally statistically significant, even after adding additional controls, county-specific linear times trends, and state-by-year fixed effects. The coefficient implies that a one percentage-point increases in the county unemployment rate is associated with an increase in a average third grade math scores of 0.005-0.008. These values can be interpreted relative to one standard deviation in the national score distribution, i.e. representing 0.5 to 0.8 percent of a standard deviation in test scores). They imply that the average peak-to-trough unemployment change of around 4 percentage points that occurred during the Great Recession would result in a test score increase of around two percent of a standard deviation. For 8th grade math and both sets of ELA scores, the coefficients are even smaller and insignificant.

In Table 4 I examine whether there is a response to local unemployment shocks in grades other than 3rd or 8th grade. I use my preferred specification, which includes county and year fixed effects, additional controls, and county-specific trends, to estimate the association between county unemployment rates and math and ELA scores for each grade. With the exception of the significant effect on 3rd grade math scores, seen also in the previous table, across all grades in both subjects, the coefficients are all small and insignificant. Taken together, the regression results in Tables 3 and 4 echo the patterns found in the descriptive analysis—while between-county variation in unemployment is negatively associated with student test scores, within-county changes in unemployment are uncorrelated (or slightly positively associated) with overall academic achievement.

4.3.2. Unemployment rates and achievement by race, ethnicity, and socioeconomic status

It is possible that the null results for the full sample might be masking significant and different responses to local economic shocks among subgroups of students. In particular, as described above, it is possible that minority students or students in economically disadvantaged families might experience more-severe repercussions of a local economic downturn. To explore this possibility, Table 5 explores heterogeneity in the association between county unemployment rates and math test scores in 3rd and 8th grade by race/ethnicity and socioeconomic status ("economically disadvantaged" (ECD) vs. "non-economically-disadvantaged (NEC).) The table shows *positive* effects of increasing unemployment on math and ELA test scores for black students and non-economically-disadvantaged students in the third grade. These positive effects could potentially reflect substitution effects—changes in employment and the opportunity cost of home production time may

increase the amount of time that parents invest in children during an economic downturn. Alternatively, there could be improvements in teacher quality that result from the recession labor market.

In Table 6, I look at the effects of changes in unemployment rates on 3rd grade test scores for economically disadvantaged and non-disadvantaged students, comparing estimated effects across four categories of urban density: mostly urban, mostly suburban, mostly town, and mostly rural. In particular, I an interested in learning whether there are negative effects of economic downturns on achievement in especially-urban or especially-rural counties, or if the improvements in achievement for more-advantaged students that we observe for the full sample are concentrated in dense or rural counties. I find that the improvements in test scores for more-advantaged students with increases in local unemployment are concentrated in urban and suburban areas. While the results are less precisely estimated due to smaller sample sizes, I see larger coefficients in more-dense areas and several are statistical significant. Notably, I again do not see any evidence that economically disadvantaged students were hurt by increases in unemployment at any level of density.

Finally, I directly estimate the effects of local unemployment shocks on achievement gaps by race/ethnicity and socioeconomic status in Table 7. Despite the improvement in 3rd grade scores among black students in Table 5, I do not see robust evidence of any significant association between changes in local unemployment and gaps in test scores between white and Black students. I do see, however, that the improvement in scores economically advantaged students seen in the previous two tables translates into increases in the achievement gap between advantaged and disadvantaged students. In particular, I find that a one percentage-point increase in unemployment is associated with a 0.008 standard deviation increase in the achievement gap between advantaged and disadvantaged students on 3rd grade math exams—a 1.2 percent increase relative to the baseline gap of 0.649. The effects in 8th grade and on ELA scores are smaller in both absolute and relative terms, but still positive and statistically significant. I also see weak evidence in Table 7 of increases in the gap in ELA scores between white and Hispanic students in 3rd grade.

We zoom in on the estimated effects of changes in unemployment on achievement gaps in Appendix Tables A1, A2, and A3, estimating the full range of model specifications for each gap measure. In Table A1 I see that for the white-Black gap, there is a negative association in the pooled data between the local unemployment rate and the white-Black gap, but when county fixed effects are added, that association disappears and remains small and insignificant across the remaining columns. In Table A2, the association similarly

flips from negative to positive with the addition of county fixed effects (though the coefficient is less stable in columns 1 and 2), and remains positive and weakly significant for 3rd grade scores, even as additional controls are added. This suggests that increasing unemployment rates are associated with deterioration of the test scores of Hispanic 3rd grade students, relative to their white peers. This association disappears by 8th grade, however. Finally, I show in Table A3 that the positive association between unemployment rates and the advantaged-disadvantaged gap is present across specifications once county fixed effects are included, but is not robust to the inclusion of state-by-year fixed effects.

Taken together, my results show that, while there are strong cross-sectional associations between area unemployment and student test score levels, *changes* in unemployment rates within counties over time do not lead to significant corresponding changes in average test scores for most groups of students. There are some exceptions, such as the improvement in test scores for advantaged students in urban and suburban areas, which translates into increases in test score gaps between advantaged and disadvantaged students when local unemployment increases. There is also some evidence that increasing unemployment is associated with increases in white-Hispanic score gaps.

5. Conclusion

In this study, I use nationwide county-level achievement data from the Stanford Educational Data Archive to examine the contributions of local economic downturns to changes over time in local average test scores for different groups of students and in achievement gaps by race, ethnicity, and socioeconomic status. The SEDA provides a unique opportunity for my analysis because it includes detailed information on test scores for counties across the nation that are standardized so as to be comparable across areas and over time. In order to complement previous studies that have linked economic factors such as poverty and unemployment to average student achievement in the cross-section, I use a panel data approach. In particular, I use regression models that include both county and year fixed effects so that my estimates are identified based on variation in unemployment rates within counties over the sample period, while controlling for aggregate shocks common to all students.

My results are striking. The strong negative association between economic conditions and test scores seen in the pooled sample evaporates when county fixed effects are added to the regression models and the

coefficients for almost every subgroup and sample become near zero or even slightly positive. This suggests that while unemployment and earnings may be important determinants of achievement, cylical variation in local economic conditions does not lead to deterioration in test scores, even among disadvantaged students. Instead, I find that increases in unemployment are, if anything, associated with *improvements* in test performance for more-advantaged students. This result, which is concentrated in urban and suburban areas, is consistent with possible substitution effects, if parents commit more time to investing in their children when economic opportunities are weak, or improvements in school or teacher quality during a local recession.

The results from my study are perhaps surprising in light of (1) the large literature that establishes a negative association between adverse economic outcomes and students' academic achievement in the cross-section, (2) previous research showing that Black and Hispanic and less-educated workers experience more severe impacts of economic downturns, and (3) the many theoretical mechanisms through which exogenous shocks to employment, wages, and economic stability might be expected to affect student academic performance. However, previous work has shown that achievement gaps by race and ethnicity have remained remarkably constant over time despite dramatic changes in economic output, inequality, and the structure of the labor market (Hanushek et al., 2020), and other studies have shown that parental education, local segregation, and school SES composition are far more important predictors of achievement than unemployment and individual family income (Reardon, Kalogrides and Shores (2019); Reardon (2016); Hung et al. (2020); Häkkinen, Kirjavainen and Uusitalo (2003)). My results also provide useful context for recent papers by Shores and Steinberg (2019) and Jackson, Wigger and Xiong (2021) showing that changes in school funding and school quality during the pandemic had adverse effects on the students and districts for whom those changes were concentrated during the Great Recession. In particular, these results show that while some students and districts experienced adverse effects, there is not a measurable negative correspondence between local area unemployment rates and contemporaneous scores, even for the most disadvantaged groups, or achievement gaps by race/ethnicity and socioeconomic status. Evans, Schwab and Wagner (2019) provide some useful points for interpretation these findings—though certain areas and students were hit particularly hard in terms of funding loss, they find that state funding losses were largely mitigated by increases in property tax rates and federal government spending.

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Figure 1: Unemployment Rates, by Quartile of Trough-to-Peak Unemployment Change

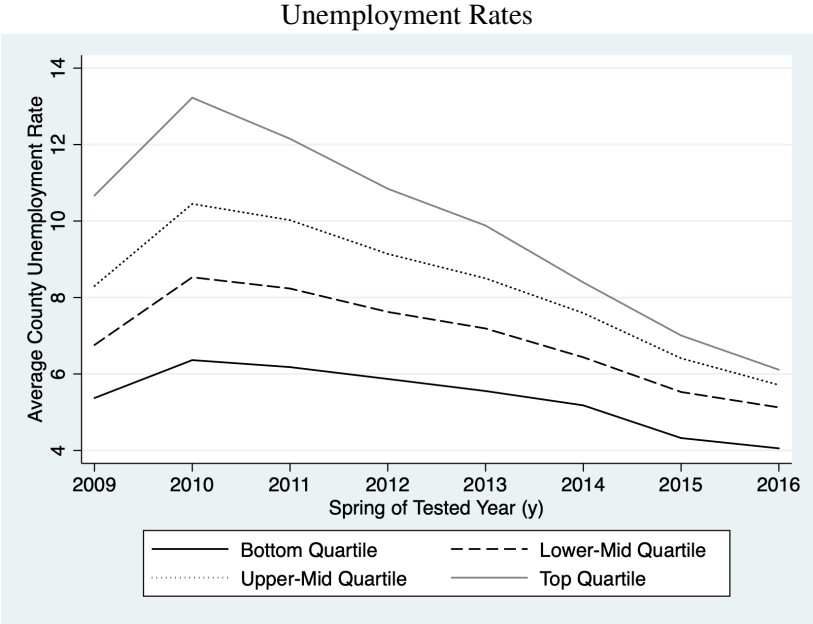


Figure 2: Academic Achievement, by Quartile of Trough-to-Peak Unemployment Change

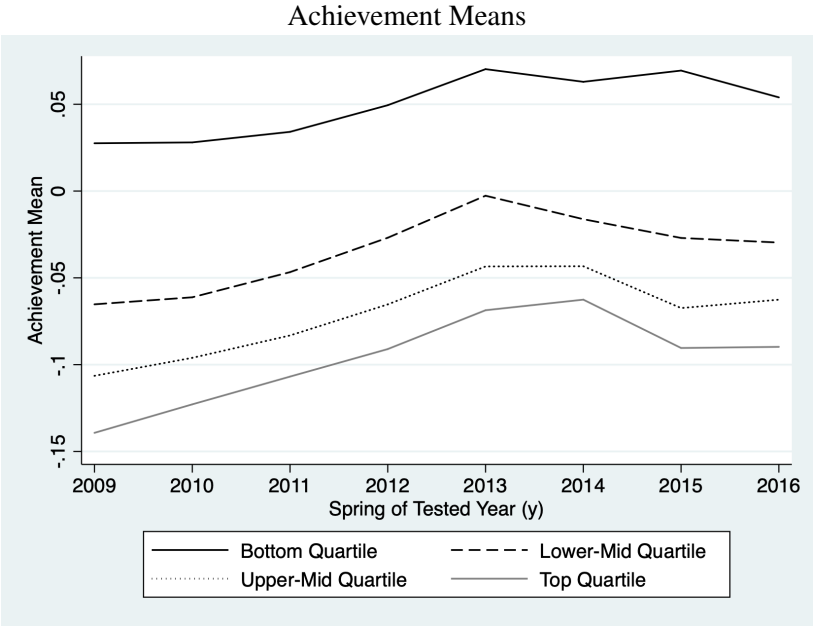


Figure 3: Achievement Means by Race, Ethnicity, and Socioeconomic Status

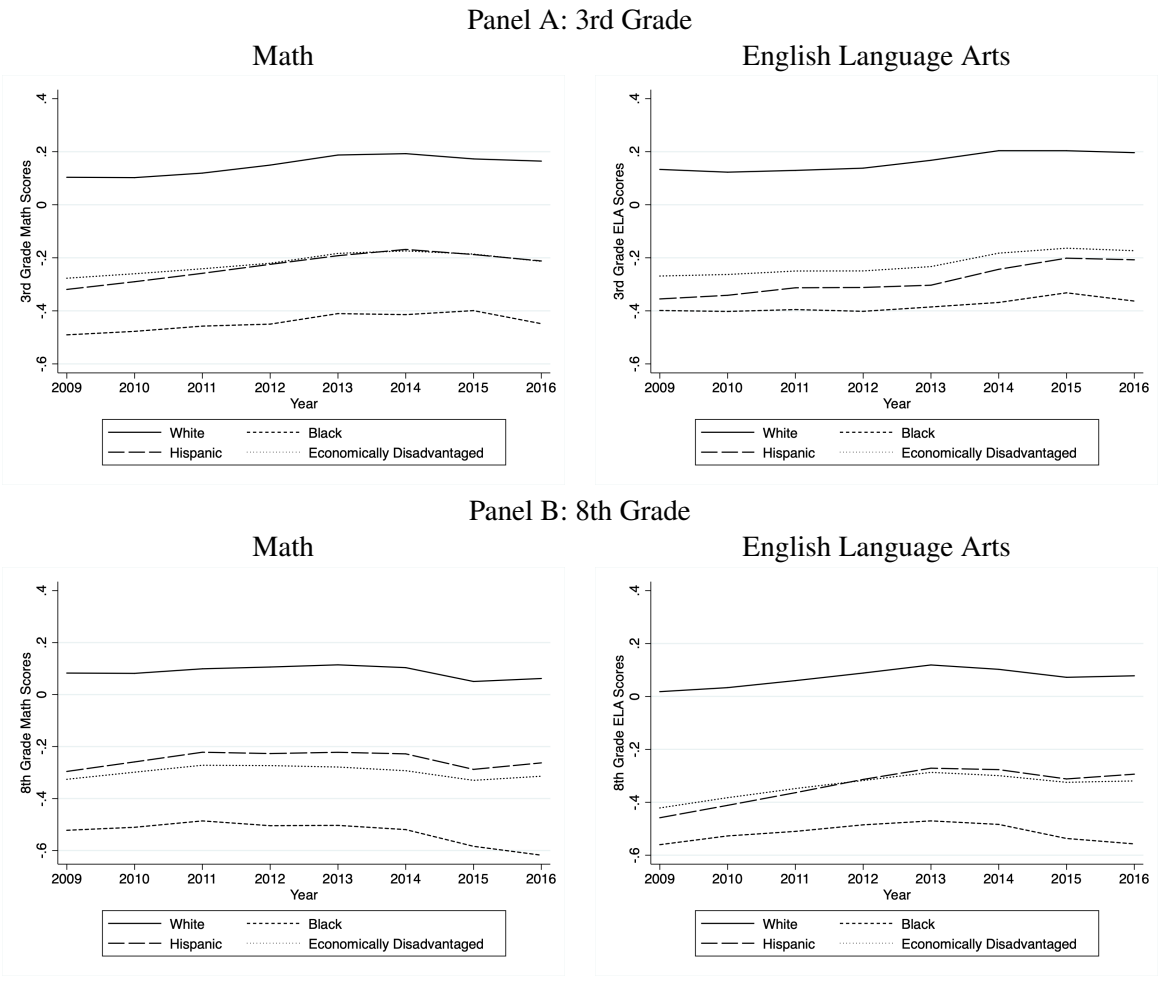


Figure 4: Achievement Gaps by Race, Ethnicity, and Socioeconomic Status

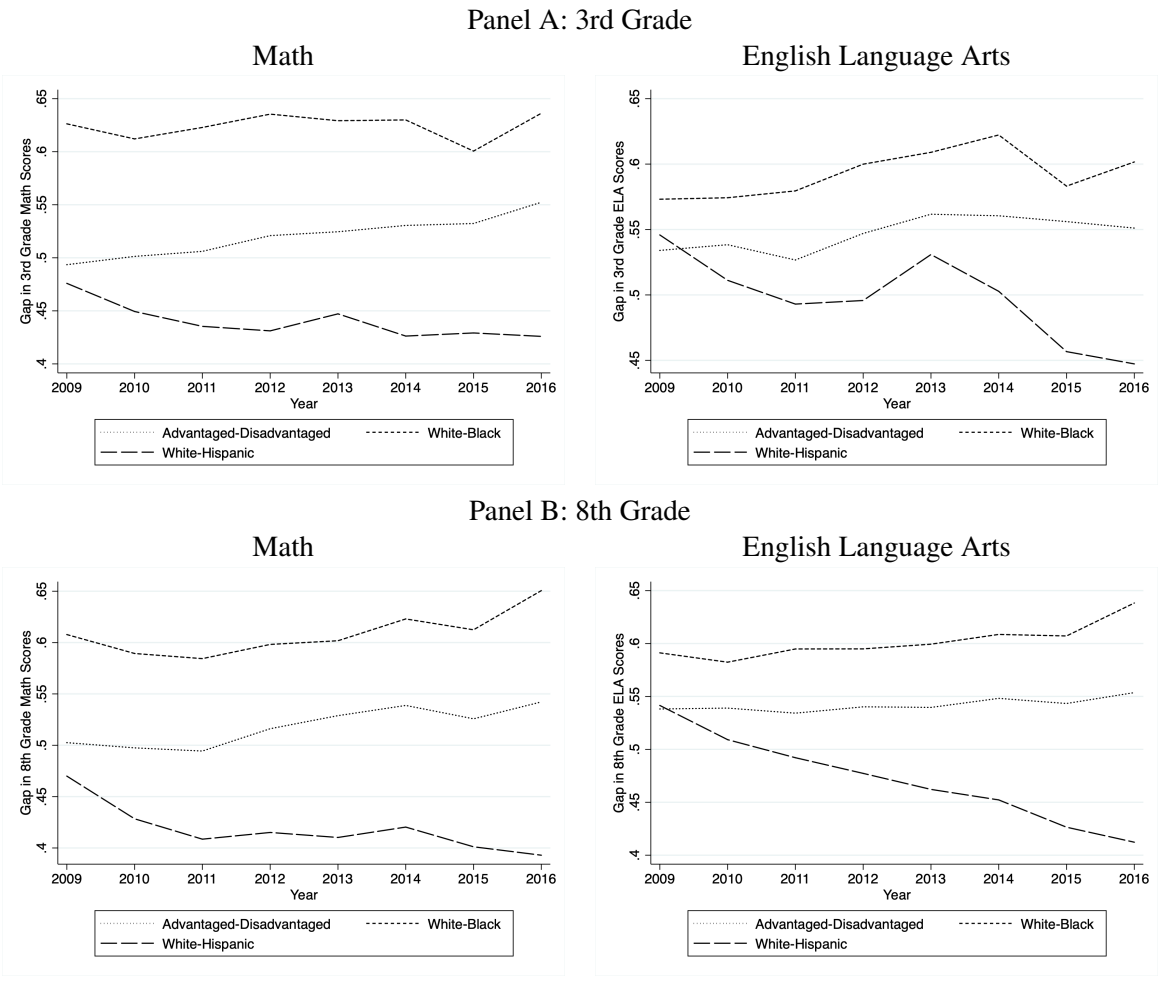
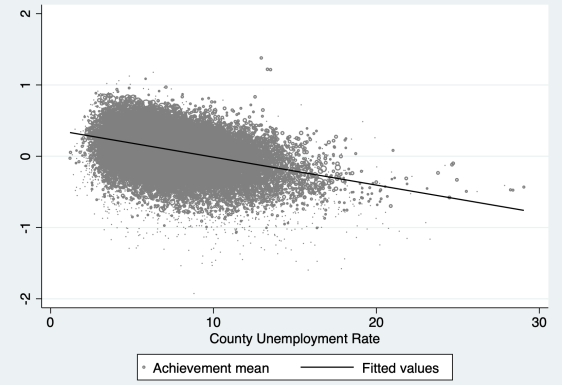


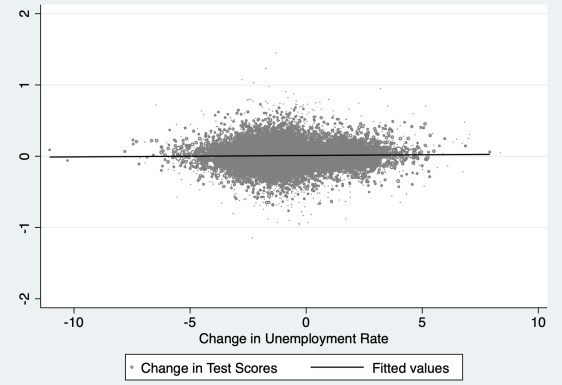
Figure 5: County Unemployment Rates and 3rd Grade Math Scores

Panel A: Full Sample Scores

Current unemployment rate

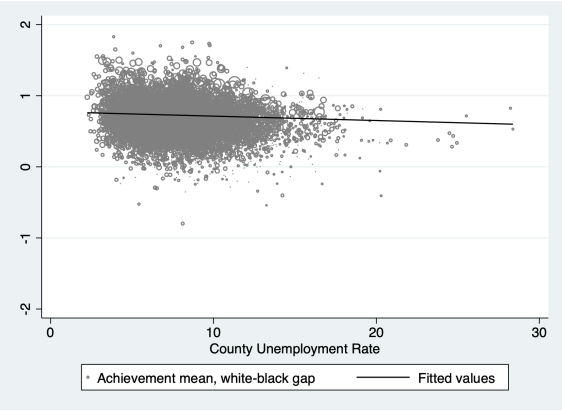


Two-year change in unemployment rate



Panel B: White-Black Gap

Current unemployment rate



Two-year change in unemployment rate

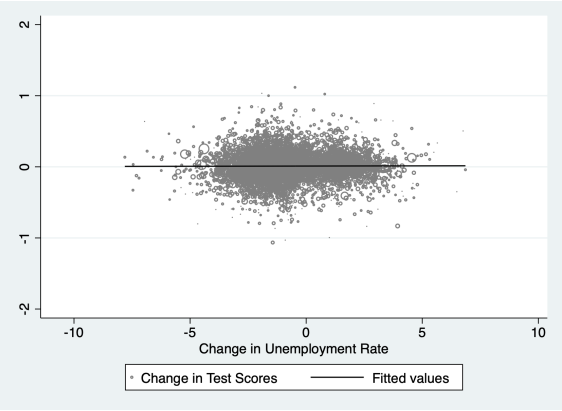
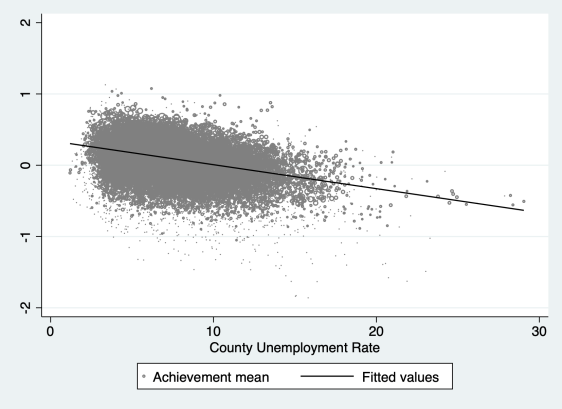


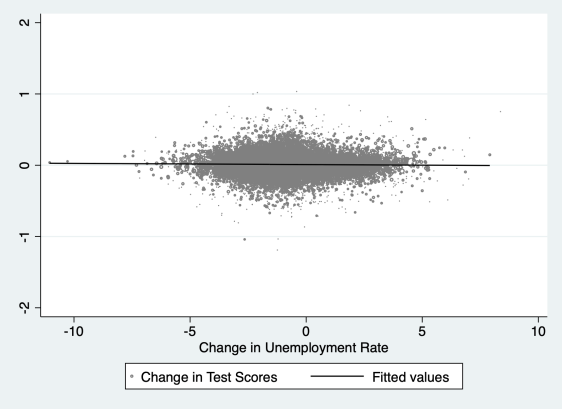
Figure 6: County Unemployment Rates and 3rd Grade ELA Scores

Panel A: Full Sample Scores

Current unemployment rate

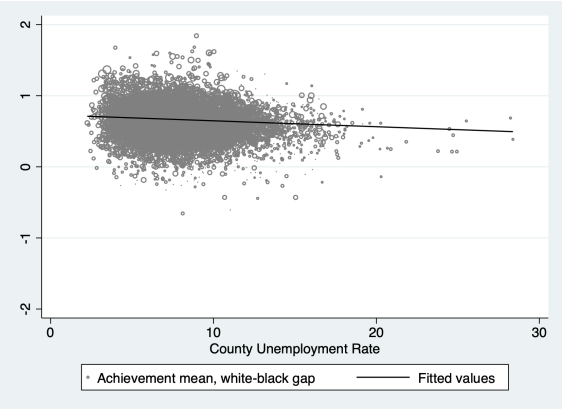


Two-year change in unemployment rate



Panel B: White-Black Gap

Current unemployment rate



Two-year change in unemployment rate

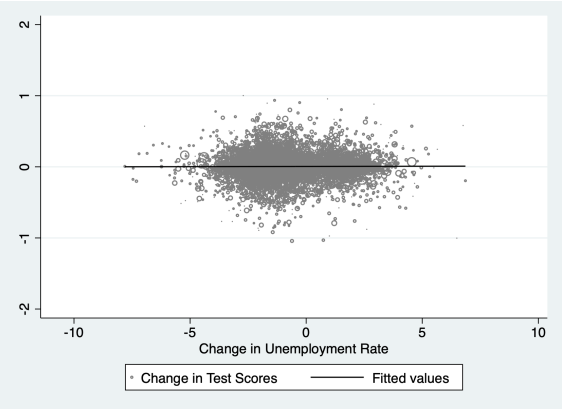


Table 1: Pooled County Sample Means

County Unemployment Rate	7.70
Peak to Trough Change in Unemployment	4.06
Percent white	0.71
Percent black	0.12
Percent Hispanic	0.12
Percent free or reduced price lunch	0.57
Parents with BA+, share of white students	0.22
Parents with BA+, share of black students	0.13
Parents with BA+, share of Hispanic students	0.10
Poverty rate, white students	0.13
Poverty rate, black students	0.29
Poverty rate, Hispanic students	0.25
Parent unemployment rate, white students	0.07
Parent unemployment rate, black students	0.14
Parent unemployment rate, Hispanic students	0.08
Single mother, share of white students	0.13
Single mother, share of black students	0.41
Single mother, share of Hispanic students	0.20
SES Composite, white-black gap	2.34
SES Composite, white-Hispanic gap	1.28
Observations	22087

Table 2: County Achievement Means

Math			
	All Grades	3rd Grade	8th Grade
Achievement mean	-0.04	-0.00	-0.04
Achievement mean, white	0.10	0.15	0.09
Achievement mean, black	-0.50	-0.45	-0.52
Achievement mean, Hispanic	-0.25	-0.23	-0.25
Achievement mean, non-economically-disadvantaged	0.26	0.31	0.23
Achievement mean, economically-disadvantaged	-0.27	-0.22	-0.30
Achievement mean, white-black gap	0.62	0.62	0.60
Achievement mean, white-Hispanic gap	0.43	0.44	0.42
Achievement mean, economic disadvantage gap	0.52	0.52	0.51
Observations	123718	22095	18111
English Language Arts			
	All Grades	3rd Grade	8th Grade
Achievement mean	-0.04	0.00	-0.08
Achievement mean, white	0.11	0.16	0.07
Achievement mean, black	-0.46	-0.38	-0.52
Achievement mean, Hispanic	-0.32	-0.29	-0.34
Achievement mean, non-economically-disadvantaged	0.27	0.33	0.21
Achievement mean, economically-disadvantaged	-0.29	-0.23	-0.34
Achievement mean, white-black gap	0.60	0.59	0.60
Achievement mean, white-Hispanic gap	0.49	0.50	0.48
Achievement mean, economic disadvantage gap	0.55	0.55	0.54
Observations	133122	22317	21885

Table 3: County Unemployment Rates and Student Achievement

	3rd Grade Math					
County Unemployment Rate	-0.039**	-0.056**	0.009**	0.008**	0.005*	0.006**
	(0.002)	(0.004)	(0.003)	(0.003)	(0.002)	(0.002)
	3rd Grade English Language Arts					
County Unemployment Rate	-0.036**	-0.046**	0.006**	0.003	0.002	0.003
	(0.003)	(0.005)	(0.002)	(0.002)	(0.001)	(0.002)
	8th Grade Math					
County Unemployment Rate	-0.035**	-0.058**	0.003	0.002	0.003*	0.003
	(0.003)	(0.005)	(0.002)	(0.002)	(0.002)	(0.002)
	8th Grade English Language Arts					
County Unemployment Rate	-0.038**	-0.051**	-0.001	-0.001	-0.000	0.000
	(0.003)	(0.004)	(0.002)	(0.001)	(0.001)	(0.002)
Year Fixed Effects	No	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	No	No	Yes	Yes	Yes	Yes
Additional Controls	No	No	No	Yes	Yes	Yes
County-Specific Trends	No	No	No	No	Yes	No
State-by-Year Effects	No	No	No	No	No	Yes

Notes: Counties are weighted by the number of student test takers in each grade and subject. Robust standard errors which allow for clustering at the county level are shown in parentheses. Significance at 1% and 5% levels are indicated by **, and *, respectively.

Table 4: County Unemployment Rates and Student Achievement, All Grades

	Math					
Grade	3rd	4th	5th	6th	7th	8th
County Unemployment Rate	0.005*	0.002	-0.000	0.001	0.000	0.003*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Mean	0.011	-0.003	-0.014	-0.021	-0.007	0.001
	English Language Arts					
Grade	3rd	4th	5th	6th	7th	8th
County Unemployment Rate	0.002	0.001	0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mean	0.011	-0.003	-0.014	-0.021	-0.007	0.001

Notes: All regressions include county and year fixed effects, county-specific linear trends, and controls for fractions white, Black, and Hispanic, fraction free and reduced price lunch, and fraction English-language learners. Counties are weighted by the number of student test takers in each grade and subject. Robust standard errors which allow for clustering at the county level are shown in parentheses. Significance at 1% and 5% levels are indicated by **, and *, respectively.

Table 5: County Unemployment Rates and Student Achievement, by Group

	3rd Grade Math				
	White	Black	Hispanic	NEC	ECD
County Unemployment Rate	0.000	0.007*	0.003	0.008**	0.004
	(0.002)	(0.004)	(0.006)	(0.002)	(0.003)
Mean	0.085	-0.066	-0.043	0.095	-0.034
	3rd Grade English Language Arts				
	White	Black	Hispanic	NEC	ECD
County Unemployment Rate	-0.000	0.009**	-0.002	0.006**	0.003
	(0.001)	(0.003)	(0.004)	(0.002)	(0.002)
Mean	0.093	-0.041	-0.073	0.094	-0.028
	8th Grade Math				
	White	Black	Hispanic	NEC	ECD
County Unemployment Rate	0.001	0.004	0.005	0.006**	0.002
	(0.001)	(0.003)	(0.003)	(0.002)	(0.002)
Mean	0.072	-0.124	-0.020	0.084	-0.052
	8th Grade English Language Arts				
	White	Black	Hispanic	NEC	ECD
County Unemployment Rate	0.000	-0.001	-0.005	0.002	0.001
	(0.001)	(0.002)	(0.003)	(0.001)	(0.002)
Mean	0.031	-0.139	-0.140	0.029	-0.107

Notes: All regressions include county and year fixed effects, county-specific linear trends, and controls for fractions white, Black, and Hispanic, fraction free and reduced price lunch, and fraction English-language learners. Counties are weighted by the number of student test takers in each county-group-grade-subject cell. Robust standard errors which allow for clustering at the county level are shown in parentheses. Significance at 1% and 5% levels are indicated by **, and *, respectively.

Table 6: Unemployment Rates and 3rd Grade Achievement, by Socioeconomic Status and Density

	Mostly Urban			
	Advantaged		Disadvantaged	
Grade	Math	ELA	Math	ELA
County Unemployment Rate	0.007	0.018**	0.010	0.010
	(0.008)	(0.007)	(0.010)	(0.007)
Mean	0.391	0.408	-0.323	-0.338
	Mostly Suburban			
	Advantaged		Disadvantaged	
Grade	Math	ELA	Math	ELA
County Unemployment Rate	0.010*	0.010**	-0.001	0.009*
	(0.005)	(0.004)	(0.005)	(0.004)
Mean	0.458	0.487	-0.246	-0.220
	Mostly Town			
	Advantaged		Disadvantaged	
Grade	3rd	8th	3rd	8th
County Unemployment Rate	0.007	0.003	-0.000	0.001
	(0.004)	(0.003)	(0.003)	(0.002)
Mean	0.375	0.398	-0.205	-0.201
	Mostly Rural			
	Advantaged		Disadvantaged	
Grade	3rd	8th	3rd	8th
County Unemployment Rate	0.004	0.003	-0.000	-0.001
	(0.003)	(0.002)	(0.003)	(0.002)
Mean	0.369	0.406	-0.201	-0.188

Notes: All regressions include county and year fixed effects, county-specific linear trends, and controls for fractions white, Black, and Hispanic, fraction free and reduced price lunch, and fraction English-language learners. Across the three panels, counties are weighted by the number of student test takers county-grade-subject (respectively). Robust standard errors which allow for clustering at the county level are shown in parentheses. Significance at 1% and 5% levels are indicated by **, and *, respectively.

Table 7: Unemployment Rates and Achievement Gaps by Race, Ethnicity, and Socioeconomic Status

	White-Black Gap			
	Math		ELA	
Grade	3rd	8th	3rd	8th
County Unemployment Rate	0.002	-0.003	0.001	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)
Mean	0.779	0.778	0.739	0.739
	White-Hispanic Gap			
	Math		ELA	
Grade	3rd	8th	3rd	8th
County Unemployment Rate	0.008	-0.002	0.010*	0.004
	(0.005)	(0.003)	(0.005)	(0.003)
Mean	0.588	0.593	0.666	0.661
	Economically Advantaged-Disadvantaged Gap			
	Math		ELA	
Grade	3rd	8th	3rd	8th
County Unemployment Rate	0.008**	0.004*	0.007**	0.003*
	(0.002)	(0.002)	(0.002)	(0.002)
Mean	0.649	0.603	0.686	0.654

Notes: All regressions include county and year fixed effects, county-specific linear trends, and controls for fractions white, Black, and Hispanic, fraction free and reduced price lunch, and fraction English-language learners. Across the three panels, counties are weighted by the number of Black, Hispanic, and economically disadvantaged student test takers county-grade-subject (respectively). Robust standard errors which allow for clustering at the county level are shown in parentheses. Significance at 1% and 5% levels are indicated by **, and *, respectively.

Figure A1: Share of Test Takers by Race and Ethnicity and Socioeconomic Status

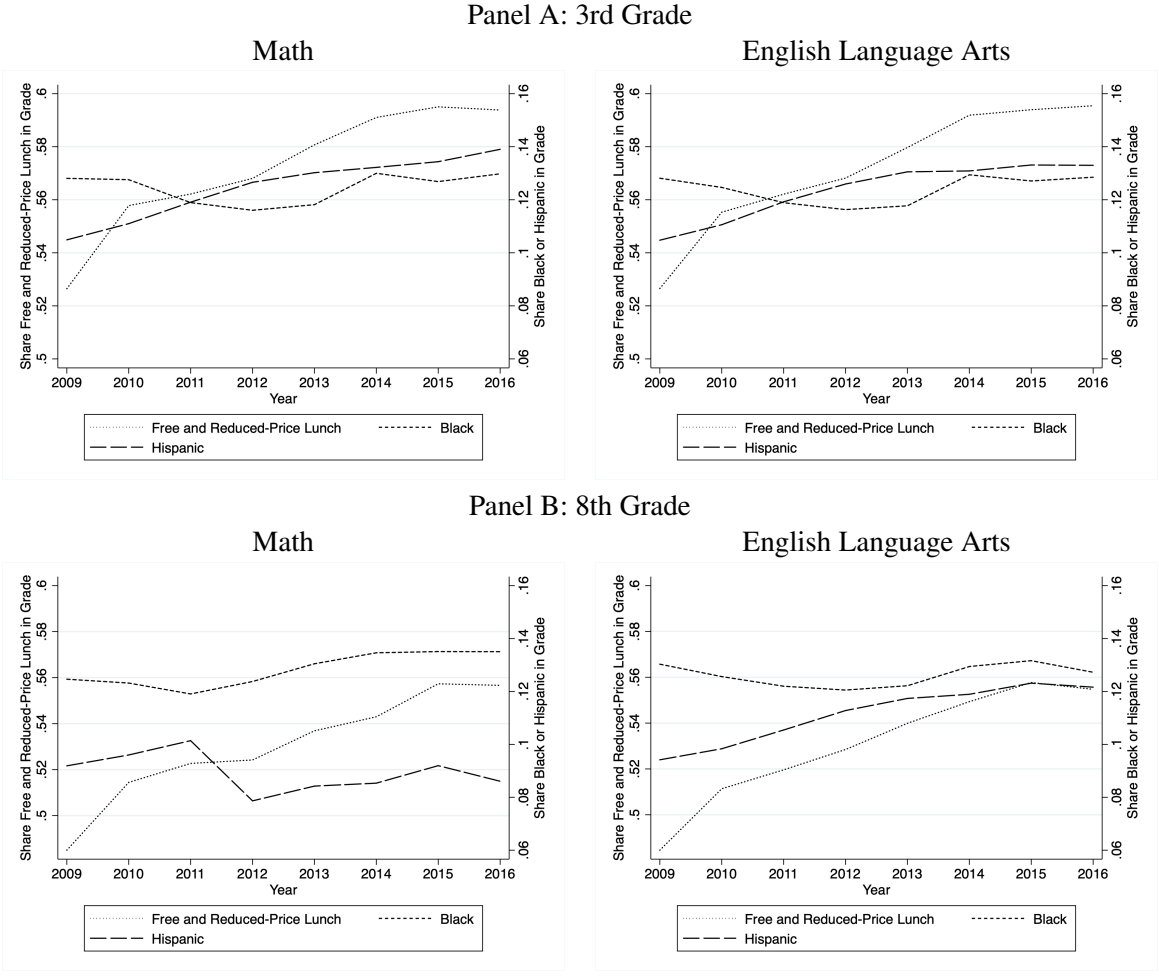


Table A1: County Unemployment Rates and the Achievement Gap between White and Black Students

	3rd Grade Math					
County Unemployment Rate	-0.010*	-0.013*	0.008	0.004	0.002	0.001
	(0.004)	(0.006)	(0.006)	(0.005)	(0.003)	(0.004)
	3rd Grade English Language Arts					
County Unemployment Rate	-0.014**	-0.018**	0.002	0.002	0.002	-0.004
	(0.004)	(0.005)	(0.003)	(0.004)	(0.003)	(0.004)
	8th Grade Math					
County Unemployment Rate	-0.022**	-0.029**	-0.004	-0.005	-0.003	0.005
	(0.004)	(0.006)	(0.004)	(0.004)	(0.003)	(0.004)
	8th Grade English Language Arts					
County Unemployment Rate	-0.012**	-0.015**	0.005	0.000	-0.001	0.001
	(0.004)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)
Year Fixed Effects	No	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	No	No	Yes	Yes	Yes	Yes
Additional Controls	No	No	No	Yes	Yes	Yes
County-Specific Trends	No	No	No	No	Yes	No
State-by-Year Effects	No	No	No	No	No	Yes

Notes: Counties are weighted by the number of student test takers in each county-group-grade-subject. Robust standard errors which allow for clustering at the county level are shown in parentheses. Significance at 1% and 5% levels are indicated by **, and *, respectively.

Table A2: County Unemployment Rates and the Achievement Gap between White and Hispanic Students

	3rd Grade Math					
County Unemployment Rate	-0.001	-0.004	0.012*	0.010*	0.008	0.013**
	(0.003)	(0.005)	(0.005)	(0.005)	(0.005)	(0.003)
	3rd Grade English Language Arts					
County Unemployment Rate	0.004	0.002	0.007	0.009*	0.010*	0.010*
	(0.004)	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)
	8th Grade Math					
County Unemployment Rate	-0.009*	-0.011*	0.005	-0.000	-0.002	0.004
	(0.004)	(0.005)	(0.003)	(0.003)	(0.003)	(0.004)
	8th Grade English Language Arts					
County Unemployment Rate	0.002	-0.004	0.012**	0.004	0.004	0.011*
	(0.005)	(0.006)	(0.004)	(0.003)	(0.003)	(0.005)
Year Fixed Effects	No	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	No	No	Yes	Yes	Yes	Yes
Additional Controls	No	No	No	Yes	Yes	Yes
County-Specific Trends	No	No	No	No	Yes	No
State-by-Year Effects	No	No	No	No	No	Yes

Notes: Counties are weighted by the number of student test takers in each county-group-grade-subject. Robust standard errors which allow for clustering at the county level are shown in parentheses. Significance at 1% and 5% levels are indicated by **, and *, respectively.

Table A3: County Unemployment Rates and the Achievement Gap between Economically-Advantaged and Disadvantaged Students

	3rd Grade Math					
County Unemployment Rate	-0.004	-0.004	0.018**	0.011**	0.007**	0.003
	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)	(0.002)
	3rd Grade English Language Arts					
County Unemployment Rate	-0.002	-0.002	0.011**	0.006**	0.004*	-0.000
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
	8th Grade Math					
County Unemployment Rate	-0.016**	-0.016**	0.014**	0.005*	0.004*	0.003
	(0.003)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)
	8th Grade English Language Arts					
County Unemployment Rate	-0.007*	-0.008*	0.012**	0.003	0.002	0.002
	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)
Year Fixed Effects	No	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	No	No	Yes	Yes	Yes	Yes
Additional Controls	No	No	No	Yes	Yes	Yes
County-Specific Trends	No	No	No	No	Yes	No
State-by-Year Effects	No	No	No	No	No	Yes

Notes: Counties are weighted by the number of student test takers in each county-group-grade-subject. Robust standard errors which allow for clustering at the county level are shown in parentheses. Significance at 1% and 5% levels are indicated by **, and *, respectively.