Are GPAs an Inconsistent Measure of College Readiness across High Schools? Examining Assumptions about Grades versus Standardized Test Scores

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ABSTRACT

High school GPAs (HSGPAs) are often perceived to represent inconsistent levels of readiness for college across high schools, while test scores (e.g., ACT scores) are seen as comparable. This study tests those assumptions, examining variation across high schools of both HSGPAs and ACT scores as measures of academic readiness for college. We find students with the same HSGPA or the same ACT score graduate at very different rates based on which high school they attended. Yet, the relationship of HSGPAs with college graduation is strong and consistent, and larger than school effects. In contrast, the relationship of ACT scores with college graduation is weak, smaller than high school effects, and the slope of the relationship varies by high school.

High school course grades are critical indicators of academic performance for students, educators, and institutions of higher education. Yet, standardized test scores are often seen as more reliable and objective indicators of academic preparation than students' grades because all students are judged based on the same tasks under the same conditions. All states use standardized tests to judge students' progress toward college readiness goals, with 45 states using ACT or SAT scores (Nayar, 2015). The use of standardized test scores to monitor students' college readiness is recommended clearly in the *What Works Clearinghouse Practice Guide* on how to prepare students for college, while HSGPAs are discussed as one piece of performance data to consider, along with curriculum and assessments (Tierney, Bailey, Constantine, Finkelstein, & Hurd, 2009). A key assumption behind the emphasis on test scores in policy and practice is that college entrance exams are strong and consistent measures of readiness. Yet, the emphasis on test scores over grades in policy and practice recommendations stands in contrast to research showing high school grade point averages (HSGPAs) are stronger predictors than test scores of college outcomes (Bowen, Chingos, & McPherson, 2009; Geiser & Santelices, 2007; Hiss & Franks, 2014; Kobrin, Patterson, Shaw, Mattern, & Barbuti, 2008).

In this study, we directly address questions about the variability in HSGPAs across high schools as predictors of college readiness, examining whether students with the same HSGPAs are systematically more likely to graduate college if they came from particular high schools, and whether the slope of the relationship differs by high school. We then conduct the same tests with ACT scores. We also discern the extent to which there are high school effects on college graduation that are not captured in either students' HSGPAs or ACT scores.

Prior Literature on the Reliability of Course Grades across Schools and Validity of Tests

Numerous publications give the impression that course grades are not reliable measures of achievement in comparison with test scores. For example, the introduction of a new book on testing and college admissions states:

> ...standardized admissions tests provide a neutral yardstick to assess the performance and promise of students from secondary schools whose course offerings differ sidely in variety and rigor. This is a particularly salient point in an era of widespread grade inflation … (Buckley, Letukas, & Wildavsky, 2018).

Likewise, the introduction of a new report by the Fordham Foundation expresses concern that teachers' grades do not reflect state standards, and wonders how to help parents put more faith in test scores as measures of their students' readiness instead of relying so much on grades (Northern & Petrilli, 2018). These documents reflect current beliefs, which are echoed in the emphasis placed on test scores in policy and in practice recommendations, described above, and often inferred without strong evidence in research studies. However, the evidence is not strong for these beliefs, as described below.

Grades can be seen as non-comparable across schools because they are based on criteria developed by individual teachers, in schools with different curricula. Grades are assigned based on a potentially wide-ranging array of tasks, measured over time, capturing academic knowledge, skills, and academic behaviors, effort, and incorporating teacher judgement. (Bowers, 2011; Brookhart, 1993; Brookhart et al., 2016; Farkas, Sheehan, Grobe, & Shuan, 1990; Kelly, 2008). The fact that grades are based on a wide range of factors, with judgement from many different teachers, makes them potentially highly variable across contexts.

At the same time, the fact that they are based on a large number of raters (teachers) across a wide range of relevant tasks, could actually make them very reliable as indicators of academic readiness for college, where students will also be asked to do a wide range of tasks with different expectations, assessed by many different instructors.

There is no reason to believe *a priori* that tests would necessarily be more reliable than grades as predictors of college performance. Standardized tests assess students on a narrow range of skills (mostly a subset of what students learn in English and math classes) in one type of condition (a timed test), while colleges expect students to have broad knowledge and skills across many subjects, and to show consistent effort in different types of assignments over months at a time. Schools could prepare students for the tests in very different ways (see Koretz, 2017), with different implications for their students' readiness for college.

Moderate correlations with test scores are often used as evidence of unreliability in grades. People sometimes make the argument that grades are "inflated" or "subjective" based on evidence that HSGPAs have increased over time, without concurrent changes in test scores (Camara, Kimmel, Scheuneman, Sawtell, 2004; Gershenson, 2018; Godfrey, 2011; Hurwitz & Lee, 2018), or that students with the same test scores have different HSGPAs at different schools (U.S. Department of Education, 1994; Woodruff & Ziomek, 2004). Pattison, Grodsky, and Muller (2013) describe some of the conceptual flaws in the argument that grades should align tightly with standardized test scores, and suggest focusing instead on the predictive validity of each for later outcomes.

Evidence about the validity of standardized test scores as measures of college readiness has its own weaknesses, making it questionable to use standardized tests as a metric for judging the reliability of grades. SAT and ACT validitation studies tend to be based on improvement in the prediction of college freshman GPAs when test scores are used together with student-reported HSGPA, relative to models that use student-reported HSGPA alone (e.g., Kobrin, et al., 2008; Noble & Sawyer, 2002; Woodruff & Ziomek, 2004). Researchers argue that because the test scores improve the prediction of college freshman GPAs over and above student-reported HSGPAs, they are valid indicators to adjust for inconsistencies in HSGPAs. However, student-reported HSGPAs are more weakly correlated with college freshman GPAs than unweighted HSGPAs taken from transcripts (Geiser & Santelices, 2006; Kuncel, Credé, & Thomas, 2005; Zwick & Himelfarb, 2011); the studies likely over-estimate the value that test scores provide.

Studies based more heavily on HSGPAs from transcripts than student reports suggest test scores provide little improvement in the prediction of college outcomes. Using data from a large sample of colleges across the country, Bowen, Chingos, and McPherson (2009) found the relationship of SAT and ACT scores with college outcomes was small and sometimes not significant (depending on institution type), controlling for HSGPAs, comparing students in the same colleges. In contrast, HSGPAs had a strong relationship with college outcomes controlling for students' test scores. Hiss and Franks (2014) concluded that students in test-optional colleges who did not submit test scores had similar or better college outcomes than students in the same colleges with similar HSGPAs who did submit scores, even though their scores on standardized tests were much lower. Using data from California universities, Rothstein (2004) found that most of the relationship of SAT scores with college GPA could be attributed to high school poverty, school racial composition, and student background.

Grades are lower in harder classes with stronger peers, and this suggests inconsistency in HSGPAs. A number of studies have discerned what are called "frogpond" effects (Attewell, 2001), where students with similar prior test scores, academic performance, or effort receive lower grades in classrooms and schools of predominantly high-achieving students, as compared to those with lower-achieving students (Farkas et al., 1990; Nomi & Allensworth, 2009; Barrow, Sartain, & de la Torre, 2016). Students also tend to get lower grades in classes that are intentionally designed to be challenging, such as Advanced Placement and Honors courses (Sadler & Tai, 2007).

Differences in the types of classes that students take, and the expectations associated with the peer composition, introduce "noise" into the metric of HSGPAs as an indicator of academic performance in high school. ACT and SAT validity studies claim that students' test scores can be used to adjust for different standards and expectations at different schools. There is a need to evaluate that claim using data on HSGPAs from transcripts. It is possible that the overall achievement level in a student's school—information that is publicly available—might be just as useful, or more useful, than individual student's test scores. Two prior studies note that the size of the relationship between HSGPA and college outcomes (graduation or college GPAs) is larger among students within the same high school (i.e., when high school fixed effects are used in a model), than across schools (Bowen et al., 2009; Koretz & Langi, 2018). They interpret this as meaning that HSGPA represents a higher level of achievement at some schools than others, which would be consistent with the "frogpond" effects discussed above, and suggest adjusting for these differences with information on school average achievement.

Different college outcomes for student subgroups with the same HSGPAs have been used as evidence of different grading standards. Other studies have suggested that HSGPAs are inconsistent measures of achievement across high schools because HSGPAs predict that Black and Latino students, and students from low-SES high schools, will receive higher college grades than they actually do (Zwick & Himelfarb, 2011; Zwick, 2013). The researchers suggest that this discrepancy results from differences in the quality of high schools attended by students, and show that school average poverty, used as a proxy for school quality, accounts for some of the differences. They do not conduct equivalent tests of SAT scores to see if similar or larger discrepancies by race or school poverty would occur with prediction models that use SAT scores alone. They also find discrepancies to be much smaller when they use HSGPAs from transcripts, rather than student-reported HSGPAs. Their arguments hold if one is to believe that race, ethnicity, and SES do not affect college success in ways unrelated to acacemic readiness. There are many reasons to believe this is not true, and studies have shown that SAT and ACT scores also overpredict college performance for the same groups (Noble, 2004; Bridgeman, McCamley-Jenkins, & Ervin, 2000; Rothstein, 2004). However, this does suggest that it is important to compare students with similar backgrounds when evaluating the validity of HSGPAs or test scores as indicators of college readiness, and suggests there may be high school effects on students' college outcomes that need to be better understood.

High schools could effect college outcomes in many ways that are not reflected in either students' HSGPA or test performance. For example, high schools might develop structures to prepare students with more "college knowledge" to navigate the post-secondary realm (Hoxby & Turner, 2015; Conley, 2008), or provide a more diverse environment that teaches students to adjust to new situations and people (Tam & Bassett, 2004). Fletcher and Tienda (2007) found that high school fixed effects explained half or more of the differences in college GPA and graduation by students' race and ethnicty, sometimes reversing the relationships. Such high school effects could make it appear that HSGPAs have different value in some schools than others—when there are simply other factors about high schools that also matter for college success.

Contributions of this Study and Research Questions

In this study, we compare the strength and consistency of HSGPAs as predictors of college graduation across high schools with ACT scores, adding to the current literature in a number of ways:

1) **Showing variation across high schools in the relationship of HSGPA with college graduation.** Variation in the predictiveness of HSGPAs by high school could occur either because HSGPAs represent higher levels of readiness from some high schools vs. others (i.e., HSGPAs under- or over-predict graduation for all students at a school), or because the relationship (slope) of the HSGPA differs across high schools (i.e., providing a stronger signal at some schools than others). Prior research has not shown the extent to which there is variation in the relationship of HSGPAs with college graduation by high school.
2) **Conducting equivalent tests on ACT scores as on HSGPA.** Past studies have not explicitly tested whether standardized assessments are comparable across high schools as measures of college readiness. We examine whether students with the same ACT or SAT scores have different college outcomes based on which high school they attended, or if the slope of the relationship of test scores to college outcomes varies by high school.
3) **Discerning the extent to which there are high school effects on college graduation that are not captured in either students' HSGPAs or ACT scores.** While past studies have provided evidence that high school effects on college outcomes exist, they have not quantified the magnitude of high school effects (e.g., the variance across high schools),

that is, how much of a difference it makes which high school a student attended for students who look similar based on their ACT score and HSGPA.

We begin by identifying the extent to which the relationship of each achievement indicator depends on the high school a student attends:

> RQ1: How different are college graduation rates for students with the same HSGPAs/ACT scores, who come from different high schools?

We then compare the size and consistency of the relationships of HSGPAs and ACT scores with college graduation, and examine whether including students' ACT scores in the prediction of college graduation substantially reduces inconsistency across high schools over using HSGPA alone:

> RQ2: Do ACT scores provide a stronger, or more consistent, prediction of college readiness across high schools than HSGPAs?
>
> RQ3: Is there less high school variance in college graduation rates in models that use students' ACT scores and HSGPAs together, than models that use HSGPAs alone?

Finally, we show the extent to which information about high schools (school poverty and average ACT scores) explain high-school level variation.

> RQ4: To what extent are high school differences in college graduation rates for students with the same HSGPAs and ACT scores explained by school achievement level and school poverty?

Research Methods

This study uses data from the Chicago Public Schools (CPS), a large, public school district that contains schools with varying academic composition—extremely high-achieving selective schools that get ranked among the top high schools in the country, heterogeneous schools, and schools with very low test scores. We include for analysis all students who graduated from neighborhood, magnet, selective, and vocational high schools between the years of 2006 and 2009, who enrolled in a four-year college immediately following graduation, and who had complete data (n=17,753).[1] Table 1 provides summary statistics of the analytic group and variables used in the models.

We only include students who enrolled in a four-year college, so as not to confound enrollment in college with ability to succeed in college once enrolled. Because college admissions use HSGPA and ACT scores to determine who is accepted, those measures will be related to college graduation simply because they provide access, regardless of whether they indicate readiness to succeed once enrolled. By comparing only students who enrolled in college, and controlling for institutional characteristics (described below), we focus on the extent to which the HSGPAs and ACT scores are indicators of students' likelihood of succeeding once in college, not the degree to which they are signals to admissions officers.

Data and Variables

Data on academic performance and student demographic information (gender, race, and ethnicity) come from district administrative datasets. We obtained economic information on students' residential neighborhoods by linking students' addresses to information from the U.S. Census at the level of block groups on the percent of adult males employed and the percent of families with incomes above the poverty line. HSGPAs were created by coding grades in

[1] Charter school graduates were not included because their transcripts are not available. A total of 2,595 cases had missing data: 934 were missing cumulative HSGPAs, 982 were missing ACT scores, and 828 were missing the IPEDS institutional graduation rate for the college they attended. Students in the restricted group had slightly higher HSGPAs (2.72 vs 2.69) and ACT scores (20.12 vs 19.97) than students in the total population. The groups were nearly identical with regards to ethnicity, race, gender, SES, and institutional graduation rate.

students' transcripts 0 through 4 (F through A), and creating an unweighted average of all courses completed in high school. At the time the students were in high school, all students in Illinois took the ACT during the spring of the eleventh grade. College enrollment records and six-year graduation outcomes were obtained through the National Student Clearinghouse. Students were included for analysis if they had full-time enrollment records in a four-year college during the fall term after they graduated high school. Six-year college graduation is defined as earning a four-year college degree within six years of graduating from high school. Appendix Table A1 shows college graduation rates by students' ACT scores and HSGPA unadjusted for demographic and college characteristics or high school effects.

Colleges offer different supports and structures which influence whether students graduate (Bowenet al., 2009; Cohodes & Goodman, 2012; Kurlaender & Grodsky, 2013). Therefore, it was important to control for college characteristics. We did this by including information on colleges obtained through the Integrated Postsecondary Education Data System (IPEDS) as covariates: the race- or ethnicity-specific six-year institutional graduation rate of the college (matched to the race and ethnicity of the student), college size (number of undergraduate students), the percentage of freshman students who are full time, and the student-to-faculty ratio.

Methods

We estimated the variance in college graduation rates by high school using hierarchical linear models, with students nested within high schools. We considered using cross-nested models with students simultaneously nested within their high school and college, or controlling for college fixed effects. However, students in our analysis group matriculated to more than 500 different four-year colleges across the U.S., and at many of these colleges there were only a small number of students. This resulted in imprecise estimates of college effects for a large proportion of the sample through these other methods.

For RQ1, we used two different methods of estimating variation in college graduation rates by high school for students with the same HSGPA/ACT score. First, we used a series of dummy variables to model the relationship between HSGPA and college graduation non-parametrically. There is no intercept, so the coefficient for each HSGPA dummy variable represents the average college graduation rate for students in that HSGPA group. We allowed the coefficients to vary by high school to identify the variation in college graduation rates across high schools for students with the same HSGPAs. These same models were then repeated with student ACT bins in lieu of HSGPA bins. Coefficients for other covariates were fixed across schools, predicting the log odds of graduating from a four-year college in six years:

Level-1 Model [1]

$$\log(p_{grad}/1\text{-}p_{grad})_{ij} = \sum_{s=1}^{5} \beta_{sj} (S)_{ij} + \sum_{g=6}^{21} \beta_{gj} (G)_{ij} + \sum_{c=22}^{25} \beta_{cj} (C)_{ij} + r_{ij}$$

Level-2 Model

$$\beta_{sj} = \gamma_{s0}$$
$$\beta_{gj} = \gamma_{g0} + u_{gj}$$
$$\beta_{cj} = \gamma_{c0}$$

S is a vector of student background variables (Neighborhood poverty, male, Black, Latino, and Asian).

G is a vector of dummy variables representing HSGPA bands.

C is a vector of college institutional variables.

u_{gj} is the high school-level variance in college graduation rates for students in the HSGPA band, controlling for student background and college institutional variables.

The above method assumes no particular functional form. However, because students with different levels of achievement are not evenly distributed across schools, not all high schools have students in all achievement bands. Therefore, we only calculated school-level random effects for bands in which at least 95 percent of schools are represented.

We also ran models which use standardized continuous versions of HSGPAs, rather than the binned variables, and calculated the average school effect across all achievement levels. These models include a squared term, since the relationship of each achievement measure is slightly quadratic. We ran models in which the slopes of each achievement measure with college graduation are fixed, and models that allow the slopes of the relationships to vary by high school. As the results are similar, only the second are shown in the manuscript, and the first are available from the authors:

Level-1 Model [2]

$$\log(p_{grad}/1\text{-}p_{grad})_{ij} = \beta_{0j} + \sum_{s=1}^{5} \beta_{sj} (S)_{ij} + \beta_{6j}(ZGPA)_{ij} + \beta_{7j}(ZGPA^2)_{ij} + \sum_{c=8}^{11} \beta_{cj} (C)_{ij} + r_{ij}$$

Level-2 Model

$$B_{0j} = \gamma_{00} + u_{0j}$$
$$\beta_{sj} = \gamma_{s0}$$
$$\beta_{6j} = \gamma_{60} + u_{6j}$$
$$\beta_{7j} = \gamma_{70} + u_{7j}$$
$$\beta_{cj} = \gamma_{c0}$$

In Equation 2, u_{0j} is the high school-level variance in college graduation rates, controlling for students' HSGPA, student background variables and the institutional characteristics of the colleges in which they enroll. Variance components on the slopes, u_{6j} and u_{7j}, show variation in the size the relationship of HSGPA with college graduation across high schools--whether grades are stronger measures of college readiness at some schools than others. Equations 2 was replicated with ACT scores.

Finally, we ran models that entered HSGPA and ACT scores together in the models to discern how much ACT scores improve the prediction of college graduation beyond using HSGPAs alone, to answer question 3:

Level-1 Model, Equation 2 [3]

$$\log(p_{grad}/1-p_{grad})_{ij} = \beta_{0j} + \sum_{s=1}^{5} \beta_{sj}(S)_{ij} + \beta_{6j}(ZGPA)_{ij} + \beta_{7j}(ZACT)_{ij} + \beta_{8j}(ZGPA^2)_{ij} + \beta_{9j}(ZACT^2)_{ij} + \sum_{c=10}^{13} \beta_{cj}(C)_{ij} + r_{ij}$$

Level-2 Models

$B_{0j} = \gamma_{00} + u_{0j}$
$\beta_{sj} = \gamma_{s0}$
$\beta_{6j} = \gamma_{60} + u_{6j}$
$\beta_{7j} = \gamma_{70} + u_{7j}$
$\beta_{6j} = \gamma_{80} + u_{8j}$
$\beta_{7j} = \gamma_{90} + u_{9j}$

$\beta_{cj} = \gamma_{c0}$

We did this in two ways. First, we grand-mean centered all student variables to show the overall relationships, and then we group-mean centered the variables to discern the relationship of each with college graduation relative only to other students in the same school. This second specification is similar to a school fixed-effects model. To address RQ4, we included school-level predictors of school performance level (average ACT score) and school poverty as predictors of B_{0j}.

Results

Table 2 displays coefficients from models predicting college graduation rates with HSGPA, without and with covariates. The odds ratios show the likelihood of graduating from college; students with a 3.0-3.25 HSGPA have fairly even odds (0.91), which gives them just under a 50-50 chance (48 percent probability), while students with a HSGPA of 3.5-3.75 are 3.6 times more likely to graduate as to not graduate (odds of 3.65, or about 78 percent graduating and 22 percent not graduating). HSGPA has a strong relationship with college graduation in both the unconditional model and the model that controls for students' backgrounds and college institutional variables, although the relationship is smaller once the control variables are introduced. The coefficients from the full model are converted into percentages and displayed graphically as the thick black line in the left panel of Figure 1. Across the range of HSGPAs, the probability of graduating from college ranges from 20 percent for students with HSGPAs less than 1.5 to about 80 percent for students with HSGPAs of 3.75 or higher, after controlling for student backgrounds and college characteristics.

The random effects at the bottom of Table 2 show the degree to which average graduation rates vary across high schools among students in each HSGPA bin. There is significant high school variance in college graduation rates for students in each HSGPA bin. For example, among students with HSGPAs between 3.25-3.5, a two-standard deviation range of high school effects is 0.144 ± 0.575 in log-odds in the conditional model. Thus, students with a 3.25-3.5 HSGPA at schools with very negative school effects (one standard deviation below the mean) have college graduation rates that are similar to students with HSGPAs of 2.75-3.0 at more typical schools (where the odds of graduating are 0.72).

Model 2 in Table 2 shows the results from a model where HSGPA is entered as a continuous variable along with a squared term, instead of discrete bins. The linear component shows that for every standard deviation increase in HSGPA, the odds of graduating from college double (odds coefficient = 2.02) at the point where the quadratic term is zero (which is at the sample average). The quadratic term is positive, so the relationship is larger among students with the highest levels of achievement, and lower among students with low HSGPAs. The school variance component for the intercept from this model (0.603) is slightly higher than those in the binned model (where variance components ranged from 0.501 to 0.575), and represents the variance in school effects averaged across students of all achievement levels. Not only is the school-level variance component large (0.603), it is larger when HSGPAs are included in the model than in a model that only includes control variables (0.447, not shown in table). This pattern is consistent with the "frogpond" effects discussed earlier, wherein HSGPAs are suppressed at high schools with more positive school effects. About one-fourth of the school-level variation in Model 2 ((0.603-0.447)/0.603 = 26%) is "extra" variation that is induced by comparing students with similar HSGPAs.

The model displayed in Table 2 also allows the slope of the relationship between HSGPA and college graduation to vary by high school. The strong linear trend (coefficient of 0.703), does not vary significantly by high school. The quadratic term (coefficient of 0.062) does vary slightly across schools (0.103). The noise that is introduced by variation in the linear and quadratic components is small relative to the signal from the linear slope (0.703), so the overall slope of the relationship is fairly similar across schools. The gray lines in the left panel of Figure 2 show the relationship of HSGPA with college graduation for each high school, estimated from the coefficients and variance components from Model 2. The considerable variation in college graduation rates by high school for students with the same HSGPA is clearly visible. At the same time, the relationship between HSGPA and college graduation has a similar slope, and is large and positive, across high schools.

Table 3 shows the results of models that mirror those in Table 2, substituting ACT scores for HSGPAs. Differences in college graduation rates by ACT score are more modest than by HSGPA, particularly after controlling for student background and college characteristics, but show a sizable range—from odds of 0.39 to 1.98 in the conditional model (graduation rates of 28 to 66 percent). School-level variance is smaller among students with the same ACT score than among students with the same HSGPA. Still, there is considerable variation in college graduation rates by high school among students with the same ACT score (0.265 to 0.343). For students with an ACT score of 16-17, for example, a two-standard deviation range in the log-odds of graduating is -0.387 ± 0.343. Students with an ACT score of 16-17 in a school with large positive effects (one standard deviation above the mean) would graduate at a rate that similar to students with scores of 20-21 in a more typical school. Thus, students with the same qualifications, defined by either their HSGPA or their ACT score, graduate at different rates based upon which high school they attend.

Model 2 in Table 3 shows the relationship of ACT scores with college graduation modeled with continuous linear and quadratic terms. The standardized linear term is much smaller than that of standardized HSGPA scores (0.129 vs. 0.703), with the odds of graduating increasing by 14 percent (odds coefficient of 1.14) for every standard deviation increase in ACT scores when the quadratic term equals zero. There is a negative quadratic term, so the relationship is larger among students with low achievement, small among students with high achievement, and becomes negative among students with the highest achievement. The variance components show that the linear component of the slope varies significantly, and the variance in the slopes (0.192) is larger than the average slope (0.129). Thus, the noise introduced by school effects is larger than the signal from ACT scores. Where students attend high school says more about whether they are likely to graduate from college than their individual ACT score, at least among students with average or high ACT scores.

ACT scores also provide less accurate predictions of college success based on students' race, ethnicity, and gender than HSGPAs. The subgroup differences in college graduation rates are significantly different from zero for Asian and male students in the models that control for ACT scores, but the demographic coefficients are not significantly different from zero in the models that control for HSGPAs. ACT scores explain only a little of the school-level variance in college graduation rates; the variance component on average school effects (0.411) is similar to a model with the same control variables but no ACT scores (0.446). However, they do not induce more school-level variance, as was seen with HSGPAs.

The right panel of Figure 1 shows the relationships from Models 2 and 3, modeled as percentages. The dark line shows the averages from the bins in Model 2, while the gray lines show the relationship for each school, calculated from the coefficients and variance components in Model 2. The dark line is not at the center of the gray lines because most of the students with high ACT scores are concentrated in schools with high average college graduation rates, while students with very low ACT scores are concentrated at schools with low average college graduation rates. Many schools do not have students with very high ACT scores, and a number of other schools do not have students with very low ACT scores, so few of the lines go the full range of the horizontal axis. The figure shows how the relationship of students' individual ACT scores with college graduation is small relative to the variation in.

In Table 4, ACT scores and HSGPAs are included together in the models. The main HSGPA coefficient does not change substantially relative to the model without ACT scores in Table 2 (0.708 vs 0.703), but the main ACT coefficient shrinks considerably from the model without HSGPA (from 0.129 to a nonsignificant -0.016). Because the ACT score contributes little to the prediction, there is a similar amount of school-level variance in the combined model (0.622) as the model that includes HSGPA alone (0.603, from Table 1). ACT scores used at the individual student level do not reduce the variability by high school in predicting who will graduate college. The slope of the relationship of ACT scores with college graduation still varies significantly based on high school (0.213); in schools a standard deviation below the mean the linear slope is negative (-0.016 - .213, or -0.219) and in others it is positive (-0.016 + 0.213 or

0.197).

In the next model, the variables are group-mean centered so that the coefficients show the relationship of each variable with college graduation relative to other students in the same school. The school-level variance of the intercept in this model is much larger because the student variables do not control for differences across schools in student body composition. The within-school coefficient for HSGPAs is slightly larger than the coefficient from the earlier model, while the ACT score coefficient is small and not significant. The ACT slope varies significantly by high school (0.206, $p<0.000$) while the main linear portion of GPA slope does not vary and the quadratic term varies only slightly.

In final model, we include predictors of school performance level (average ACT scores among all students) and school poverty level. School average ACT scores are significantly related to college graduation, explaining school-level differences among students with the same HSGPAs and individual ACT scores. The odds of graduating college increase by 60 percent for every standard deviation increase in school average ACT scores, for students with the same HSGPA and ACT score. Average ACT scores in the school reduce the high school variation in college graduation rates by 42 percent (0.324 vs. 0.622). The school poverty level is not significant in this model, but that is because it is highly correlated with school average ACT scores ($r=0.70$). If entered alone in the model, either variable is a significant predictor with odds ratios of 0.70 for school poverty and 1.68 for school average ACT.

Discussion

It is commonly believed that HSGPAs indicate different levels of readiness for college, based on the high school a student attended, while ACT scores are consistent indicators.

However, HSGPAs perform in a strong and consistent way across high schools as measures of college readiness, while ACT scores do not. There are large high school effects on college graduation, such that students with either the same HSGPA or the same ACT score graduate from college at different rates, based on which high school they attended. Neither capture all of the ways in which high schools influence college graduation. The school differences are larger for students with the same HSGPA, which is consistent with prior studies showing that grades are depressed in schools and classes with higher-achieving students. HSGPAs are not equivalent measures of readiness across high schools, but they are strongly predictive in all schools, and the signal they provide is larger than the differences across schools. School-level variance in college graduation rates is one-quarter smaller among students with the same ACT score than students with the same HSGPA. However, this still leaves considerable school-level variance, and the signal provided by ACT scores is much smaller than the noise introduced by school effects.

As measures of individual students' academic readiness, ACT scores show weak relationships, and even negative relationships at the higher achievement levels. The negative slope among students with the highest achievement could result if people are using ACT scores to make decisions about students' readiness for very rigorous academic programs out of a belief that they are strong indicators of readiness, when they are not. Future research might investigate this further. Regardless, there is little evidence that students will have more college success if they work to improve their ACT score, as most of the signal from the ACT score seems to represent factors associated with the student's school, rather than the student. In contrast, students' efforts to improve their HSGPAs would seem to have considerable potential leverage for improving college readiness. The fact that HSGPAs are based on so many different criteria—including effort over an entire semester in many different types of classes, demonstration of skills through multiple formats, and different teacher expectations—does not seem to be a weakness. Instead, it might help to make HSGPAs strong indicators of readiness, since they measure a very wide variety of the skills and behaviors that are needed for success in college, where students will also encounter widely varying content and expectations.

Test scores provide more of a signal at the school level, with school-level average test scores providing additional information about students' likelihood of graduating above and beyond students' individual HSGPAs. For judging college readiness (e.g., college admissions), school-average ACT scores would provide a stronger prediction than students' individual scores. This is consistent with the findings and recommendations in Koretz and Langi (2018) and Bowen, Chingos, and McPherson (2009). The same pattern is observed with school-average poverty levels (in models that do not control for average ACT scores), which echoes Rothstein's (2004) findings. High school effects could result from higher academic standards (e.g., more college-oriented curricula at higher-achieving, higher-SES schools). Yet, they could also represent selection effects. Families with more financial, social, and human capital might select into higher-achieving, higher-SES high schools, either by choice of residence or application, and those families would likely continue to offer financial support when students are in college. School effects also could come from different peer networks, advising, supplemental experiences, or broader curricular offerings available at schools with more resources. Future research should investigate high school effects on college outcomes more thoroughly.

This study was conducted only with data from Chicago, and only with data from public schools. There could be more variation across high schools with a more comprehensive sample, and different relationships. The similarity in results that are available from studies of schools in other places provide some indication of their generalizability. Studies that use data from samples that include 21 prestigious flagship universities from across the country and all public universities in four states (Bowen et al., 2008; Koretz & Langi, 2018; Rothstein, 2004) all show that HSGPAs are strongly related to either college graduation or to college freshman GPA, and that students' individual ACT or SAT scores add only modestly to the prediction beyond HSGPA, if at all, in models that include high school fixed-effects. The graduation rates presented by Bowen, Chingos, and McPherson (2008) for specific HSGPAs are also similar to the graduation rates found here and shown in Figure 1. Graduation rates by HSGPA are not provided in other studies, to our knowledge.

This research strongly supports the use of students' grades in a formative way, to guide school improvement efforts and assess the effectiveness of programs designed to improve college readiness, and relying much less heavily on test scores. The teachers and schools that improve test scores are not always the same as those that improve students' grades (Jackson, 2016), and programs that have positive effects on test scores do not always have positive effects on grades (Nomi & Allensworth, 2009). Reaching goals that all students will graduate college-ready would seem to require strategies around improving students' HSGPAs, since HSGPAs are so strongly related to eventual college completion at all high schools. Higher ACT scores might help students get access to stronger colleges, but the pay-off would only occur if students actually attend stronger colleges. As an increasing number of colleges become test-optional, they are likely to be decreasingly salient for college admissions, as well.

States and districts might also consider relying less heavily on standardized test scores in their accountability systems as indicators of college readiness, given that the relationship is not strong and not consistent across schools. A number of states have developed longitudinal data systems that allow for the creation of metrics of students' actual performance in college. The existence of large school effects among students with the same ACT scores suggests that if high schools are not tracking the success of their students in college, and are relying solely on students' test scores as indicators of their students' college readiness, they may be misestimating the effects of their practices on students' college readiness. Likewise, we worry that if families and college admissions officers must rely on school poverty levels and average test scores as proxy indicators for school effects, they might not recognize strong practices at schools serving low-income students. Measuring and publishing school effects on postsecondary outcomes would provide better information to guide families, educators, and policymakers.

References

Attewell, P. (2001). The winner-take-all high school: Organizational adaptations to educational stratification. *Sociology of Education 74*(4), 267-295.

Barrow, L., Sartain, L., & de la Torre, M. (2016). *The role of selective high schools in equalizing educational outcomes: Heterogeneous effects by neighborhood socioeconomic status* (Working Paper No. 2016-17). Chicago, IL: Federal Reserve Bank of Chicago.

Bowen, W.G., Chingos, M.M., & McPherson, M.S. (2009). *Crossing the finish line: Completing college at America's public universities*. Princeton, NJ: Princeton University Press.

Bridgeman, B., McCamley-Jenkins, L., & Ervin, N. (2000). *Predictions of freshman grade-point average from the revised and recentered SAT® I: Reasoning test*. New York, NY: College Entrance Examination Board.

Bowers, A.J. (2011). What's in a grade? The multidimensional nature of what teacher-assigned grades assess in high school. *Educational Research and Evaluation*, *17*(3), 141-159.

Brookhart, S. M., Guskey, T. R., Bowers, A. J., McMillan, J. H., Smith, J. K., Smith, L. F., & Welsh, M. E. (2016). A century of grading research: Meaning and value in the most common educational measure. *Review of Educational Research*, *86*(4), 803-848.

Buckley, J., Letukas, L., & Wildavsky, B., (Eds). (2018). *Measuring success: Testing, grades, and the future of college admissions*. Baltimore, MD: Johns Hopkins University Press.

Camara, W., Kimmel, E., Scheuneman, J., & Sawtell, E.A. (2004). *Whose grades are inflated?* (Research Report No. 2003-4). New York, NY: College Entrance Examination Board.

Cohodes, S., & Goodman, J. (2012). *First degree earns: The impact of college quality on college completion rates* (HKS Faculty Research Working Paper Series RWP12-033). Cambridge, MA: John F. Kennedy School of Government, Harvard University.

Conley, D. T. (2008). Rethinking college readiness. *New directions for higher education*, *2008*(144), 3-13.

Farkas, G., Sheehan, D., & Grobe, R.P. (1990). Coursework mastery and school success: Gender, ethnicity, and poverty groups within an urban school district. *American Educational Research Journal*, *27*(4), 807-827.

Fletcher, J., & Tienda, M. (2010). Race and ethnic differences in college achievement: Does high school attended matter?. *The Annals of the American Academy of Political and Social Science*, *627*(1), 144-166.

Geiser, S., & Santelices, M.V. (2006). The role of Advanced Placement and honors courses in college admissions. In P. Gandara, G. Orfield, & C. Horn (Eds.), *Expanding opportunity in higher education* (pp. 75-114). Albany, NY: SUNY Press.

Geiser, S., & Santelices, M.V. (2007). *Validity of high-school grades in predicting student success beyond the freshman year: High-school record vs. standardized tests as indicators of four-year college outcomes*. Berkeley, CA: Center for Studies in Higher Education.

Gershenson, S. (2018). *Grade inflation in high schools (2005–2016).* Washington, DC: Thomas B. Fordham Institute.

Godfrey, K.E. (2011). *Investigating grade inflation and non-equivalence* (Research Report 2011-2) New York, NY: College Entrance Examination Board..

Hiss, W.C., & Franks, V.W. (2014). *Defining promise: Optional standardized testing policies in American college and university admissions*. Arlington, VA: The National Association for College Admission Counseling.

Hoxby, C.M., & Turner, S. (2015). What high-achieving low-income students know about college. *The American Economic Review*, *105*(5), 514-517.

Hurwitz, M., & Lee, J. (2018). Grade inflation and the role of standardized testing. In J. Buckley, L. Letukas, & B. Wildavsky (Eds.) *Measuring success: Testing, grades, and the future of college admissions*. Baltimore, MD: Johns Hopkins University Press.

Jackson, C.K. (2016). *What do test scores miss? The importance of teacher effects on non-test score outcomes* (No. w22226). Cambridge, MA: National Bureau of Economic Research. Retrieved from https://www.nber.org/papers/w22226

Kelly, S. (2008). What types of students' effort are rewarded with high marks?. *Sociology of Education*, *81*(1), 32-52.

Kobrin, J. L., Patterson, B. F., Shaw, E. J., Mattern, K. D., & Barbuti, S. M. (2008). Validity of the SAT® for predicting first-year college grade point average (Research Report No. 2008-5). New York, NY: College Entrance Examination Board.

Koretz, D., & Langi, M. (2018). Predicting freshman grade-point average from test scores: Effects of variation within and between high schools. *Educational Measurement: Issues and Practice*, *37*(2), 9-19.

Koretz, D. (2017). *The Testing Charade*. Chicago: University of Chicago Press.

Kuncel, N.R., Credé, M., & Thomas, L.L. (2005). The validity of self-reported grade point averages, class ranks, and test scores: A meta-analysis and review of the literature. *Review of Educational Research*, *75*(1), 63-82.

Kurlaender, M., & Grodsky, E. (2013). Mismatch and the paternalistic justification for selective college admissions. *Sociology of Education*, *86*(4), 294-310.

Nayar, N. (2015). *How are States reporting on college and career readiness?* Washington, DC: College & Career Readiness & Success Center at American Institutes for Research.

Noble, J. (2004). The effects of using ACT composite scores and high school averages on college admissions decisions for ethnic groups. In R. Zwick (Ed.), *Rethinking the SAT: The future of standardized testing in university admissions* (pp. 303-319). New York, NY: Routledge.

Noble, J., & Sawyer, R. (2002). *Predicting different levels of academic success in college using high school GPA and ACT composite score*. Iowa City, IA: ACT, Inc.

Nomi, T., & Allensworth, E. (2009). "Double-dose" algebra as an alternative strategy to remediation: Effects on students' academic outcomes. *Journal of Research on Educational Effectiveness*, *2*(2), 111-148.

Northern, A.M., & Petrilli, M.J. (2018). Foreword and executive summary. In S. Gersheson (Ed.), *Grade inflation in high schools (2005-2016)*. Washington, DC: Thomas B. Fordham Institute.

Pattison, E., Grodsky, E., & Muller, C. (2013). Is the sky falling? Grade inflation and the signaling power of grades. *Educational Researcher*, *42*(5), 259-265.

Rothstein, J.M. (2004). College performance predictions and the SAT. *Journal of Econometrics*, *121*(1), 297-317.

Sadler, P.M., & Tai, R.H. (2007). Weighting for recognition: Accounting for advanced placement and honors courses when calculating high school grade point average. *NASSP Bulletin*, *91*(1), 5-32.

Tam, M.Y.S., & Bassett, G.W. (2004). Does diversity matter? Measuring the impact of high school diversity on freshman GPA. *Policy Studies Journal*, *32*(1), 129-143.

Tierney, W. G., Bailey, T., Constantine, J., Finkelstein, N., & Hurd, N. F. (2009). *Helping students navigate the path to college: What high schools can do: A practice guide (NCEE #2009-4066)*. Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. Retrieved from http://ies.ed.gov/ncee/wwc/publications/practiceguides/

U.S. Department of Education, Office of Educational Research and Improvement. (1994). *What do student grades mean? Differences across schools* (Office of Research Report 94-3401). Washington, DC: U.S. Department of Education.

Woodruff, D.J., & Ziomek, R.L. (2004). *Differential grading standards among high schools* (ACT Research Report Series, 2004-02). Iowa City, IA: ACT, Inc.

Zwick, R., & Himelfarb, I. (2011). The effect of high school socioeconomic status on the predictive validity of SAT scores and high school grade-point average. *Journal of Educational Measurement*, *48*(2), 101-121.

Zwick, R. (2013). Disentangling the role of high school grades, SAT® scores, and SES in predicting college achievement. *ETS Research Report Series*, *2013*(1), 1-20.

Tables and Figures

Table 1. Descriptive Statistics of Variables Used in the Models

		Mean	Std. Dev.
Demographic Characteristics	Male	37%	
	Black	50%	
	Latino	26%	
	Asian	10%	
	White	14%	
	Neighborhood Poverty (standardized across all students, not just college-goers)	-0.12	0.99
High School Achievement	Cumulative HSGPA	2.72	0.65
	ACT Composite Score	20.12	4.33
College Outcome	College Degree in Six Years	49%	
College Institutional Characteristics	College Size (# Freshmen)	3662	2390
	% Full Time Freshmen	65%	17%
	Student to Faculty Ratio	17	5.43
	Six-Year Institutional Graduation Rate for student's racial or ethnic group	47%	22%

Based on students who enrolled in a four-year college the fall after graduation (n=17,753). Institutional characteristics are based on the college freshmen cohort of 2008.

Table 2. Model Predicting Six-Year College Graduation Rates by Student HSGPA Score
Students Nested within High School

Coefficients	**Unconditional GPA Binned**			**Model 1 GPA Binned**			**Model 2 Random GPA slope**		
	Coeff	s.e.	odds	Coeff	s.e.	odds	Coeff	s.e.	odds
Male				-0.096	0.04	0.91	-0.092	0.04	0.91
Black				-0.024	0.07	0.98	0.127	0.08	1.14
Latino				-0.077	0.06	0.93	0.013	0.07	1.01
Asian				0.052	0.08	1.05	0.046	0.08	1.05
ZPoverty				-0.093	0.02	0.91	-0.069	0.02	0.93
ZCollege Size				0.061	0.02	1.06	0.016	0.00	1.02
Z%Full Time Students				0.013	0.03	1.01	0.000	0.00	1.00
ZStudent-Faculty Ratio				0.151	0.03	1.16	0.833	0.15	2.30
ZCollege Grad Rate				0.487	0.03	1.62	0.019	0.00	1.02
GPA <1.5	-1.834	0.11	0.16	-1.410	0.11	0.24			
GPA 1.5-1.75	-1.720	0.11	0.18	-1.319	0.11	0.27			
GPA 1.75-2.0	-1.210	0.07	0.30	-0.875	0.07	0.42			
GPA 2.0-2.25	-1.429	0.10	0.24	-1.025	0.09	0.36			
GPA 2.25-2.5	-1.185	0.10	0.31	-0.844	0.09	0.43			
GPA 2.5-2.75	-0.834	0.09	0.43	-0.593	0.08	0.55			
GPA 2.75-3.0	-0.496	0.09	0.61	-0.326	0.08	0.72			
GPA 3.0-3.25	-0.098	0.10	0.91	-0.002	0.09	1.00			
GPA 3.25-3.5	0.144	0.10	1.15	0.144	0.08	1.15			
GPA 3.5-3.75	1.296	0.07	3.65	0.939	0.07	2.56			
GPA 3.75-4.0	1.830	0.11	6.23	1.320	0.11	3.74			
ZGPA							**0.703**	**0.03**	**2.02**
$ZGPA^2$							0.062	0.02	1.06
Intercept							-0.558	0.07	0.57
Variance Components	**Variance of Coefficients across High Schools** *In Standard Deviations*								
	s.d.	p-value		s.d.	p-value		s.d.	p-value	
GPA 2.25-2.5	0.792	0.000	***	0.522	0.000	***			
GPA 2.5-2.75	0.745	0.000	***	0.598	0.000	***			
GPA 2.75-3.0	0.754	0.000	***	0.500	0.000	***			
GPA 3.0-3.25	0.863	0.000	***	0.501	0.000	***			
GPA 3.25-3.5	0.814	0.000	***	0.575	0.000	***			
ZGPA							0.107	0.106	
$ZGPA^2$							0.103	0.032	*
Intercept							0.603	0.000	***

*p<0.05, **p<0.01, ***p<0.001. Student background and college institutional control variables were grand-mean centered in all models. Variables beginning with Z were standardized, except squared terms which are the square of the standardized variables. A model with only the control variables, without HSGPA, produces a school-level variance component of 0.447 in standard deviation units.

Table 3. Model Predicting 6-Year College Graduation Rates by Student ACT Score
Students Nested within High School

Coefficients	Unconditional ACT Binned			Model 1 ACT Binned			Model 2 Random ACT slope		
	Coeff	s.e.	odds	Coeff	s.e.	odds	Coeff	s.e.	odds
Male				-0.346	0.04	0.71	-0.342	0.04	0.71
Black				-0.045	0.08	0.96	0.026	0.08	1.03
Latino				-0.056	0.06	0.95	-0.012	0.06	0.99
Asian				0.231	0.10	1.26	0.227	0.08	1.25
ZPoverty				-0.091	0.02	0.91	-0.069	0.02	0.93
ZCollege Size				0.005	0.02	1.00	0.009	0.02	1.01
Z%Full Time Students				0.059	0.02	1.06	0.058	0.02	1.06
ZStudent-Faculty Ratio				0.144	0.03	1.15	0.139	0.02	1.15
ZCollege Grad Rate				0.673	0.04	1.96	0.671	0.03	1.96
ACT < 14	-1.59	0.11	0.20	-0.941	0.11	0.39			
ACT14-15	-1.01	0.07	0.37	-0.482	0.07	0.62			
ACT16-17	-0.793	0.06	0.45	-0.387	0.06	0.68			
ACT18-19	-0.489	0.06	0.61	-0.231	0.05	0.79			
ACT20-21	-0.012	0.07	0.99	-0.059	0.07	0.94			
ACT22-23	0.552	0.09	1.74	0.309	0.09	1.36			
ACT24-25	0.852	0.08	2.34	0.407	0.08	1.50			
ACT26-27	0.986	0.11	2.68	0.356	0.10	1.43			
ACT28-29	1.46	0.15	4.33	0.684	0.15	1.98			
ACT30+	1.58	0.17	4.86	0.506	0.18	1.66			
ZACT							**0.129**	**0.04**	**1.14**
$ZACT^2$							-0.099	0.02	0.91
Intercept							-0.251	0.06	0.78
Variance Components	**Variance of Coefficients across High Schools** *In Standard Deviations*								
	s.d.	p-value		s.d.	p-value		s.d.	p-value	
ACT14-15	0.446	.002 **		0.343	.040*				
ACT16-17	0.447	.000***		0.343	.000***				
ACT18-19	0.402	.000***		0.265	.002**				
ZACT							0.192	.012	*
$ZACT^2$							0.067	.424	
Intercept							0.411	.000	***

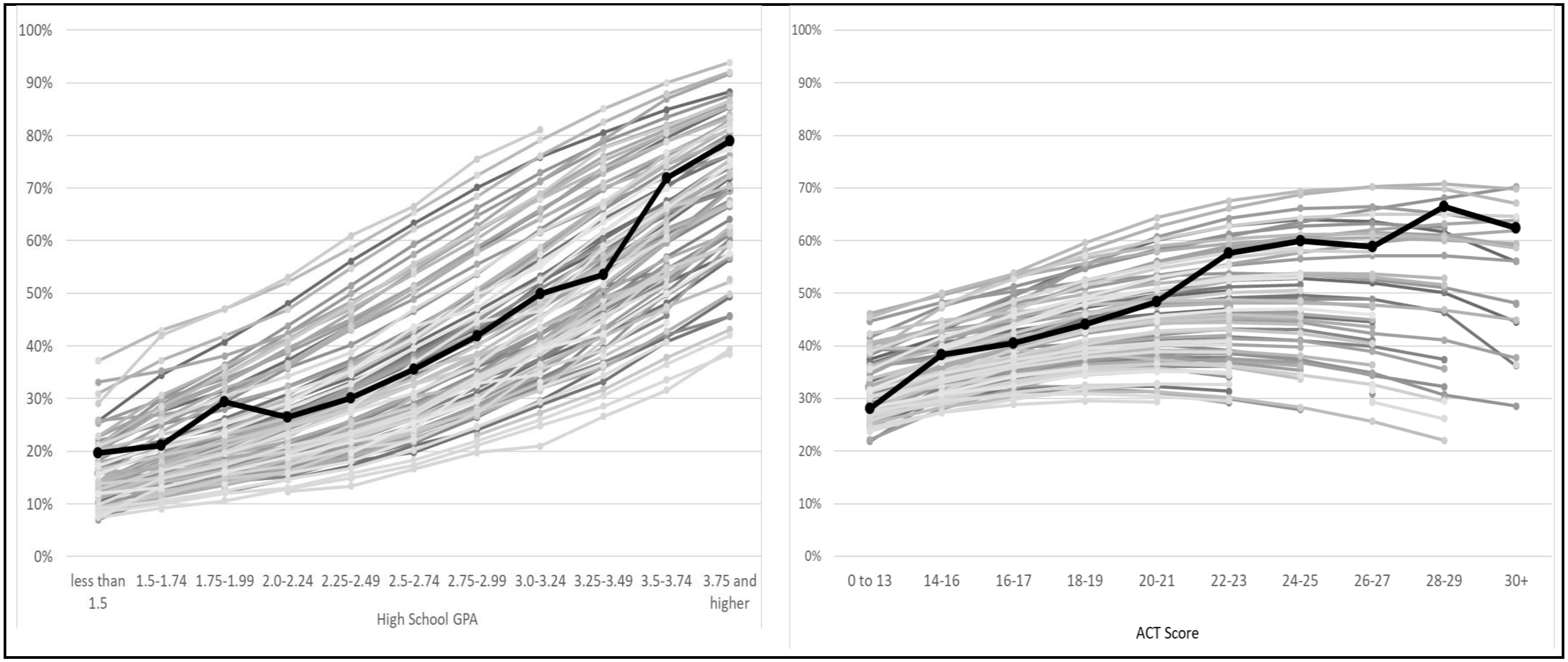
***p<0.001, **p<0.01, *p<0.05. Student background and college institutional control variables were grand-mean centered in all models. Variables beginning with Z were standardized, except squared terms which are the square of the standardized variables. A model with only the control variables, without ACT scores, produces a school-level variance component of 0.447 in standard deviation units.

Table 4. Models Predicting 6-Year College Graduation Rates by Both HSGPA and ACT Score
Students Nested within High School

	Varying Slopes			Group-Mean Centered (School Fixed Effects)			School-Level Variables		
	Coeff	s.e.	odds	Coeff	s.e.	odds	Coeff	s.e.	odds
Male	-0.086	0.04	0.92	-0.08	0.04	0.92	-0.08	0.04	0.92
Black	0.134	0.08	1.14	0.17	0.08	1.19	0.17	0.06	1.18
Latino	0.011	0.07	1.01	0.02	0.07	1.02	0.00	0.07	1.00
Asian	0.042	0.08	1.04	0.03	0.08	1.03	0.04	0.10	1.04
ZPoverty	-0.071	0.02	0.93	-0.06	0.02	0.94	-0.06	0.02	0.94
ZCollege Size	0.089	0.02	1.09	0.09	0.02	1.10	0.10	0.02	1.10
Z%Full Time Students	-0.006	0.03	0.99	-0.01	0.03	0.99	-0.01	0.02	0.99
ZStudent-Faculty Ratio	0.151	0.03	1.16	0.15	0.03	1.16	0.16	0.03	1.17
ZCollege Grad Rate	0.422	0.04	1.52	0.42	0.04	1.51	0.42	0.04	1.52
ZGPA	0.708	0.03	2.03	0.73	0.03	2.07	0.75	0.03	2.12
$ZGPA^2$	0.063	0.02	1.06	0.05	0.02	1.05	0.06	0.02	1.06
ZACT	-0.016	0.04	0.98	-0.07	0.04	0.94	-0.02	0.04	0.98
$ZACT^2$	-0.108	0.02	0.90	-0.10	0.02	0.90	-0.08	0.02	0.92
ZSchool ave. poverty							-0.07	0.05	0.94
ZSchool Average ACT							0.47	0.05	1.60
Intercept	-0.515	0.08	0.60	-0.70	0.09	0.50	-0.56	0.06	0.57
Variance Components	**Variance of coefficients across high schools** *In Standard Deviations*								
ZGPA	0.110	0.246		0.096	0.204		0.112	0.364	
$ZGPA^2$	0.106	0.080		0.105	0.036	*	0.112	.037	*
ZACT	0.213	0.002	**	0.206	.000	***	0.192	.002	**
$ZACT^2$	0.089	>.500		0.088	>.500		0.066	>.500	
Intercept	0.622	0.000	***	0.859	0.000	***	0.324	0.000	***

*p<0.05, **p<0.01, ***p<0.001. Student background and college institutional control variables were grand-mean centered in all models. Variables beginning with Z were standardized, except squared terms which are the square of the standardized variables.

Figure 1. College Graduation Rates by HSGPA and ACT Score,
Controlling for Student Background and College Characteristics
Each gray line represents a high school, the black line is the average across high schools



Note: Graduation rates by school are calculated from 2-level hierarchical models that allow the relationship between ACT scores or HSGPA to vary by high school and include a quadratic term, and control for student race, ethnicity, neighborhood SES, college size, percent full-time students, student-faculty ratio, and institutional graduation rate. The average for each point reflects the predicted graduation rate given the average HSGPA or ACT score of students in a particular achievement range at each school, which is not always the midpoint. Lines only include HSGPA and test score ranges that are observed at the high school, among their college enrollees. The overall rate is calculated from a non-parametric model in which HSGPA or ACT scores are entered as a series of dummy variables, along with the same control variables.

Appendix

Table A1. College Graduation Rates by HSGPA and ACT Score
Unadjusted for Student Backgrounds, College Characteristics or High School Effects

ACT Score ->	0 to 13		14-16		16-17		18-19		20-21		22-23		24-25		26-27		28-29		30+		Overall	
HS GPA	Grad	n	Grad	n	Grad	n	Grad	n	Grad	n	Grad	n	Grad	n	Grad	n	Grad	n	Grad	n	Grad	n
<1.5	11%	64	9%	115	17%	133	12%	154	16%	127	15%	55	15%	27	31%	16	N/A	3	N/A	3	14%	697
1.5-1.74	9%	57	10%	89	15%	158	14%	161	17%	104	30%	61	20%	30	13%	15	N/A	9	N/A	1	15%	685
1.75-1.99	9%	68	15%	176	21%	206	22%	247	26%	185	34%	106	37%	60	23%	26	47%	15	N/A	4	23%	1093
2.0-2.24	10%	86	21%	287	23%	379	29%	347	31%	269	43%	166	44%	97	40%	48	50%	18	36%	11	28%	1708
2.25-2.49	18%	92	21%	262	28%	453	34%	447	41%	376	56%	207	55%	150	47%	78	58%	38	44%	25	36%	2128
2.5-2.74	18%	83	34%	272	31%	477	41%	475	47%	386	57%	292	60%	218	60%	126	76%	46	67%	24	44%	2399
2.75-2.99	24%	58	33%	217	39%	429	48%	483	53%	436	63%	320	71%	275	73%	163	74%	72	73%	44	53%	2497
3.0-3.24	33%	49	40%	195	44%	392	56%	465	67%	380	77%	361	79%	282	82%	183	87%	107	78%	55	64%	2469
3.25-3.49	34%	32	45%	101	51%	273	61%	313	65%	316	73%	309	84%	210	84%	189	90%	124	84%	83	68%	1950
3.5-3.74	N/A	7	65%	43	51%	130	67%	203	73%	233	85%	202	90%	204	91%	136	92%	121	93%	103	79%	1382
3.75 and higher	N/A	5	64%	14	70%	40	71%	56	77%	129	92%	99	90%	119	94%	80	91%	70	96%	133	86%	745
Overall	17%	601	27%	1771	33%	3070	42%	3351	50%	2941	63%	2178	70%	1672	73%	1060	81%	623	83%	486	49%	17753

Graduation rates for cells with less than 10 students are not displayed to protect confidentiality.