The increasing role of student effort in postsecondary attainment
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In his classic article on different modes of intergenerational mobility, Turner (1960) suggested that the American system is best understood as a contest in which contenders compete with one another for elite status. He distinguished this ideal type from sponsored mobility, a system in which one generation of elites chooses the next generation based on an assessment of the qualities shown by aspirants. Although intellect and cunning can contribute to success in the contest system, "the most satisfactory outcome is not necessarily a victory of the most able, but of the most deserving."

Who then is deserving? What weights do gatekeepers accord different dimensions of merit such as intellect and effort? We answer these questions in the context of increasingly critical hurdles to elite status in the United States, those of four-year college entry, elite four-year college entry and baccalaureate completion. Admission to competitive colleges is largely (though not entirely) driven by test scores, high school grades and course taking. We argue that these measures map on to different overlapping dimensions of merit. Test scores reflect a combination of intelligence and academic achievement while grades reflect these qualities in combination with the ability to conform to teacher social and behavioral expectations. Advanced course taking reflects a combination of academic achievement, motivation, understanding of the importance of taking demanding courses and the opportunity to do so. Each of these academic achievement measures, therefore, reflects different mixtures of the qualities one might consider as evidence of merit or worthiness in a contest system of elite status attainment.

Using data from nationally representative samples of students who were high school sophomores in 1980, 1990 and 2002, we investigate the roles of grades, test scores and mathematics course taking in these transitions. Contrary to some recent empirical work on this topic (Alon & Tienda, 2007), we show that the Unites States is not becoming more of a testocracy. Instead, we find that high school grades and courses have increased in importance relative to test scores over time in structuring transitions into and through higher education. We argue that this reflects a trend toward Turner's ideal type of contest mobility; to the extent that test scores are driven more by cognitive ability and grades and course taking by student effort, it appear that the U.S. postsecondary education system is increasingly one in which, within the bounds of structural constraints on the availability of courses, effort trumps ability in determining who enters elite institutions and who earns a baccalaureate degree.

Data

We draw on rich student surveys and secondary and postsecondary transcript data from nationally representative sample of cohorts of sophomores enrolled in American secondary schools in 1980 (High School and Beyond: Sophomore cohort), 1990 (National Educational Longitudinal Study of 1988) and 2002 (Educational Longitudinal Study of 2002). [1] The key outcomes in our analyses are whether students ever attended a four-year college, whether they attended an elite four year college (conditional on attending any four-year college), and whether they ultimately earned a baccalaureate degree (conditional on attending any four year college).

[1] The 2002 cohort has secondary but not postsecondary transcripts at this time. Due to their age this most recent cohort has also had less time to attend college and inadequate time to complete. We view results for this cohort as preliminary.

We use both self-report and transcript measures of college attendance for students in the 1980 and 1990 cohorts and student self-reports two years after their high school graduation for the 2002 cohort. We consider colleges to be elite if they were ranked by Barron's guide as 'highly competitive' or 'most competitive' in the year students in our sample were expected to complete high school (Schmitt, 2009).

Our three key dimensions of merit are high school grade point average (GPA), achievement test scores in mathematics and reading, and highest math course completed. We experiment in this paper with five measures of GPA. For each measure, the course grades we include are weighted by the number of credits students earned in the course. The most basic measure is the mean weighted GPA for all courses taken in high school. Other versions of the GPA measure are restricted to only core academic courses (reading, math, science and social studies) and general academic courses (core plus fine arts, foreign language and computer science). For each of these two measures we create one version of GPA in which grades in honors, AP, and IB courses are assigned an extra grade point and one version in which they are not. Competitive college and universities generally take course difficulty into account when making admissions decisions, and some do so by adding weight to the grades students earn in more demanding courses (Rigol, 2003). Alternatively, in some models we include counts of AP, honors and IB credits completed along with GPA measures in which we do not award additional grade points for such courses.

Our achievement test scores are from standardized measures of academic achievement administered to each cohort in their sophomore and seniors years of high school. Although we have directly comparable sophomore scores for the 1992 and 2002 cohorts, we do not have such measures for the 1980 cohort. Instead, we standardize each assessment by grade and cohort and take as our measures of math and reading test scores the mean of the available standardized scores for each student in each subject.[2]

We construct an ordinal measure of math course completion for each student. We adjudicate among students who fail to take any course beyond geometry, those whose highest course is algebra 2, advanced math, pre-calculus and calculus. In addition to these key measures of secondary school achievement, we adjust for student sex, race/ethnicity and parental education. In models of selective college attendance and college completion we also include a measure of the predicted probability that a student ever attends a four-year college to adjust for student self-selection. This latter measure is based on a logistic regression for the full sample of students who complete a high school diploma or GED in each cohort, separately by cohort. We delete cases with missing data and will test the sensitivity of this approach to other approaches (constant substitution, multiple imputation) prior to the meetings.

Methods

We use logistic regression models to estimate the relationship between these disparate dimensions of merits and the probability of attending college, attending a selective college and completing college. Logistic coefficients and associated odds ratio are not directly comparable across cohorts as a result of potential changes in unobserved variance (Allison, 1999; Hoetker, 2007). In fact, we anticipate that the unobserved variance associated with each educational transition will decline over time as entrance requirements (especially for more competitive

[2] Although the math test was administered in both the sophomore and senior years for the 2002 cohort the reading test was administered in only the sophomore year.

colleges) become more stringent. To overcome this methodological challenge and enhance interpretability we provide estimates of marginal effects instead of odds ratios. These results, however, are explicitly margin-sensitive and therefore may not fully capture changes in the relative weights accorded to different aspects of high school achievement. To accommodate a more direct evaluation of relative change we also present ratios of each coefficient to the GPA coefficient. These provide the estimated conditional effect of each dimension of merit in terms of grade point equivalents while simultaneously standardizing out differences in observed variance over cohorts (Hoetker, 2007). All models are weighted and standard errors are adjusted to account for clustering at the initial high school (or middle school in the case of the 1990 cohort).

Results

Table 1 shows average marginal effects from logistic regressions of each outcome on the full set of achievement origin measures. We present only the achievement coefficients here. Looking first at models predicting baccalaureate college attendance, it appears that the association between grades, test scores and attendance has changed little over time. On average, a one standard deviation increase in math test scores was associated with a five percentage point increase in the probability of attending college for both 1980 and 2002 sophomores (give or take about 1.8 percentage points). The importance of reading test scores may have declined slightly (from a 5.9 percentage point bump to a 3.6 percentage point bump), while the importance of grades may have risen slightly. Among 1980 sophomores, each additional grade point led to an average 11.8 percentage point increase in the probability of attending a four-year college; for 2002 the return to each grade point was 14.1 percentage points. Since the standard deviation of GPA is more or less the same across cohorts (at about 0.75), we can multiply these effects by 0.75 to get estimates more comparable to those of test scores. Either way, grades appear to be more important than test scores at each point in time for the decision to attend a four-year college. Finally, courses have been and remain important predictors for college attendance. The increase in the average marginal effect of calculus from 0.13 to 0.20 is particularly noteworthy but must be viewed with some caution as the ELS data reflect timely college attendance (within two years of the expected date of high school completion) while other data sets allow ten to twelve years to enter college.[3]

The next three columns of results pertain to elite college attendance. While the preferred measure of GPA in other models based on model fit statistics (both BIC and deviance) is the simple credit-weighted GPA, for elite college attendance the preferred model relies on core academic GPA with an additional point for grades in honors, AP and IB courses. GPA coefficients for models of elite college attendance thus pertain to this more refined measure.

Consistent with Alon and Tienda (2007), we find that math test scores have become somewhat more powerful predictor of elite college attendance over time, from a 3.2 percentage point bump in the probability of attendance for 1980 sophomores to a 6.7 percentage point bump for 2002 sophomores. Reading test scores increased in importance between 1980 and 1990 but may have declined in importance between 1990 and 2002. Contrary to Alon and Tienda's assertion of a rising testocracy, however, we find that other dimensions of academic achievement have increased even more in their importance. While augmented core academic GPA failed to predict elite college attendance for 1980 sophomores, each point in augmented core academic

[3] Still, the substantial majority of students who ever attend a four-year college will do so within two years of completing high school.

GPA increased the probability of attending an elite college by 6.1 percentage points for 1990 sophomores and 11.4 percentage points for 2002 sophomores. The advantage accorded to students who complete calculus relative to those who complete algebra 2 has risen more dramatically over time, from 3.8 percentage points for 1980 sophomores to 20.3 percentage points for 2002 sophomores.

The final set of results show the relationship between different dimension of high school achievement and the probability of completing a bachelor's degree conditional on social origin and the propensity to attend a baccalaureate college for those who ever attended a baccalaureate college. These analyses are limited to 1980 and 1990 sophomores since data for the 2002 sophomores are not yet available. Test scores were moderately predictive of baccalaureate completion for 1980 sophomores but conditionally independent of baccalaureate completion for 1990 sophomores (nonsignificant and approaching 0). In contrast, high school GPA is a powerful predictor of completion for students who completed high school in the 1980s and became an even more important predictor among those who completed high school in the 1990s. For the latter cohort, each additional grade point was associated with an average 20 percentage point increase in the probability of earning a bachelor's degree, give or take 5.4 percentage points. Course taking also became more important for completion over time, at least at the higher end of the distribution. The completion advantage for student with higher level course taking relative to those who complete algebra 2 only increased over time while the penalty for not completing algebra 2 seems to have almost disappeared.

Conclusion

Contrary to some recent work on the rising relative importance of test scores for postsecondary transitions, we find that grades and course taking are increasingly important determinants of postsecondary pathways and baccalaureate attainment. We find no evidence of an increase in the importance of test scores for baccalaureate attendance or completion and evidence of a comparatively modest increase in the importance of test scores for attending an elite college. On the other hand, we find strong support for the increasing relevance of grades for each of these outcomes and for the advantage students who complete calculus enjoy over those whose highest high school mathematics course is algebra 2. Within the confines of the availability of advanced courses (including honors, AP and IB courses), our result indicate a shift in the meritocracy away from test scores and toward dimensions of merit more closely tied to student effort and noncognitive skills.

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	Four-year college attendance			Elite college attendance			Baccalaureate completion	
	HS &B	NELS	ELS	HS &B	NELS	ELS	HS &B	NELS
Math Test	0.050***	0.032**	0.050***	0.032***	0.041***	0.067***	0.046**	0.001
	(0.009)	(0.013)	(0.008)	(0.005)	(0.015)	(0.014)	(0.018)	(0.024)
Reading Test	0.059***	0.037***	0.036***	0.007	0.052***	0.036***	0.015	-0.006
	(0.008)	(0.012)	(0.007)	(0.005)	(0.013)	(0.011)	(0.017)	(0.020)
HS GPA*	0.118***	0.105***	0.141***	0.004	0.061***	0.114***	0.135***	0.202***
	(0.009)	(0.012)	(0.008)	(0.006)	(0.015)	(0.013)	(0.030)	(0.027)
	-	-	-					
Less than Alg 2	0.119***	0.125***	0.100***	0.010	0.021	0.058	-0.077**	-0.023
	(0.016)	(0.017)	(0.012)	(0.013)	(0.045)	(0.055)	(0.036)	(0.046)
Advanced Math	0.041**	0.055***	0.060***	0.024**	0.065**	0.083**	-0.007	0.062*
	(0.017)	(0.014)	(0.011)	(0.012)	(0.029)	(0.037)	(0.027)	(0.034)
Pre-Calculus	0.113***	0.085***	0.109***	0.013	0.056**	0.129***	-0.007	0.088***
	(0.032)	(0.013)	(0.011)	(0.012)	(0.026)	(0.035)	(0.040)	(0.031)
Calculus	0.130***	0.157***	0.201***	0.038**	0.107***	0.203***	0.038	0.114**
	(0.036)	(0.044)	(0.019)	(0.016)	(0.033)	(0.039)	(0.041)	(0.046)
N	8,208	8,768	11,190	3,979	5,293	5,979	4,307	5,017

* Core academic GPA with added point for honors, AP, IB courses in elite college model

[1] All models include controls for sex, race/ethnicity and parental education. Models for elite college attendance and baccalaureate completion also adjust for the propensity to attend college. Models are weighted and standard errors adjusted for clustering within schools sampled for each study.