Who Takes Advanced Placement (AP)?

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Abstract

In recent years there has been a renewed interest in the sources of achievement gaps between groups of students. One potential source is differential access to high quality educational opportunities. This paper provides an analysis of who takes Advanced Placement (AP) Economics. Using two years of administrative data on all high school students who take a course to satisfy Georgia's graduation requirement in economics, we find large differences in enrollment in AP Economics across groups. Specifically, African-American and Hispanic students and students from low-income backgrounds are about half as likely to be enrolled in AP Economics as other students. However, once we control for prior academic achievement in Geometry, African-American and Hispanic students are overrepresented relative to whites and the difference between low income and other students is reduced significantly. Female students are overrepresented relative to males, and Asian students are overrepresented relative to whites—this latter effect is large. African-American, Hispanic, and especially Asian students are more likely to attend high schools that offer AP Economics. Students living outside of metropolitan Atlanta and students in smaller schools have much less access to AP Economics.

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Economists and other social scientists have long been interested in analyzing the sources of differences in student achievement between various groups of students. Jencks and Phillips (1998) reported that differences in test scores between African-American and white students had narrowed considerably after the 1954 U.S. Supreme Court decision in Brown v. Board of Education declared that governments could no longer legally establish separate schools for black and white students. Johnson and Neal (1998) found that differences in basic cognitive skills in Language Arts and Mathematics as measured by the Armed Forces Qualifying Test (AFQT) explained a large portion of the differences in later wages and earnings between whites and African-Americans.

After decades of declines, the gap between the academic achievement of African-American and white students has remained large. Moreover, in recent years the declines in achievement gaps have stagnated or slowed (Magnuson and Waldfogel, 2008). Recent research has discovered that the gap in academic achievement between low income and higher income students is large and—in contrast to the black-white achievement gap—has widened significantly since the 1950s (Reardon, 2011).

Given the large role that cognitive skills appear to play in determining wages, earnings, and other life outcomes and given the large—and sometimes growing—achievement gaps that exist between different groups of students, it is worth analyzing potential sources of achievement gaps. One potential source of achievement gaps is differences in access to Advanced Placement (AP) courses in high school. If low income students and students from historically disadvantaged racial and ethnic groups have less access to AP courses than other students, this differential access may be a source of achievement gaps between students and may have adverse effects on their labor market and other outcomes. This paper analyzes access to AP with a special emphasis on differences across racial and income groups and geographic differences.

The Advanced Placement (AP) Program sponsored by the College Board has been creating curricula and tests for advanced high school courses since 1955. AP courses are designed to be more challenging than typical high school courses and potentially lead to course credit for college (Willingham and Morris 1986). High schools can select to teach any of the 34 AP subjects the College Board currently offers provided that they obtain College Board approval. To label a course as an "AP" course means that the high school obtains approval of the syllabus and teacher by the College Board and has a class size that is typically smaller than non-AP courses.

Over the past generation American policymakers have made increasing enrollment in AP courses a national priority. In 1989, the governors of the 50 American states and then-President George H.W. Bush met in Charlottesville, Virginia and created, for the first time, national goals for education. Their effort was called Goals 2000. The 3rd of these national education goals stated that "By the year 2000, American students will leave grades four, eight, and twelve having demonstrated competency in challenging subject matter …." One specific metric to measure progress toward this 3rd national education goal was the number of students in Advanced Placement courses (National Education Goals Panel 1999, vi).

In recent years national leaders from both major American political parties have advocated for greater enrollment in AP courses. For example, in his 2006 State of the Union Address then-President Georgia W. Bush said, "Tonight I propose to train 70,000 high school teachers, to lead advanced-placement courses …" (Bush, 2006). And, U.S. Secretary of Education Arne Duncan recently said, "It is no secret that I am a huge fan of AP" (Duncan, 2010), and "I am also especially encouraged by increasing enrollment in advanced placement classes as one indicator of high school rigor" (Duncan 2011).

In addition, leaders of the business community have expressed the opinion that greater enrollment in AP courses is an important step toward improving the quality of the American workforce. Furthermore, they use AP enrollment and success as measures of workforce quality (U.S. Chamber of Commerce, 2011).

Overall, the United States has seen significant increases in enrollment in AP courses. In the six decades since the birth of the AP Program, the number of schools offering AP courses has increased from under 900 to over 15,000 (College Board 2007; Klopfenstein and Thomas 2009). According to the College Board, "In May 2011, nearly two million students representing more than 18,000 schools around the world, both public and nonpublic, took 3.4 million AP Exams." (College Board 2012a)

Many, however, have an additional goal regarding the AP program. On its website, the College Board—the purveyor of AP courses—states that "equitable access" to AP courses is an important goal. Their statement of support of equitable access pays particular attention to access for students who are racial or ethnic minorities who have traditionally been "underserved" or are from low income backgrounds:

> *The College Board strongly encourages educators to make equitable access a guiding principle for their AP programs by giving all willing and academically prepared students the opportunity to participate in AP. We encourage educators to:*
>
> - *Eliminate barriers that restrict access to AP for students from ethnic, racial, and socioeconomic groups that have been traditionally underserved.*
> - *Make every effort to ensure their AP classes reflect the diversity of their student population.*
> - *Provide all students with access to academically challenging coursework* ***before*** *they enroll in AP classes*
>
> *Only through a commitment to equitable preparation and access can true equity and excellence be achieved.* (College Board 2012b)

It is this access issue regarding the AP program that is the subject of this paper. Specifically, we analyze the likelihood of taking AP Economics for different types of students. Given that national leaders, business leaders, and leaders in economic education have the goal of increasing enrollment in AP courses, we analyze AP course-taking and pay particular attention to students who have been "traditionally underserved".

Using administrative data from two cohorts of students in Georgia public schools, we estimate a series of regression models that analyze course-taking in AP Economics in various ways. Georgia data are well-suited for examining course-taking in AP Economics because all public school students are required to take economics in high school, and a good measure of prior student achievement in mathematics is available. Prior achievement in mathematics has been found to be a strong predictor of success in high school economics (Clark, et al. 2012; Ballard and Johnson 2004).

In what we consider to be a naïve empirical specification, that has only student demographic characteristics as regressors—and is similar to virtually all the prior literature on AP course-taking—we find large differences in AP Economics course-taking across groups. Asian students, white students, and students from higher income backgrounds are much more likely to be enrolled in AP Economics relative to other types of students. However, once we control for prior achievement in Geometry, African-American and Hispanic students are actually overrepresented in AP Economics relative to white students—this overrepresentation is large relative to the percentage of students overall in AP Economics and statistically significant. Conditional on prior achievement in Geometry, low income students are underrepresented in AP Economics, but the estimated difference is reduced by just over one-half relative to our naïve specification. Nevertheless, the difference between low income and higher income students remains large and statistically significant.

The likelihood that a low income African-American or Hispanic student takes AP Economics is virtually identical to that of a higher income white student all else equal, including prior achievement in Geometry. Based on our results, an important reason why African-American, Hispanic, and low income students are less likely to be enrolled in AP Economics relative to white and Asian students is prior achievement in Geometry.

Males and females are about equally likely to be enrolled in AP Economics—even though males have much higher prior achievement in Geometry. Thus, controlling for prior achievement, males are less likely to take AP Economics relative to females, all else equal.

Smaller high schools and high schools outside of the twenty county region defined as metropolitan Atlanta are much less likely to offer AP Economics. African-American, Hispanic, and especially Asian students are more likely to attend high schools that offer AP Economics. In addition, African-American, Hispanic, and students from low income backgrounds attend schools that increase their likelihood of taking AP Economics.

Our results are consistent with the empirical findings in Conger et al. (2009)—the only other study that, to our knowledge, controls for prior achievement when analyzing AP course-taking. While we confirm the results in Conger et al. using data from a different state, we also add to the literature by pointing out the important role that geography plays in access to AP—students in urbanized areas outside of metropolitan Atlanta and especially students in rural areas have far less access to AP than students who live in metropolitan Atlanta, even after controlling for school size. The differences in access to AP Economics by geography are large.

The rest of this paper is organized as follows. The next section contains an explanation of critiques of the AP program, including the issue regarding access for traditionally underserved student populations, and a review of the relevant literature. The section that follows explains why the state of Georgia is well-suited for analyzing the issue of AP course-taking and also describes our data. A discussion of our empirical approach follows. The final two sections contain our empirical results and concluding remarks, respectively.

The AP Program

There are at least three arguments for AP coursework in high school. First, AP coursework may provide a challenge for those students who might otherwise be bored by the typical high school coursework and risk becoming disengaged. The second argument is that the advanced material in AP courses increases human capital more than the corresponding "regular" high school course. That is, perhaps AP courses better prepare students for college than what they might otherwise experience in high school. Third, students who successfully complete AP coursework in high school may receive college credit, which may reduce expenses in college.

Researchers have analyzed a series of questions regarding AP coursework. First, chapters in the edited volume *AP: A Critical Examination of the Advanced Placement Program* (Sadler et al., eds. 2010) ask whether AP coursework provides any benefits beyond regular coursework to students. Any correlation between AP coursework or success in AP courses in high school and later success in college may be an artifact of better and more motivated students selecting into AP courses. That is, students who took or were more successful in AP coursework in high school may have had the same success in college, with or without AP. Authors and editors of this volume suggest that the AP program may be a costly diversion of resources away from more worthy programs and more needy students. A second set of questions regards the content standards prescribed for AP courses, including AP Economics (see, for example, Ferrarini, et al. 2011).

A third question raised by researchers is whether there are barriers facing students who are racial or ethnic minorities and students from low income backgrounds that deny them the same access to AP courses as other students. These barriers, they suggest, could exacerbate existing inequalities in the education system.

There has been a lot of evidence that students who are racial and ethnic minorities and students from lower income backgrounds are less likely than other students to be enrolled in AP courses (see, for example, Taliaferro and DeCuir-Gunby 2008; Handwerk et al. 2008; Moore and Slate 2008; and Klopfenstein 2004). Typically, these studies find that low income, African-American, and Hispanic students are about half as likely to be enrolled in AP courses as other students.

There are several hypotheses put forward as to why minority and low income students have lower rates of enrollment in AP courses. Given the significant segregation of American public schools by race and class, many suggest schools where racial and ethnic minorities attend and schools where low income students attend are less likely to offer AP courses. In addition, many question whether schools overtly or subtly steer minority or low income students out of AP courses, and whether minority or low income students exclude themselves from AP courses because of ignorance about the benefits of AP or because of peer pressure (see, for example, Fordham and Ogbu 1986).

If AP courses increase the human capital of students beyond regular high school courses, then access to AP courses is an interesting issue. The evidence as to whether AP course-taking or success in AP coursework increases human capital is mixed. Clark, et al. (2012) provides a review of the literature.[1]

Klopfenstein and Thomas (2010), however, present a further rationale for analyzing the AP access issue. They write, "Non-AP students can face substantial opportunity costs as a result of increasing the number of AP courses, and these costs are exacerbated in small schools. In order to expand AP course offerings with limited financial and staffing resources, schools must increase non-AP class sizes, divert the highest quality teachers away from non-AP classes, and eliminate non-AP course offerings."(p. 176) Thus, if certain groups of students are less able to enroll in AP courses, then these students have less access to potentially better courses and may have fewer resources, less effective teachers, and fewer course offerings in the non-AP classes they take.

Conger, et al. (2009) provide a comprehensive survey of the literature regarding who takes AP and other advanced high school courses. They fault the earlier studies for not controlling for observable measures of student achievement prior to attending (or having the opportunity to attend) an AP class. If an AP class is supposed to be available to students who are ready for college-level work, one would expect that academic achievement serves as a relevant predictor of participation in AP. Once they control for prior student achievement, they find that many of the observed differences in AP course-taking disappear. Conger et al. analyze course-taking for AP and other advanced high school courses. They find that in some cases African-American and Hispanic students are overrepresented in these advanced courses, controlling for prior achievement. Thus, they find that prior achievement is a strong predictor of AP course-taking. They use performance on standardized tests in 8th grade as their measure of prior achievement.

Our study takes an approach very similar to Conger et al. (2009). While we limit our attention to the AP Economics course, we find very similar results.

Data from Georgia and its suitability for analyzing access to AP Economics

Georgia offers a good opportunity to examine whether various groups of students have differential access to AP Economics. First, all Georgia public school students are required to take economics as part of their high school curriculum. Thus, each Georgia public high school must offer one or more courses in economics: “regular” Economics, AP Microeconomics, and/or AP Macroeconomics. In our empirical work, we treat both AP Microeconomics and AP Macroeconomics as “AP Economics.”

Second, during the time period covered by our data, all public school students had to take Geometry and the same standardized End of Course Test (EOCT) in Geometry. This EOCT, at that time, counted as 15 percent of each student’s course grade, so students had an incentive to perform well on the exam.[2] Since Geometry has been shown to be a strong predictor of success in high school economics (see, for example, Clark, et al. 2012; Ballard and Johnson 2004), performance on the Geometry EOCT serves as a strong control for aptitude and achievement prior to taking an economics course. Therefore, we have a useful measure of each student’s preparedness for AP Economics. Only one prior study, that we are aware, on AP course-taking has used prior student achievement in its analysis. As shown in our results below and in Conger, et al. (2009), prior achievement is an important predictor of AP and other advanced course-taking.

The third reason that Georgia is well-suited for studying AP course-taking is that the Georgia Department of Education (GaDOE) tracks each student’s achievement throughout his or her school years, and its administrative data are rich with information concerning relevant student characteristics.[3]

The data for our research come from the GaDOE. For the 2006-07 and 2007-08 school years, our database contains student-level administrative data for all public high school students in Georgia who took economics during those two school years. Our student-level data contain demographic information such as gender, economic status, and ethnicity. Also contained in the data is a code for the type of economics course the student has taken, AP or a basic economics course.

In our data, we also observe the prior Geometry EOCT score for each student who takes economics. This is important because it allows us to include a measure of student achievement before taking an economics class as a predictor of enrollment in AP.

Scores on the Geometry EOCT have been trending upward since it was first implemented in 2004. This general trend indicates, in part, that teachers and students may be getting more familiar with the testing environment over time. Therefore, we norm the test results so that they are comparable from year to year. We create Z-scores for each test score equal to: $((x_{it} - \mu_t)/\sigma_t)$, were x_{it} is the individual student's EOCT score at time *t*, μ_t is the mean of the test scores in year *t*, and σ_t is the standard deviation of the test score for year *t*.

Table 1 presents student-level summary statistics of our data. About seven percent of students who took economics during the two years under study were enrolled in AP Economics. About 33 percent of Georgia public high schools offered AP Economics during our sample period. These schools that offered AP Economics served 54.7 percent of Georgia students. Students enrolled in classes that would not be considered AP or "regular", such as International Baccalaureate (IB) classes, were dropped from the sample. There were only 101 students enrolled in IB classes in the initial sample. When we included IB courses with AP for the analysis there were no meaningful changes in either the statistical significance or magnitudes of any variables in any of the regressions presented in this paper.

At the top of Table 1 we report student level data for the full sample and separately for students who are enrolled in an AP Economics course and for students who are enrolled in a "regular" economics course. The bottom of Table 1 contains school variables, including region of the state (metropolitan Atlanta, rural, or suburban or urban region outside metropolitan Atlanta—*other region*), average school Geometry test score, and average student demographic characteristics. These school-level variables allow us to examine whether school location, the number of economics students in the school, or types of students at schools affect whether schools offer AP Economics and students' AP course-taking. We utilize the number of economics students in the school rather than a general school size variable. Given that every student in Georgia is required to take an economics course, the number of economics students is a more relevant measure of school size when examining the decision of a school to offer an AP Economics course.

About 33 percent of economics students are eligible for a free or reduced price lunch, a measure that proxies for being from a low income family. Almost 38 percent of students are African-American, almost 4 percent are Asian, and just over 5 percent are Hispanic. Almost 64 percent of the students in our sample reside in the twenty-county region that is considered as metropolitan Atlanta. Just over 12 percent of the sample is located in a rural area outside of the twenty county region considered as metropolitan Atlanta, and another 24 percent of students live in urban or suburban settings outside of metropolitan Atlanta.

The last two columns of Table 1 show the differences in means for students enrolled in AP Economics and for students enrolled in a basic economics course. Just like the prior literature, we find large differences in course-taking across groups of students. While more than 34 percent of students in the basic economics course come from a low income background, only about 17 percent of AP students are eligible for a free or reduced price lunch. While 39.1 percent of students in the basic economics course are African-American, only 18.7 percent of AP Economics students are African-American. AP Economics students averaged one standard deviation above the mean on their geometry test, while the mean Z-score on the Geometry test was -.02 for students in the basic economics course.

Table 2 shows differences in school-level means for schools that offer AP Economics and for schools that do not. High schools that offered AP Economics during the time period under study had students with much higher average achievement in geometry, and they also had higher proportions of white, Hispanic, and especially Asian students. Schools that offered AP Economics had lower proportions of low income students, on average, relative to schools that did not offer AP Economics. Schools that offered AP Economics were over twice as large as schools that did not—659.5 economics students relative to 306.3 students.

In the next section we describe our empirical approach to analyzing the effects of race/ethnicity, economic status, prior achievement, location, and the number of economics students in the school on differences in AP course-taking. To our knowledge, we are the first study to analyze the effect of school location on AP course-taking.

Empirical Approach

To get at the many aspects of the issue, we estimate a series of regressions to analyze AP course-taking.

Access to AP Economics at the School Level

An obvious determinant of access to AP is whether one's school offers AP courses. The following empirical model estimated with school-level data allows us to analyze what factors are associated with individual schools offering AP economics. The school-level empirical model is

$$SchoolAP = \beta_0 + \beta_1 * AverageGeometryScore + \beta_2 * PctAsian + \beta_3 * PctBlack + \beta_4 * PctHispanic + \beta_5 * PctOtherRace + \beta_6 * PctPoverty + \beta_7 * PctDisable + \beta_8 * Year2008 + e \quad (1)$$

where *SchoolAP* is a dummy variable that equals 1 if the school offers AP economics courses. *AverageGeometryScore* is the school level average score on the Geometry End of Course Test. Each of the *Pct* variables is the relevant percentage of students in the school with that specific characteristic (with percent white as the omitted ethnic classification). As shown in Table 1 very small percentages of our sample are either classified as disabled or from the "other" race/ethnicity category. Given these small percentages, we do not make specific claims about the results for these two groups of students below.

In a second school-level specification we add variables to capture the effects of region and the number of economics students in the school on AP access at the school level. The enhanced school-level empirical model is

$$SchoolAP = \beta_0 + \beta_1 * AverageGeometryScore + \beta_2 * PctAsian + \beta_3 * PctBlack + \beta_4 * PctHispanic + \beta_5 * PctOtherRace + \beta_6 * PctPoverty + \beta_7 * PctDisable + \beta_8 * Year2008 + \beta_9 * Rural + \beta_{10} * OtherRegion + \beta_{11} * \#EconStudents + e. \quad (2)$$

Rural and *OtherRegion* are dummy variables that indicate the area of the state in which the individual lives (*metropolitan Atlanta* is the omitted variable). *#EconStudents* is the number of students at the school enrolled in economics courses at the school and represents the relevant indicator of school size.

Naïve Student-Level Specification

We then examine AP course-taking at the individual student level. First we estimate a "naïve" regression that provides a baseline for comparison with later regressions. Our naïve empirical model is

$$AP = \beta_0 + \beta_1 * Poverty + \beta_2 * Male + \beta_3 * Black + \beta_4 * Asian + \beta_5 * Hispanic + \beta_6 * OtherRace + \beta_7 * Disable + \beta_8 * Year2008 + e \quad (3)$$

where *AP* is a dummy variable equal to one if the individual student is enrolled in an AP economics course. *Poverty* is a dummy variable that equals one if the individual student is eligible for a free or reduced price lunch. The other variables are also dummy variables.

We believe that this empirical specification is naïve in that it does not control for prior academic achievement. Nevertheless, all prior studies on AP course-taking except one have used this approach, to our knowledge, and it serves as a baseline for comparison purposes.

Student-Level Specification that Controls for Prior Academic Achievement

We then modify the baseline in Equation 3 to include the student's past Geometry score as a measure of prior achievement, ability, and effort. Our enhanced student-level empirical model is

$$AP = \beta_0 + \beta_1 * Poverty + \beta_2 * Male + \beta_3 * Black + \beta_4 * Asian + \beta_5 * Hispanic + \beta_6 * OtherRace + \beta_7 * Disable + \beta_8 * Year2008 + \beta_9 * GeometryScore + e \quad (4)$$

where *GeometryScore* is the student's standardized Z-score on the Geometry End of Course Test. If AP courses are, as advertised, for high school students who are prepared to do college-level work, it follows that prior achievement should be an important predictor of AP course taking.

Further Empirical Specifications with a Restricted Sample

We estimate Equation 4 using two samples—the "full" sample that includes students at schools that both offer and do not offer AP Economics and a "restricted" sample that includes only students who attend schools that offer AP classes, where the latter allows us to examine only those students for which AP enrollment is possible at their current schools.

We also add school-level fixed effects to the restricted sample to control for time invariant school-level factors that may influence AP course taking, such as location and racial makeup. We then replace the school level fixed effects with the series of school-level variables utilized in Equation (2). These latter two specifications allow us to analyze the impact of schools on AP course-taking, for students who attend schools with AP Economics. As discussed above, the school-level empirical models in Equations (1) and (2) analyze which schools offer AP Economics.

Estimation of Empirical Models

We estimate each of the empirical models described above using ordinary least squares with robust standard errors and report the results in the next section. Given that the dependent variable of each of these empirical models is a dummy variable, we are using a linear probability model approach. This approach allows us to include school-level fixed effects in our empirical models, which is problematic in the estimation of probit models.[4] These fixed effects, which control for time-invariant school factors, are shown below to be very important in our results presented in the next section.

In the appendix we include probit results for the student level regressions that do not include fixed effects. The results in the appendix are virtually identical with the corresponding OLS results in Tables 4 and 6. Because of problems identifying the correct approach to estimating probit models with fixed effects (Fernández-Val, 2009), we do not replicate the fixed effects models.

However, using a linear probability approach as opposed to probit estimation strategy involves a tradeoff. Linear probability models suffer from three potential problems: heteroskedasticity, predicted probabilities that may lie outside the 0 – 1 range, and potentially biased and inconsistent estimates (Horrace and Oxacca, 2006). As we are estimating and reporting robust standard errors, heteroskedasticity isn't a concern.[5]

Horace and Oxacca suggest that empirical researchers may still have good reasons to use a liner probability approach despite its potential problems. Given the similarity between the probit and OLS results, the problems concerning the use of fixed effects in a probit model, and the ease of interpretation and comparison we choose to report the OLS results in the main body of the paper.

Results

Determinants of Schools Offering AP Economics

Table 3 contains estimates from our two school-level linear probability models consistent with Equation (1) and estimated by OLS. The dependent variable is an indicator variable that indicates whether the school offers AP Economics. As shown in Table 2, 130 high schools offered AP Economics during the time period we study, while 256 high schools did not.

The first column of Table 3 presents OLS results from regressing the presence of AP on average student characteristics. High schools with students who have higher levels of prior achievement, more Asian and African-American students, and fewer students from low income backgrounds were more likely to offer AP Economics. No other average student characteristics had statistically significant effects, although the estimated coefficient on percent low income students (*Percent Free/Reduced Lunch*) was negative, large in absolute value, and borderline statistically significant (p-value of 0.15), while the coefficient on Hispanic was positive and large, albeit statistically insignificant.

In the second column of Table 3, we add variables on school location and number of economics students to the regression. The bottom row of Table 3 shows how the R-squared increases considerably (0.17 to 0.32) when we add the variables for location and number of economics students. Adding these variables also has large effects on the coefficient estimates for the average demographic characteristics of schools. The estimated coefficient on percent African-American students becomes negative, much smaller in absolute value (.30 to -.12) and not statistically significant. The estimated coefficient on percent of low income students becomes positive, larger in absolute value, and statistically significant.

Students at high schools outside of metropolitan Atlanta (*Rural* =1 or *Other Region*=1) have less access to AP Economics relative to high schools in metropolitan Atlanta. Students from larger schools are more likely to have access to AP Economics. These effects are large—a school in a rural area is almost 25 percentage points less likely to have AP Economics than an otherwise identical high school in metropolitan Atlanta. Schools in urbanized areas outside of metropolitan Atlanta (*Other Region* = 1) are about 13 percentage points less likely to offer AP

Economics relative to high schools in metropolitan Atlanta. Schools that are one standard deviation larger (339 more economics students) are about 20 percentage points more likely to offer AP Economics.

The results in column (2) show that location and school size have very large effects on the likelihood that a school offers AP Economics. The differences in the results between columns (1) and (2) are also interesting. While African-American and Hispanic students are more likely than white students to attend schools that offer AP Economics (column 1), that appears to be the case because they disproportionately reside in metropolitan Atlanta or attend large schools. The coefficients on *African-American* and *Hispanic* become negative when we add location and school size variables in column (2). While low income students are less likely to attend schools that offer AP Economics (column 1), this appears to be the case because they disproportionately attend schools outside metropolitan Atlanta or attend small schools. The evidence for this is that the coefficient on *Percent Free/Reduced Lunch* becomes positive when we add location and school size variables in column (2).

Although the largest drivers of offering AP Economics are location in metropolitan Atlanta and school size, student characteristics do seem to be independently related to schools offering AP Economics in some cases. In particular, the estimates in column (2) show that attending a school that has a one standard deviation higher average geometry score is associated with about an 8 percentage-point increase in the likelihood that a school offers AP Economics, all else equal. A ten percentage point increase in the percent of Asian students at a school is associated with about a 10.6 percentage point increase in the likelihood that a school offers AP Economics, all else equal. A ten percentage point increase in the percentage of low income students is associated with about a 3.8 percentage-point increase in the likelihood that a school offers AP Economics, all else equal. We do not want to make too much of the very large estimated coefficient on *Percent Other* (percent of students who are of other nonwhite races/ethnicities) given that less than 2 percent of the students of this sample are in this category. Each of the other demographic characteristics has statistically insignificant coefficient estimates, but they are large in some cases.

We cannot say with our data what is causing these results. Could it be that larger schools have economies of scale that allow them to offer AP courses? Could it be that schools in metro Atlanta have more information about any benefits of AP or more access to AP teacher training?

Could it be that the parents of Asian, African-American, and Hispanic students choose schools that offer AP courses when they decide where to live or they advocate for AP course offerings once they attend school? We pose these thoughts as examples of questions that—given the results in Table 3—merit further study.

Student-Level Regression Results

Table 4 shows the results from three student-level linear probability models, where each is estimated using OLS. We discuss each set of results in turn. Each of these models is estimated with standard errors clustered by school. The first two models are estimated using all students in our data. The third is estimated using only students who attend a high school that offers AP Economics.

The first column of Table 4 is our naïve specification—naïve in that it does not include any measure of prior student achievement. The results in column (1) indicate that African-American, Hispanic, and low income students are less likely to be enrolled in AP relative to other students and the effect sizes are large and statistically significant. Again, this finding is universal in the prior literature.

However, adding prior achievement in Geometry—column (2)—changes these results in important ways. In column (2), the estimated coefficients on African-American and Hispanic become positive and statistically significant. That is, all else equal—including prior achievement in Geometry—African-American and Hispanic students are more likely to be enrolled in AP Economics than white students.

Also, adding prior achievement in Geometry to the empirical model reduces the estimated difference for low income students (*Free/Reduced Lunch*) from -0.036 [column (1)] to -0.016 [column (2)]. The point estimate in column (2) indicates that low income students are about 1.6 percentage points less likely to be enrolled in AP Economics relative to a student from a wealthier family, all else equal—including race/ethnicity and prior achievement in Geometry. Comparing column (1) and column (2) shows clearly that prior achievement is a very important reason why African-American, Hispanic, and low income students are underrepresented in AP Economics.

The results in column (2) suggest that African-American and Hispanic students are overrepresented in AP Economics as compared to white students with the same prior achievement. Low income students are underrepresented in AP Economics relative to higher income students with the same prior achievement in Geometry. Asian and female students are more likely to be enrolled in AP Economics, conditional on prior achievement.

Given that only 7 percent of the students overall are enrolled in AP Economics, the effect sizes in column (2) are large. For example, controlling for prior achievement in Geometry, African-American students are about 1.6 percentage points more likely to be enrolled in AP Economics than white students; Hispanic students are 1.7 percentage points more likely than white students; Asian students are about 16 percentage points more likely than white students to be enrolled; low income students are about 1.6 percentage points less likely to be enrolled in AP Economics than higher income students; and males are almost one percentage point less likely to be enrolled in AP Economics than females. Each of these differences is statistically significant.

Based on the results in column (2), a low income African-American student or a low income Hispanic student, for example, is slightly more likely than a higher income white student to be enrolled in AP Economics—these differences are tiny and not statistically significant. Thus, we find no evidence that an African-American or Hispanic student of low income background has more barriers to enrolling in AP Economics per se than an otherwise identical but higher income white student. Rather, a lack of prior preparation appears to be a critical barrier to access.

The results in column (2) are the main findings in our paper and answer the question of who takes AP Economics. However, the results in column (2) combine the effects of schools choosing whether or not to offer AP Economics; qualified students choosing to enroll or to not enroll in AP Economics; and schools, teachers or counselors choosing to steer students into or away from AP Economics. While no study to date, including ours, has rich enough data to fully separate individual student choice from the effects of schools on AP course-taking, the results below shed light on the role of schools on AP course-taking across groups of students.

Student-Level Regressions Using Only Students who Attend Schools that Offer AP Economics

In column (3) of Table 4, we restrict the sample only to students who attend schools that offer AP Economics, while controlling for prior achievement in Geometry. Some of the reasons why equally qualified students may not be enrolled in AP Economics when it is available include either a lack of motivation on their part or subtle, or overt, obstacles they may face within the school. The results in column (3) do not directly indicate whether one or more of these reasons are occurring. However, the results in column (3) do shed light on whether these explanations are possibilities.

Conditional on attending a school that offers AP Economics and conditional on prior achievement in Geometry, African-American, Asian, and female students are overrepresented in AP Economics relative to otherwise identical white and male students, respectively. For Asian students, this effect is large—an otherwise identical Asian student is about 16 percentage points more likely to be enrolled in AP Economics than an otherwise identical white student. For African-American and female students, they are about 1.6 percentage points more likely to be enrolled in AP Economics than otherwise identical white and male students, respectively. Each of these results is statistically significant.

Conditional on attending a school that offers AP Economics, there is no statistical difference in the likelihood of enrolling in AP Economics between white and Hispanic students. In column (3), the coefficient estimate on *Hispanic* is very close to zero in magnitude. Students who score one standard deviation higher on the Geometry exam are almost ten percentage points more likely to be enrolled in AP Economics.

Low income students, however, are less likely to be enrolled in AP Economics, all else equal. A student from a low income family is about 1.1 percentage points less likely to be enrolled in AP Economics than an otherwise identical higher income student. Again, given that only 7 percent of the students during our sample period are enrolled in AP Economics, we consider this 1.1 percentage point difference large.

Using the results in column (3), for students who attend schools that offer AP Economics, a low income African-American student is slightly more likely to be enrolled in AP Economics than an otherwise identical (including the same prior achievement) but higher income white student. However, a low income white student or low income Hispanic student is about 1.1 percentage points less likely to be enrolled in AP Economics than a higher income white student, all else equal.

Adding School Fixed Effects to the Regression Using Only Students who Attend Schools That Offer AP

Adding school fixed effects to our linear probability model allows us to see if individual schools influence AP course-taking and whether any school-level influences impact different types of students differently. These influences are shown by comparing results with and without school fixed effects.

In Table 5 we report OLS estimates of linear probability models that contain school-level fixed effects to control for any time invariant school characteristics that may impact AP course taking. Following Conger et al. (2009) we use only the sample of students who attend schools that offer AP Economics—school fixed effects allow an examination as to whether time invariant school factors impact the enrollment probabilities of various types of students differently. Given its importance in the prior specifications, we include prior achievement in Geometry (*Geometry Score*) in each specification. Column (1) in Table 5 is reproduced from column (3) of Table 4 and is included only for ease of comparison. Column (2) of Tale 5 contains the results obtained after including the school-level fixed effects. The addition of school-level fixed effects increases the descriptive power of the model—the R-squared increases from 0.115 to 0.183.

The addition of school-level fixed effects to our sample that contains only schools that offer AP courses causes the magnitudes, and in some cases the signs, of a number of the coefficients in the model to change considerably. Adding these fixed effects caused the coefficient on African American to flip signs from a marginally significant 0.016 (p-value of 0.14) to a statistically significant -0.013. This indicates that something at the school level was significantly increasing the likelihood of African Americans enrolling in AP courses. That is, African-American students were more likely to attend high schools with positive fixed effects that increased their enrollment in AP Economics.

The results are similar for Hispanic students. When adding school-level fixed effects to the regressions estimated using the sample of students who attend schools that do offer AP courses, the coefficient on Hispanic drops from a not statistically significant value of 0.001 to a highly statistically significant and larger in absolute value -0.024. The schools where Hispanic students currently attend are doing a relatively good job of enrolling them in AP Economics.

The inclusion of school-level fixed effects also increases the magnitude of the effect of being from a low income family. The coefficient on *Free/Reduced Lunch* decreases from -0.01 to -.03 when school-level fixed effects are included in the model. This indicates that something at the school level was significantly increasing the likelihood that a low income student would enroll in an AP course, at schools where these low income students actually attend. That is, the estimates of the school-specific fixed effects at their schools tend to be larger and positive.

The changes in the estimated coefficient between columns (1) and (2) suggest that African-American, Hispanic, and low income students benefit from the schools they attend in that those schools increase the likelihood that they enroll in AP Economics.

The negative coefficients on African-American, Hispanic, and low income students in column (2), however, indicate that if these groups of students were relocated to other schools it would likely decrease their probabilities of being enrolled in AP Economics.[6]

There are not large differences in the coefficient estimates for males and Asians between columns (1) and (2) in Table 5. Thus, adding school fixed effects to the regression (column 2) does not change the result that males are about 1.5 percentage points less likely to be enrolled in AP Economics relative to otherwise identical females or that Asian students are 14 to 16 percentage points more likely than white students to be enrolled in AP Economics. Thus, we find no evidence of school-level factors that are driving these results for males and Asians.

The results in Table 5 show that at least some groups of students are impacted by school-level factors that affect their AP course-taking. In the next subsection we explore if any of these school-level factors are related to school characteristics that we observe in our data.

Adding Observable School Characteristics to the Regression Using Only Students who Attend Schools That Offer AP

In Table 6, we include the school-level variables from Table 3 in our student-level regression to see if we can detect what school-level variables impact AP course-taking. In column (1) of Table 6 we have reproduced the fixed effects results from column (2) in Table 5 to make comparisons easy. We cannot include school fixed effects and observable school characteristics in the same regression because some of the school characteristics are time invariant (e.g. region) or tend to change very little from one year to the next (e.g. school size and student composition).

One takeaway from Table 6 is that the coefficients on the individual student characteristics are largely unchanged when comparing the fixed effects results (column 1) with the results that contain school characteristics as regressors in place of the school fixed effects (column 2). Given that the school characteristics are changing only slowly over time or not changing at all, this similarity of results is not surprising.

The average student characteristics tend to be statistically insignificant, except for the two smallest groups of students—disabled students and students of other races/ethnicities (column 2). Again, given their small numbers in our data, we do not want to make specific claims regarding these results. The region dummy variables follow the pattern reflected previously—students who attend schools outside of metropolitan Atlanta are less likely to be enrolled in AP Economics. Perhaps surprisingly, school size (*# of Economics Students*) is not found to have a large or statistically significant coefficient estimate. Taken together, the results from the model with school fixed effects and the results from the model with the observable school characteristics suggest that school-level factors have important effects on the likelihood of various types of students being enrolled in AP Economics. However, the estimates do not suggest what specific school-level factors are associated with these school-level effects on AP course-taking. Additional research is warranted to investigate what factors may systematically contribute to these school-level effects.

Adding Interactions Between Individual Student Demographic Characteristics and the Corresponding School-Level Average to the Regression Using Only Students who Attend Schools That Offer AP

In column (3) of Table 6 we include interactions between the demographic characteristics of individual students with the corresponding average demographic characteristics of all students at their respective schools.[7] This regression also contains all school characteristics included in column (2) and uses the sample of students who attend schools that offer AP Economics. The purpose of including these interaction terms is to see if there is any increase in enrollment in AP for students who attend schools with more students who share their demographic characteristics. For example, are African-American students more likely to enroll in AP Economics, all else equal, if there are more African-American students at their school? Having more students that share the same characteristics may lead to more peer pressure or more feelings of comfort that could impact—negatively or positively—the probability that students enroll in AP Economics.

As shown in column (3) of Table 6, most of these interaction terms are quantitatively small and statistically insignificant. The two exceptions are the interaction term Asian*Percent Asian at the school (*Asian Interaction*) and Hispanic*Percent Hispanic at the school (*Hispanic Interaction*). The best way to see the magnitudes of these interaction terms is to compare the results in column (2) with the results in column (3). Based on the results in column (2), if any student—including an Asian student—attends a school that has a one standard deviation higher percentage of Asian students (0.0509, or 5.1 percentage points, as shown in the first column of Table 2), then he or she is .07 percentage points more likely to enroll in AP Economics (.1305*.0509 = .0066), but this magnitude is not statistically different from zero. However, the results in column (3) suggest there is an increased likelihood of taking AP Economics for individual Asian students who attend schools that have more Asian students. Based on the results in column (3), an Asian student who attends a school that has a one standard deviation higher percentage of Asian students is 2.2 percentage points more likely to enroll in AP Economics (.0774*.0509 + .3592*.0509 = .022). Given that only 7 percent of all students take AP Economics, 2.2 percentage points is large. The corresponding increase for non-Asian students is less than 0.4 percentage points and is not statistically significant (.0774*.0509 = .0039).

The results for Hispanic students who attend schools with higher percentages of Hispanic students are quite different than the results for Asian students. Based on the results in column (2)—with no interaction terms—if any student, Hispanic or otherwise—attends a school with a one standard deviation higher percentage of Hispanic students (.0919 or 9.19 percentage points), then he or she is 1.5 percentage points more likely to enroll in AP Economics, all else equal (.1641*.0919 = .015). This magnitude is not quite statistically significant at conventional levels. However, the interaction terms in column (3) allow us to see that Hispanic and non-Hispanic students have different experiences when the percentage of Hispanic students is increased by one standard deviation. Based on the results in column (3), attending a school with one standard deviation more Hispanic students, increases the probability of enrolling in AP Economics by only 0.1 percentage points for Hispanic students (.2272*.0919 - .2148*.0919 = .001). However, for non-Hispanic students, attending a school with one standard deviation more Hispanic students, increases the probability of enrolling in AP Economics by 2.1 percentage points, and this increase is statistically significant (.2272*.0919 = .0021). Thus, the results in column (3) indicate that when more Hispanic students are enrolled at a school, then there is an increase in the likelihood that non-Hispanic students are enrolled in AP Economics, all else equal. Future research should analyze the reasons for this finding.

We created a few other variables and interactions to check for similar effects. We estimated a model much like the one in the third column of Table 6 using school racial majority dummies and interactions instead of percentage variables. These majority variables were statistically insignificant.

Concluding Remarks

In this paper, we seek to analyze course taking behavior for AP Economics using the cohorts of students who took Georgia's required Economics course in either the 2006-07 or 2007-08 academic years. Differential access to AP is a potential source of achievement gaps between groups of students.

Georgia data are well-suited for examining course-taking in AP Economics because all public school students are required to take economics in high school and a good measure of prior student achievement in mathematics is available. Prior achievement in mathematics has been found to be a strong predictor of success in high school economics (Clark, et al. 2012, Ballard and Johnson 2004).

Like virtually all of the prior literature looking at AP course-taking in other states or nationally, we initially find—unconditionally—that African-American, Hispanic, and low income students are about half as likely to take AP Economics in Georgia public schools relative to other students. Based on this type of evidence, it is not uncommon for researchers and civil rights leaders to conclude as does Klopfenstein (2004, p. 130), "In many ways, black and Hispanic students do not have equal access to AP Programs even when AP courses are offered in their schools." Parker (2012) similarly intones, "'There is a twofold problem with advanced placement courses in public school system(s) because some heavily minority populated schools have limited access to advanced placement courses,' said Hilary Shelton, director of the NAACP's Washington bureau. 'Other schools have 'segregation' in their advanced placement courses because the classes tend to have a majority of white students.'"

We have endeavored to follow Conger et al. (2009) and analyze this issue with more data than was available in the prior research. Specifically, Conger et al. and our study add prior achievement and school size as control variables. In addition, we pay close attention to the effect of school location on access to AP.

Our main findings are:

Controlling for school size, students from outside metropolitan Atlanta are much less likely to have AP Economics offered at their high schools relative to students who attend high schools within the 20-county metropolitan Atlanta region. This effect is larger for rural areas outside metropolitan Atlanta relative to urbanized areas outside metropolitan Atlanta. This finding of an important role for geography is new to this literature. In addition, smaller high schools are much less likely to offer AP Economics.

Low income students are less likely and Asian, African-American, and Hispanic students are more likely to attend high schools that offer AP Economics. Although the estimate for Hispanic students is not statistically significant, it is large. There is evidence that one reason African-American, Hispanic, and Asian students are more likely to attend schools that offer AP Economics is because these students are more likely to reside in metropolitan Atlanta and attend larger high schools.

Prior achievement in Geometry is a strong predictor of enrollment in AP Economics.

Using student-level data from all Georgia high schools, Asian, African-American, Hispanic, and female students are more likely to be enrolled in AP Economics relative to white and male students—conditional on prior achievement in Geometry. Low income students are less likely to be enrolled in AP Economics relative to students from higher income families—but this difference is much smaller than suggested by prior research that did not control for prior achievement. While each of these differences is large, the differential enrollment for Asian students relative to white students is very large. These results are the main findings in the paper with regards to the question of who takes AP Economics. The results listed below shed light on some reasons why these patterns of course taking are present.

Conditional on attending a high school that offers AP Economics, low income and male students are less likely to be enrolled in AP Economics than higher income and female students, respectively, all else equal including prior achievement. Asian and African-American students are more likely to be enrolled in AP Economics than white and Hispanic students, all else equal including prior achievement. In this particular setting, there is no large or statistically significant difference in course-taking between white and Hispanic students, all else equal.

School-level effects impact the course-taking of different groups of students differently. In particular, African-American, Hispanic, and low income students are “advantaged” by the schools they attend in that some aspect of their schools make it more likely that they are enrolled in AP Economics relative to otherwise identical white and higher income students, respectively.

Individual Asian students are more likely to be enrolled in AP Economics when there are more Asian students attending their schools, and individual non-Hispanic students are more likely to be enrolled in AP Economics when there are more Hispanic students attending their schools, all else equal.

Our results are almost identical to those reported in Conger et al. (2009), the only other study that, to our knowledge, controls for prior achievement in analyzing the issue of advanced course-taking in high school. Studies that do not control for prior achievement typically conclude that schools, counselors, teachers, and parents must do more to eliminate any barriers and must devote efforts to promoting AP enrollment for African-American, Hispanic, and low income students. Our empirical results indicate that those efforts may be important in improving enrollment rates for low income students given that we find that low income students who are otherwise identical to higher income students, including having the same prior achievement, are less likely to enroll in AP courses. Our results suggest that low prior achievement is a large barrier that appears to be keeping low income students out of AP courses. Nevertheless, given the recent finding that achievement gaps between high and low income students are large and have substantially increased over the past 60 years (Reardon, 2011), future research should analyze the role that differential enrollment or access to AP coursework plays in those achievement gaps.

African-American and Hispanic students are more likely to be enrolled in AP courses than otherwise identical white students, including having the same prior achievement. Thus, efforts to enroll more African-American and Hispanic students in advanced coursework in high schools seem to have had their intended effect—based on our evidence on AP Economics in Georgia. But, our results point to the large role of prior achievement in keeping African-American and Hispanic students out of AP and other advanced courses.

In addition, smaller schools are less likely to offer AP coursework and the magnitude of this effect is large. Perhaps virtual course offerings can become a more prevalent means of providing AP and other advanced coursework to qualified students in small schools, if virtual course offerings prove to be efficacious.

Finally, our study finds a large role for school location—high schools in metropolitan Atlanta are far more likely to offer AP Economics relative to schools outside of metropolitan Atlanta, even controlling for school size. Perhaps schools outside metropolitan Atlanta are less aware of the benefits of AP, less of aware of resources available to help teachers and courses gain approval for AP status, or have less access to these resources. Of course, although Georgia is a large and diverse state, other states and other advanced courses could have different experiences than those found in Georgia.

For those who share the goal of the civil rights community, the business community, the College Board, elected officials, and others in promoting access to AP Economics for all qualified students—especially low income and minority students who have been "traditionally underserved"—our findings yield several suggestions: focus on increasing prior achievement in mathematics, further encourage qualified low income and male students to enroll in AP Economics, explore the efficacy of making AP Economics more accessible through virtual means for students in smaller high schools, and seek to understand and overcome what is stopping schools outside of large metropolitan areas from offering AP Economics.

Another suggestion comes from the results in Jackson (2010) who found that an incentive program in Texas that paid teachers and students for passing grades on AP exams led to a large increase in AP enrollment and success.

Finally, it is not likely that our results will eliminate all equity criticisms of the AP program. Some may criticize the program if there was evidence that students who are not enrolled in AP courses are harmed because of the existence of AP courses in their high schools. Even if all qualified students were enrolled in AP courses and even if the students in AP classes represent the demographics in each school there may be some inequitable distribution of resources. As noted in the introduction, Klopfenstein and Thomas (2010) suggest that AP courses may attract the best students, the best teachers, and resources out of "regular" classes and thus harm the education of students in those regular classes. Future research should seek to analyze whether there is any evidence of this possibility.

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Table 1: Summary Statistics of Student Level Data

	Full Sample Mean (Std. Dev.)	AP Mean (Std. Dev.)	Non AP Mean (Std. Dev.)
Student Characteristics			
AP	0.0714	1	0
	(0.2575)		
School Offers AP	0.5472	1	0.5124
	(0.4978)		(0.4998)
Economics Score	0.1074	1.1451	0.0276
	(0.9586)	(0.9412)	(0.9123)
Geometry Score	0.0534	1.0600	-0.0240
	(1.0239)	(1.2246)	(0.9643)
Free/Reduced Lunch	0.3310	0.1688	0.3434
	(0.4706)	(0.3746)	(0.4749)
Male	0.4684	0.4744	0.4679
	(0.4990)	(0.4994)	(0.4990)
African American	0.3766	0.1865	0.3912
	(0.4845)	(0.3895)	(0.4880)
Asian	0.0371	0.1408	0.0291
	(0.1890)	(0.3478)	(0.1681)
Hispanic	0.0522	0.0410	0.0531
	(0.2225)	(0.1982)	(0.2243)
Other Race	0.0186	0.0235	0.0182
	(0.1351)	(0.1516)	(0.1337)
Disabled	0.0440	0.0128	0.0464
	(0.2052)	(0.1123)	(0.2104)
School Characteristics			
Rural	0.1212	0.0145	0.1294
	(0.3264)	(0.1197)	(0.3356)
Other Region	0.2421	0.1146	0.2519
	(0.4283)	(0.3185)	(0.4341)
Metro Atlanta	0.6367	0.8709	0.6187
	(0.4809)	(0.3354)	(0.4857)
School Geo Score	0.0534	0.3454	0.0309
	(0.5215)	(0.5218)	(0.5146)
Percent Asian	0.0357	0.0705	0.0330
	(0.0518)	(0.0687)	(0.0493)
Percent African-American	0.4014	0.3088	0.4085
	(0.2992)	(0.2464)	(0.3017)
Percent Hispanic	0.0694	0.0976	0.0672
	(0.0849)	(0.0960)	(0.0836)
Percent Other	0.0206	0.0257	0.0202
	(0.0124)	(0.0107)	(0.0125)
Percent Free/Reduced Lunch	0.4011	0.3183	0.4075
	(0.2122)	(0.2102)	(0.2110)
Percent Disabled	0.1026	0.0999	0.1028
	(0.0291)	(0.0229)	(0.0295)
Sample Size	111,861	7,985	103,876

Table 2: Summary Statistics of School Level Data

	School Offers AP Mean (Std. Dev.)	School Does Not Offer AP Mean (Std. Dev.)
School Geo Score	0.0838	-0.1494
	(0.4991)	(0.5056)
Percent Asian	0.0369	0.0114
	(0.0509)	(0.0163)
Percent African-American	0.3960	0.4360
	(0.2973)	(0.3120)
Percent Hispanic	0.0740	0.0535
	(0.0919)	(0.0842)
Percent Other	0.0223	0.0147
	(0.0129)	(0.0120)
Percent Free/Reduced Lunch	0.4024	0.5000
	(0.2124)	(0.2081)
Percent Disabled	0.1021	0.1161
	(0.0292)	(0.0765)
Rural	0.0769	0.3594
	(0.2675)	(0.4808)
Other Region	0.2462	0.3359
	(0.4324)	(0.4732)
# of Economics Students	659.4538	306.2891
	(342.4948)	(239.6039)
Sample Size	130	256

Note: Summary statistics are not weighted.

Table 3: School Level Regressions

	(1) Characteristics Coefficient (Std. Error)	(2) Region and Size Coefficient (Std. Error)
School Geo Score	0.1392	0.0813
	(0.0604)	(0.0564)
Percent Asian	3.2131	1.0612
	(0.6035)	(0.5565)
Percent African-American	0.3013	-0.1178
	(0.1233)	(0.1298)
Percent Hispanic	0.2547	-0.3168
	(0.3126)	(0.3043)
Percent Other	4.4182	3.9861
	(2.1702)	(1.7782)
Percent Free/Reduced Lunch	-0.2817	0.3798
	(0.1748)	(0.1837)
Percent Disabled	-0.0700	-0.2541
	(0.2595)	(0.1924)
Rural	--	-0.2456
		(0.0715)
Other Region	--	-0.1309
		(0.0606)
# of Economics Students	--	0.0006
		(0.0001)
Sample Size	386	386
R-squared	0.1694	0.3191

Table 4: Student Level Regressions

	Full Sample		Only AP Schools
	(1)	(2)	(3)
	Simple	Academic Ability	Academic Ability
	Coefficient	Coefficient	Coefficient
	(Std. Error)	(Std. Error)	(Std. Error)
Free/Reduced Lunch	-0.0362	-0.0159	-0.0114
	(0.0018)	(0.0018)	(0.0075)
Male	-0.0005	-0.0084	-0.0155
	(0.0015)	(0.0015)	(0.0046)
African American	-0.0332	0.0171	0.0159
	(0.0018)	(0.0019)	(0.0106)
Asian	0.1909	0.1662	0.1588
	(0.0041)	(0.0040)	(0.0188)
Hispanic	-0.0117	0.0170	0.0012
	(0.0036)	(0.0035)	(0.0119)
Other Race	0.0120	0.0266	0.0146
	(0.0057)	(0.0055)	(0.0128)
Disabled	-0.0469	0.0020	-0.0140
	(0.0037)	(0.0036)	(0.0134)
year_2008	0.0112	0.0065	0.0146
	(0.0015)	(0.0015)	(0.0083)
Geometry Score	--	0.0658	0.0967
		(0.0008)	(0.0110)
Only AP Schools	No	No	Yes
Sample Size	111,861	111,861	61,210
R-squared	0.0366	0.0891	0.1146

Table 5: Adding Fixed Effects

	Only AP Schools	
	(1)	(2)
	Academic Ability Coefficient (Std. Error)	School FE Coefficient (Std. Error)
Free/Reduced Lunch	-0.0114	-0.0297
	(0.0075)	(0.0033)
Male	-0.0155	-0.0145
	(0.0046)	(0.0025)
African American	0.0159	-0.0131
	(0.0106)	(0.0037)
Asian	0.1588	0.1386
	(0.0188)	(0.0059)
Hispanic	0.0012	-0.0238
	(0.0119)	(0.0058)
Other Race	0.0146	0.0003
	(0.0128)	(0.0085)
Disabled	-0.0140	-0.0135
	(0.0134)	(0.0061)
year_2008	0.0146	0.0200
	(0.0083)	(0.0025)
Geometry Score	0.0967	0.0988
	(0.0110)	(0.0014)
Only AP Schools	Yes	Yes
School FE	No	Yes
Sample Size	61,210	61,210
R-squared	0.1146	0.1827

Table 6: Controlling for School Characteristics
Only AP Schools

	(1) School FE Coefficient (Std. Error)	(2) School Char. Coefficient (Std. Error)	(3) Sch. Char. & Interactions Coefficient (Std. Error)
Free/Reduced Lunch	-0.0297 (0.0033)	-0.0270 (0.0054)	-0.0337 (0.0154)
Male	-0.0145 (0.0025)	-0.0156 (0.0045)	-0.0155 (0.0045)
African American	-0.0131 (0.0037)	-0.0108 (0.0092)	-0.0220 (0.0160)
Asian	0.1386 (0.0059)	0.1407 (0.0143)	0.0972 (0.0232)
Hispanic	-0.0238 (0.0058)	-0.0245 (0.0101)	0.0102 (0.0128)
Other Race	0.0003 (0.0085)	0.0047 (0.0113)	0.0546 (0.0319)
Disabled	-0.0135 (0.0061)	-0.0133 (0.0135)	-0.0107 (0.0529)
year_2008	0.0200 (0.0025)	0.0162 (0.0088)	0.0159 (0.0087)
Geometry Score	0.0988 (0.0014)	0.0987 (0.0108)	0.0985 (0.0108)
School Geo Score	--	0.0324 (0.0323)	0.0322 (0.0328)
Rural	--	-0.0874 (0.0369)	-0.0833 (0.0370)
Other Region	--	-0.0477 (0.0204)	-0.0453 (0.0204)
# of Economics Students	--	-0.00001 (0.00003)	0.0000 (0.0000)
Percent Asian	--	0.1305 (0.1208)	0.0774 (0.1191)
Percent African-American	--	0.0713 (0.0503)	0.0598 (0.0596)
Percent Hispanic	--	0.1641 (0.1130)	0.2272 (0.1236)
Percent Other	--	-1.3567 (0.5558)	-1.2680 (0.5609)
Percent Free Lunch	--	0.0987 (0.0786)	0.0895 (0.0804)
Percent Disabled	--	0.7743 (0.3585)	0.7764 (0.3757)
Asian Interaction	--	--	0.3592 (0.1495)
African American Interaction	--	--	0.0240 (0.0465)
Hispanic Interaction	--	--	-0.2148 (0.0866)
Other Race Interaction	--	--	-1.5995 (0.9000)
Free Lunch Interaction	--	--	0.0174 (0.0358)
Disabilities Interaction	--	--	-0.0273 (0.6086)
Only AP Schools	Yes	Yes	Yes
School FE	Yes	No	No
Sample Size	61,210	61,210	61,210
R-squared	0.1827	0.1268	0.1303

Appendix: Probit Results

Table 5: Student Level Probits

	(1) Simple Marginal Effect (Std. Error)	(2) Academic Ability Marginal Effect (Std. Error)	(3) Only AP Schools Marginal Effect (Std. Error)	(4) School Char. Marginal Effect (Std. Error)
Free/Reduced Lunch	-0.0369	-0.0182	-0.0163	-0.0124
	(0.0056)	(0.0046)	(0.0085)	(0.0029)
Male	-0.0009	-0.0083	-0.0167	-0.0072
	(0.0025)	(0.0023)	(0.0045)	(0.0019)
African American	-0.0344	0.0043	0.0024	-0.0075
	(0.0070)	(0.0068)	(0.0118)	(0.0041)
Asian	0.1650	0.1159	0.1253	0.0501
	(0.0213)	(0.0178)	(0.0192)	(0.0086)
Hispanic	-0.0080	0.0125	-0.0052	-0.0097
	(0.0075)	(0.0089)	(0.0128)	(0.0033)
Other Race	0.0114	0.0225	0.0136	0.0037
	(0.0076)	(0.0084)	(0.0123)	(0.0045)
Disabled	-0.0454	-0.0197	-0.0471	-0.0204
	(0.0070)	(0.0097)	(0.0179)	(0.0073)
year_2008	0.0099	0.0041	0.0114	0.0028
	(0.0046)	(0.0042)	(0.0082)	(0.0039)
Geometry Score	--	0.0443	0.0796	0.0351
		(0.0053)	(0.0097)	(0.0041)
School Geo Score	--	--	--	0.0138
				(0.0148)
Rural	--	--	--	-0.0437
				(0.0069)
Other Region	--	--	--	-0.0253
				(0.0086)
# of Economics Students	--	--	--	0.0000
				(0.0000)
Percent Asian	--	--	--	0.1143
				(0.0585)
Percent African-American	--	--	--	0.0113
				(0.0268)
Percent Hispanic	--	--	--	0.0308
				(0.0558)
Percent Other	--	--	--	0.2544
				(0.3249)
Percent Free Lunch	--	--	--	0.0794
				(0.0428)
Percent Disabled	--	--	--	0.2534
				(0.1527)
Only AP Schools	No	No	Yes	No
Sample Size	111,861	111,861	61,210	111,861

Notes

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[1] The only two studies that, to our knowledge, analyze whether AP Economics increases human capital find that taking AP Economics increases success early in college (Klopfenstein and Thomas 2009) and increases performance on a standardized economics exam in high school (Clark, et al. 2012).

[2] Currently, Georgia has a new math curriculum and Geometry is no longer offered as a stand-alone course, and EOCTs count for 20 percent of each student's course grade.

[3] All data we were provided had been stripped of individual student or teacher names or personal identification fields by the GaDOE. We thank the GaDOE for its generosity in sharing its administrative data.

[4] See, for example, Fernández-Val (2009) for a discussion of the issues involved in estimating fixed effect probit models.

[5] See, for example, Wooldridge (2009, pgs. 249-250) for a more detailed discussion of the relative merits of linear probability models.

[6] Conger et al. (2009, 567) find this same result regarding the effect of schools increasing AP enrollment for African-American, Hispanic, and low income students. Their exposition describing these nuanced results is enlightening. They write, "That is, blacks and Hispanics are advantaged by the schools they attend.[17] Moreover, it is worth noting that within a given high school, blacks and Hispanics are significantly more likely to take advanced courses in most subjects than their observably similar white classmates." Their footnote 17 reads

> We should be careful here in explaining what we mean by "advantaged by." There are three possibilities. First, because minority students tend to enroll in schools with lower average levels of achievement, a minority student with a given test score will be a more competitive candidate for a seat in an advanced placement class relative to her schoolmates than is the typical white student with the same test score. As we show below, there is a negative relationship between mean test scores and advanced course-taking that is consistent with this explanation, but that relationship is relatively weak, suggesting this explanation plays only a small role. Second, the schools that minorities attend might be more effective at promoting advanced courses among lower achieving students. Third, minority students may be more motivated than white students with the same test score levels and thus select into schools that place more emphasis on advanced courses. Since we haven't ruled out this third explanation, it should be understood that our phrase "advantaged by" does not necessarily imply a causal effect of the schools on minority students' course-taking.

[7] We thank an anonymous referee for suggesting we include these interactions.