Implications for Scaling Up Advanced Course Offerings and Takings:

Evidence from Florida

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Paper Presented at the National Center for Scaling Up Effectives Schools Conference, Nashville, Tennessee, June 10-12, 2012.

This paper is a summary of research conducted in collaboration with Dylan Conger of George Washington University and Mark C. Long of the University of Washington. The research focused on course offerings and takings and, ultimately, the effect of high school courses on student outcomes. Funding for this research was provided by the U.S. Department of Education, Institute of Education Sciences, Grant R305B070131. This research could not have been possible without the foresight and support of the Florida Department of Education that also provided seed money for our work and, most critically, the data. Our work benefited from the excellent research assistance provided by our graduate students who at one time or another participated on the projects; Sunghyun Cha, Danielle Fumia, Niu Gao, Ana Karruz, Brittany Richards and Katie Wise. Moreover our efforts were enhanced by the critical and helpful feedback of discussants and reviewers over the five years.

1. Introduction

This year marks a decade since the federal *No Child Left Behind* (NCLB) policy was enacted. While the ultimate assessment of its impact is still to be determined, there is no doubt that it has left an indelible mark on the public education systems across the United States. NCLB spurred the development of statewide standards and accountability systems – a seed that was planted earlier with the prior reauthorization of the Elementary and Secondary Schools Act – *Improving America's Schools Act* of 1994 that set in motion greater emphasis on standards and accountability. At the same time a number of states, such as New York, Texas and Florida, started to enhance or put in place statewide standards and testing and accountability systems that early on were still focused on educational gateways, such as fourth, eighth and 10th or 12th grades. Reforms in Texas and Florida foreshadowed NCLB and served as models for the development of the federal policy. NCLB effectively institutionalized these efforts and ensured that testing in grades three through eight and in a high school grade were put in place in all states. While the effects of accountability are mixed, in general, and NCLB has been effectively superseded by the federal *Race to the Top* initiatives, accountability is now an embedded feature of the educational landscape.

Arguably, most of the reforms engendered by statewide standards and accountability systems focused on elementary and middle school grades, leaving high schools behind. In some locales, for example New York City, the accountability era marked a shift of resources from high schools to elementary schools – whereby high schools once garnered more resources on a per pupil basis in large part due to high labor costs (e.g., salary scales rewarded the specialization of high school teachers), secondary schools lost out as resources were shifted to cover reforms aimed at the lower grades. Given that NCLB

required testing in grades three through eight, this shift may have been a rational response to the policy.[1] By the end of President George W. Bush's second term in office, Margaret Spelling, then Secretary of Education, called attention to the plight of high schools and the dearth of attention and reform at the secondary level. She suggested that the mechanism by which we should begin reforms efforts was through a more rigorous curriculum that would better prepare students for college. In fact, she went further and called for increasing access to and enrollment in Advanced Placement (AP) courses.

Around the same time, the National Governors Association (NGA) shifted its attention to high schools that were the central focus of its Education Summit led by Governor Mark Warner (National Governors Association, 2005a). Among the top ten action items, resulting from the summit and the subsequent report, were to increase the rigor of both college and work curricula, provide incentives for underrepresented students to take AP courses and expand opportunities for high school students to do college-level work (National Governors Association, 2005b). NGA also took issue with how graduation rates were calculated with the governors, pledging to use a common standard calculation to measure a four-year cohort graduation rate (National Governors Association, 2005c).

The Race to the Top initiative marked, yet another, shift in focus that was a natural evolution from Spellings' call for more rigorous courses and the NGA's reports, and that was to focus on college readiness. As noted in an Education Sector Report (Adelman, 2010), most of the accountability systems that were put in place under NCLB or pre-NCLB were not particularly attuned to the needs and efforts of high schools, usually rating them on two basic measures – graduation rates and basic skills tests (e.g., 9th or 10th grade test).

[1] National figures on educational spending by grade level are not readily available. Thus, the evidence on the shift of resources from high school to elementary schools remains anecdotal.

Race to the Top focused on readiness of students to transition to the next educational level – for example, from middle to high school or from high school to college. As the Education Sector Report (Adelman, 2010) also highlights, increased accountability for high schools is necessitated by the fact high school students performance on the National Assessment of Education Progress has been stagnant and a significant number of students who enroll in college are not ready for postsecondary-level coursework. Thus, college readiness is now the key benchmark that states, such as Florida, are now incorporating into their accountability systems and the key focus of foundational support, most notably from the Bill and Melinda Gates Foundation (http://www.gatesfoundation.org/college-ready-education/pages/default.aspx).

It is within this policy context that we are meeting under the auspices of the National Center for Scaling Up Effective Schools Conference, asking what makes some high schools more effective than others, what are the components of effective high schools and what types of policies, programs and practices support these components (http://www.scalingupcenter.org/)? This paper, as noted on the cover page, is a summary of research done jointly with Dylan Conger of the George Washington University and Mark Long of the University of Washington. In 2007, we were awarded an Institute of Education Sciences grant (R305B070131) to examine - *the implications of high school course availability & course-taking for achievement, graduation and postsecondary enrollment*. Our purpose in securing the grant was to revisit earlier studies that examined transcript data from the national educational surveys, which are based on a nationally representative sample. With the development of unit level statewide longitudinal data systems, we felt that we could update and expand on the prior research using a census of students in a

single state and that would give us a much richer perspective, especially in context that had a significant number of minority students, giving us an advantage over the national survey data. Moreover, we would be able to 'speak to' the then and still relevant policy context of more rigorous courses and college readiness. Thus, we sought to secure data from the Florida Department of Education and use Florida as a case to examine the effects of high school courses on a variety of student outcomes, the determinants of schools' course offerings and factors associated with students' course taking patterns.

At that time and it is still true now, Florida is a bellwether state with respect to educational policy and, in particular, educational accountability. Florida is also an excellent landscape in which to student educational policy, reforms and practices as it enrolls nearly two million students, representing almost five percent of the nation's public schools students. Thirteen of its sixty-seven districts are among the nation's 100 largest school districts. Nearly half of the students enrolled in public schools are racial/ethnic minorities – 24% black and 22% Hispanic. The Hispanic population is somewhat unique in that Cubans are overrepresented relative to other Hispanic students. Sixty-eight percent of Cubans live in Florida and tend to be more educated and have higher incomes than other Hispanic groups. But, the Hispanic population in Florida is becoming more diverse with an influx of Puerto Ricans from the northern states and migrant laborers from central American countries. Florida is also known as the leader in the development of unit-level (student, teacher, principal) statewide longitudinal data system. Its Education Data Warehouse (EDW) tracks students over time across educational levels. Our studies that are summarized below use data on several cohorts of students, tracking them from 8th grade through high school and into postsecondary education and/or the labor market.

In this paper, I first provide some basic background information on high schools and then shift into summaries of our research, starting with our work on the impact of high school math courses on college readiness. I, then, move on to a summary of our work on the effects of high school courses on educational outcomes, including test scores, graduation and enrollment in postsecondary institutions. Next, I discuss our research on factors associated with schools' advanced course offerings and students advanced course taking. I end with a discussion of the implications of this and other ongoing research on future research, policy and practice. Also, for each summary, in text boxes I try to encapsulate the empirical approach we pursued for the respective study, including a brief description of the methods, variables, and data.

2. Background

The most recent Condition of Education published the U.S. Department of Education (2012) highlights some of the changes in high school experiences and students over the past two decades. High school enrollment grew by 21% from 1990 to 2010 and is projected to grow by a more modest four percent over the next decade to 15.5 million students. The report also tracks course taking over time and finds that a greater share of high school graduates are completing higher-level math and science courses. For example, in 2009, 88% of graduates completed a geometry course and 76% completed an Algebra II/trigonometry course as compared to 64% and 54%, respectively, of graduates in 1990. In science, greater shares of students are taking chemistry, physics and the combination of biology and chemistry. The Condition of Education cites the 1983 National Commission on

Excellence in Education's *Nation at Risk* report as spurring increased graduate requirements as a key factor in the changes in course taking among high school graduates.

While the course taking figures are impressive, high school students' educational achievement as measured by their performance on NAEP and the Program for International Student Assessment (PISA) were not similarly impressive. In fact, performance on NAEP has been stagnant over nearly four decades (1970 through 2010). The results for 15 year olds who were tested under PISA are somewhat positive in that they have shown some slight over a short period of time 2003/2006 to 2009, but we remain at or near the average for OECD countries (U.S. Department of Education, 2012).

Yet, despite this mixed picture of student performance and achievement where graduates are taking more challenging math and science courses and test scores are stagnant, more students than ever aspire to graduate from college. While "definite plans to graduate from a 4-year college" are associated with parental education levels the gap between 12th graders whose parents have a graduate or professional degree and those who have a high school diploma or less is shrinking. Aspirations or definite plans, however, do not make one ready for college even though enrollment rates are at all-time highs (U.S. Department of Education, 2012).

In Florida in 2003-04, 78% of students enrolling in the state's community colleges and 10% of those enrolling in four-year universities required remediation (OPPAGA, 2006a). This was a clarion call for higher standards that eventually were incorporated` into the new grading system for high schools that now holds schools accountable for not only graduation rates and students' performance on standardized tests, but also for student participation in accelerated coursework as measured by exams taken (AP, IB, AICE), their

performance in accelerated courses as measured by successful completion of the courses and college readiness as measured by the state's common placement exam or students scores on the ACT or SAT.

Florida has been a leader with respect of increasing the number of advanced courses and access to those courses. In collaboration with the College Board, summer professional development programs have been offered to teachers in high needs schools that introduce them to the AP curriculum, structure and content. Moreover, it is only one of a handful of states that provide financial incentives to schools and teachers for success on AP and IB exams and it is only one of three states to pay the full cost of AP exams for students (OPPAGA, 2006b). Florida has also seen tremendous growth in the number of schools offering AP courses and in students taking the courses. In just over a decade, there was a 75% increase in the number of schools offering AP courses, which increased by 38% nationally (College Board, 2009). Florida has continued to expand its AP participation. It is third in the nation in terms of the number of exams taken and sixth in terms of the percentage of students scoring at least a three on the exam with a pass rate of nearly 24%, which is a ten percentage point increase over a ten-year period (2001-2011). The state is also quite successful, relatively, in terms of minority student performance eon AP exams where Hispanic students are achieving at the same level as their representation in the graduating class (ratio of the percent of successful exam takers the percent of students in the graduating class who are of the same race/ethnicity). The ratio for African American students is much smaller 35% (College Board, 2012). Florida is also among the leaders in the number of IB diplomas awarded. So, it is clear that Florida is a rich environment in which to explore issues related to high school courses, particularly advanced courses.

3. College Readiness

In our study of college readiness, we examined how much of the gaps in readiness for college-level math are determined by the courses that students take (Long, Iatarola & Conger, 2009). In particularly, we explored the gaps between white and racial/ethnic minority students, higher income and lower-income students and male and female students. Prior research suggests that math courses are key to student success and that one needs at least Algebra II to be prepared for college (Adelman, 2006; ACT, 2007). In our review of the literature we note that:

> [T]hough causality has not been entirely established, several studies suggest that taking more credits in math and more advanced math courses increases: (1) proficiency on high school standardized mathematics exams (Gamoran 1987; Byrk, Lee, and Smith 1990; Cool and Keith 1991; Stevenson, Schiller, and Schneider 1994; Rock and Pollack 1995; US DOE 1997; Shettle et al. 2007); (2) the likelihood of high school graduation (e.g. Schneider, Swanson, and Riegle-Crumb 1998); (3) entry into and performance while in college (Schneider et al. 1998; Adelman 2006); and (4) choice of college major (Federman 2007).

It is not that remediation necessarily lowers postsecondary success, but rather that there are costs associated with remediation or lack of preparedness for college (Bettinger & Long, 2007). Somewhat dated estimates of the cost of providing remediation in Florida estimate that the additional cost that accrues to both the state and the student are over $100 million (OPPAGA, 2006a).

Table 1 reports descriptive statistics for college readiness in math and the covariates we used in our study by socio-demographic group. Focusing on the first column of numbers in the table, 64% of all students who attend college in the year after they graduate high school[2] are ready for college-level math. A greater share of this somewhat selective group of students (i.e. college going) are white (60%) with even shares of black and Hispanic students (18%) and a small share of Asian students (3%). Thirty-two percent of the students are eligible for free or reduced-priced lunch.[3] To further orient one to the table, the other columns break down the descriptive statistics by subgroup – for example, 72% of white students are ready for college math, whereas only 42% of black students and 56% of Hispanic students are and whereas Asians at 81% ready have the highest rate. Rather than going through the table in detail, I will highlight several salient differences among the students. Majorities of white and Asian students take higher levels of math course – advanced algebra, trigonometry and other level three courses[4] - 58% and 75%, respectively. Conversely, majorities of black and Hispanic highest math courses are at Algebra II or lower – 62% and 53%, respectively. The difference in readiness for college-level math between non-poor (71%) and poor (48%) is large and also reflects that fact that 58% of non-poor students take more advanced courses and this same share of poor students highest math course is Algebra II or lower. Even if we focus on the lowest level,

[2] This metric is not ideal in that it does not capture the readiness of all students graduating from high school whether or not they attend in the year following their graduation from high school. It is, however, the only measure available from the state and was constructed as such to give the state legislature a perspective on immediate subsequent enrollment in college.

[3] Free or reduced-priced lunch is far from an ideal measure of poverty, especially at the high school level where students tend not to apply for it given their perceived social stigma. It is, however, the only measure available.

[4] Florida categorizes courses by academic level – one through three. While not perfect, for example lower level courses such as Algebra I taken as honors are counted as level three, it provides a reasonable means by which to categorize courses by rigor.

Algebra I or lower, black and poor students are the most disadvantaged. With respect to the five percentage point difference between male and female students in readiness for college math, there are few differences in their highest course-taking patterns.

INSERT TABLE 1 HERE

Empirically, my colleagues and I decomposed the raw gap in readiness for college math into explained and unexplained portions and, then, we estimated the portion of the explained gap that is attributable to the highest math course taken, as seen in Table 2. Of the 30% raw gap in readiness between black and white students, 25.8% of it is explained by our empirical model (see text box for a brief description of our empirical strategy). For each set of factors in our model (e.g., demographics, educational needs, highest math course, etc.,) we calculate the contribution that is made towards explaining the raw gap. As seen in the first column for the black/white gap – 8.3 percentage points of the raw gap is explained by the highest math course taken, representing 28% of the raw gap. Over one third of the Hispanic-white gap and Poor-non-poor gaps are explained by the highest math course taken and over three-quarters of the Asian-white gap is explained by the hightes math course. These represent significant portions of the readiness gap and offer support for more advanced course taking as a means by which to reduce achievement gaps in college readiness.

INSERT TABLE 2

Empirical Approach

Long, M. C., Iatarola, P., & Conger, D. (2009). Explaining gaps in readiness for college-level math: The role of high school courses. Education Finance and Policy, 4 (Winter), 1-33.

Unit of Analysis: Students

Outcome of Interest: Readiness for college math (readiness as measured by the students' scores on the Florida Common Placement Test that has a cutoff of elementary level Algebra. Students exempt from taking the placement exam, if they scored above 440 on the math SAT-I or above 19 on math ACT)

Variable of Interest: Highest math courses taken (Florida has common course codes)

Controls: Student demographic characteristics (race/ethnicity, poverty status and gender), educational needs (limited English proficiency, exceptional education), pre-high school achievement (8th grade standardized test scores), and eighth grade campus (fixed effects)

Model: Probability model of readiness for college, controlling for the variables noted above, which include campus fixed effects that help with omitted variable biases (e.g., parental taste for education, early investments in education). Use a Blinder-Oaxaca variance decomposition to parcel out the contribution of the groups of controls listed above with respect to the gaps in readiness between groups of students.

Data: Student-level data from the EDW

Sample: Progressive cohort of students who were in the 8th grade in 1998-99 and who entered a public postsecondary institution in Florida, representing approximately 21% of all students in the cohort. It should be noted that most students do stay in state, only 10% attend a private institution or a public out-of-state institution. The Bright Futures merit based program that pays for college for students who do well in high school incentives attendance at a public postsecondary institution in Florida.

4. Effects of High School Courses on Secondary and Postsecondary Success

In our study of the effects of high school courses on secondary and postsecondary success, we use propensity score matching to generate estimates of the causal impact of taking advanced courses (Long, Conger & Iatarola, 2012). We find quite large effects of taking even one rigorous course in any subject. Doing so increases students 10th grade FCAT scores and their likelihood of graduating high school and attending a four-year college. The largest impact is taking a more rigorous course within the first two years of high school. The effects cut across all five subject areas (math, science, English, social studies, and foreign language). The returns to the courses are slightly higher for Hispanic, black and poor students when taken by the 10th grade. When considering course taking across all four years of high school, we find that taking one rigorous course before graduating, students are five to six percentage points more likely to enroll in a four-year

college. Table 3 presents our propensity score estimates of the effects of taking a more rigorous courses by Fall of 10th grade. For instance, taking a rigorous course increased 10th grade FCAT scores by a quarter of a standard deviation (0.26). Taking courses in additional subject areas ranges from 0.19 to 0.33 standard deviations. Interestingly, as noted above taking even one rigorous course increases a student's likelihood of graduating high school and enrolling in a four-year college by 9.5 and 10.6 percentage points respectively. Taking courses in additional subject areas does not further increase the likelihood of graduating by much, but it does increase the likelihood of attending a four-year college.

INSERT TABLE 3

Empirical Approach
Long, M. C., Conger, D., & Iatarola, P. (2012). Effects of high school course-taking on secondary and postsecondary success. *American Educational Research Journal*, *49(2)*, 285-322.

Unit of Analysis: Students who were expected to graduate in 2002-03
Outcome of Interest: 10th Grade FCAT, HS Diploma, Enroll in 4-year college, Enroll in 2-year collge
Treatment: Advanced Courses
Approach: Propensity score matching, average treatment effect on the treated
Data: Student-level data from the EDW
Sample: Students who were observed in at least three high school grades and who received a high school diplomas or general equivalency degree (GED) within four years of entering school.

5. Determinants of Schools' Course Offerings

In our study of course offerings, we examined the determinants of high schools' course offerings, particularly schools advanced course offerings in the form of AP or IB courses (Iatarola, Conger & Long, 2011). There had been, to date, very little research on factors associated with a schools decision to offer courses. The most notable studies, now nearly twenty plus years old, focused offerings in relation to school size (Haller, et al., 1990; Monk & Haller, 1993). Other studies that examined tracking within schools offer some

insight in how and why schools track, but do offer insight into what factors shape a schools decision to even offer advanced courses. Over time, as alluded in the introduction of this paper, advanced courses have assumed a prominent role in curricular reform. This is in part due to the emphasis that has been placed on advanced courses in the policy debates, but also because teachers perceive that they will bolster the reputation and rankings of schools (Duffette & Farkas, 2009) as highlighted in a very recent New York Times article on the plethora of high school rankings by national media outlets, such as U.S. News & World Report, Newsweek, Washington Post, and by local media outlets, such as the Chicago Sun-Times (Winerip, 2013). Further, AP and IB courses signal more rigorous curriculum and are used in college admissions processes (Geiser & Stantelices, 2004). As previously noted, states – most notably Florida – offer incentives for taking AP/IB courses and passing the related exams and now related measures are included in the accountability grading scheme. Recent policies, such as Florida's new high school grading scheme and Race to the Top competition that weighed access to advanced courses as key criteria, are placing more emphasis on rigorous curricular offerings.

The decision to offer AP/IB courses reflects a number of considerations that are not fully captured by the quantitative data that include issue related to the capacity to offer advanced course (e.g., qualified teaching force) and demand for courses (e.g., demand by parents, students or that created by teachers and administrators). Our study, once again, relies on rich student and school level data from Florida to examine which factors are most critical in determining advanced course offerings (see text box for a brief summary of the empirical approach utilized in the study).

In Table 4, I reproduce the descriptive statistics for the sample of schools included in our study. A majority of schools, but not all, do offer AP/IB courses. Over time, from 2001-01 to 2005-06, the percentage of schools offering AP/IB increased. While a simple indicator of offering AP/IB courses does not tell us much about the extent to which courses are offered, we can see from the number of students taking courses that there has been a growth in participation. In the average school in 2005-06, 50 students take an AP/IB math course, up from 37 in 2001-02, which is a 62% increase. The number taking science and English courses increased by 40% and 43%, respectively. The largest growth in AP/IB course taking as well as the highest participation levels is in social studies that saw a 71% increase in the number of students taking the course. I should note at this point that we take a somewhat unique approach in examining the relationship of school size to offerings. Rather than simply including student enrollment as a variable, we categorize enrollment by 'preparedness' as measured by students' 8th grade scores on the Florida Comprehensive Assessment Test (FCAT), grouping them based on how far above the median their scores are – e.g., slightly above average (0-1 standard deviation above the median) and far above average (over 1 standard deviation above the median) with the comparison group of students being below the median.

INSERT TABLE 4

Figure 1, however, graphs the share of schools offering an AP/IB course by total enrollment. While most of the schools above the median offer AP/IB course, there is quite a bit of variation below the median and a steep slope that suggest as schools get larger they are more likely to offer courses.

INSERT FIGURE 1

We find that the largest predictor of AP/IB course offerings is having a critical mass of students with very high 8th grade achievement as measured by FCAT scores. These students are the ones who are most likely to take advanced courses either through their own demand for the courses or as determined by the school. We also find that schools with more students below average are more likely to offer advanced courses as well. In effect, it appears that this is a net transfer of offerings from students with lower achievement to those with higher achievement. One might hypothesize that offering advanced courses in schools with more low preforming students is a mechanism by which schools seek to keep their higher performing students in the school. Interestingly, we find that the more students who are slightly above average, the less likely schools are to offer English and science courses. Notably schools appear to be unconstrained by resources in the form of the number of teachers and their characteristics that are not related in any meaningful way to the likelihood of schools offering advanced courses.

Figure 2 presents a year-by-year breakdown of the changes in marginal effects for adding 100 slightly above average students and 100 far above average students. There is convergence over time – the positive effects of adding 100 far above average students is decreasing over time to 0 and the negative effects of adding 100 slightly above average students is reducing over time. Thus, it appears that schools are responding more equally to all students over time. Course taking patterns for both groups of students, as seen in Figure 3, however suggest that differences between the slightly above and far above students is still quite evident over time and, increasingly divergent, meaning prior achievement levels are still driving course takings.

INSERT FIGURES 2 & 3

Empirical Approach
Iatarola, P., Conger, D., & Long, M. C. (2011). Determinants of high schools' advanced course offerings. Educational Evaluation & Policy Analysis, 33, 340-359.

Unit of Analysis: Schools, 2001-02 through 2005-06

Outcome of Interest: Offer Advanced Placement Course (By Subject – math, English, science and social studies)

Variables of Interest: Teacher number and characteristics, school size and student preparation (prior achievement).

Controls: schools' student demographics (race/ethnicity, socioeconomic status, educational needs, gender and progression rates).

Model: Probability model of offering course with and without district fixed effects.

Data: EDW Student-level data and publicly available school-level data from the Florida School Indicators Report.

Sample: All high schools in operation between 2001-02 and 2005-06 that have all grades 9th through 12th and at least 20 students. We exclude schools in the deaf and blind operating district and university lab schools. Our analytic sample includes 407 schools of which 88% are observed in all five years.

6. Explaining Disparities in Course Taking

In our study of course takings (Conger, Long & Iatarola, 2009) we examine well documented racial/ethnic, income and gender gaps in advanced course taking. We test three possible hypotheses for the disparities – 1)preparedness (e.g., 8th grade achievement, and educational needs), 2) offering disparities (e.g., attending schools that do not offer advanced courses, and 3) across-school access disparities (e.g., attending high schools that lower their likelihood of taking advanced courses even if offered). There are a number of studies that document the disparities, including reports by the College Board. Notably, Klopfenstein's (2004) research delves the deepest, examining racial disparities in AP course-taking among high school students in Texas. As we note in our study, "[S]he finds that students of all races are more likely to take an AP course if they attend a school that is smaller, in a large urban area, offers a variety of AP courses and implements programs that

incentivizes teachers to receive additional training and students to take more difficult courses." She also finds that magnet programs may have some positive impact for white and Hispanic students. In our study we also find that magnet schools have a positive impact for black and Hispanic students.

As seen in Table 5, all students are more likely to take an AP/IB course in English and social studies (16 and 17%, respectively) than math or science (11%). There are clear and distinct disparities across racial/ethnic groups with black students being the least likely to take an AP/IB course and Asian students being the most likely. Non-poor students are three times as likely to take an AP/IB course than poor students. Interestingly, female and male students are equally likely to take AP/IB math and science courses, but more females take AP/IB courses in English and social studies.

INSERT TABLE 5

Empirically, when we control for the three possible explanations that may account for the raw differences in course taking among racial/ethnic, income and gender sub-groups of students - preparedness, offering disparities and across-school access disparities - the gaps reduced in almost every comparison as seen in Table 6. The exception is the male/female difference that is actually greater after the adjustments. In the case of black/white and Hispanic/white gaps, deficient in raw differences were overcome and advantaged black and Hispanic students as compared to white students. For example, the eight percentage point raw gap between black and white student in advanced course taking reverses the advantage in favor of black students by 2.4 percentage points. Thus, schools make a positive difference for black and Hispanic students for raw differences in prior achievement, demographics, educational needs. For poor/non-poor, the poor deficit in

course taking is greatly reduced by schools, but not overcome. So what is it about schools that may be a factor in reducing these gaps? Size matters a bit, with students in smaller schools being more likely to take advanced courses, but the factor that is the strongest in reducing and overcoming the gaps is whether a school is a magnet or not. But when we dig deeper, we find that magnet schools advantage Asian, non-poor and female students. Thus, we do not have very insightful evidence in how schools matter.

INSERT TABLE 6

When we run the same analysis for the later cohort of students (2005-06), we find that advanced course taking increased in all subject areas with the largest increase in social studies – from 19% to 26% of the students. Both raw and fully adjusted gaps, however, increased. Whereas in 2002-03, the fully adjusted gaps for black students was in their favor, this effect of schools actually advantaged white students. In each comparison the gaps were widened. In our study we hypothesized that the worsening of gaps may be due to other trends and may not be due to adverse effects of state and federal policies. And, we suggest that "[A]t the very least, it appears that such reforms have not succeeded in eliminating the demographic disparities."

Empirical Approach
Conger, D., Long, M. C., & Iatarola, P. (2009). Explaining race, poverty, and gender disparities in advanced course-taking. Journal of Policy Analysis and Management, 28 (4), 555-576.

Unit of Analysis: Students who were expected to graduate in 2002-03 and 2005-06

Outcome of Interest: Take AP/IB course by subject area (math, science, English and social studies)

Controls: demographic characteristics, pre-high school characteristics (e.g., limited English proficiency, achievement scores), and school characteristics (e.g., size, spending, teachers, magnet school)

Model: Probability model of taking AP/IB course

Data: EDW Student-level data and publicly available school-level data from the Florida School Indicators Report.
Sample: Students who progress regularly through high school (so that we have complete transcripts records). Students who dropped out of high school or who entered a Florida high school after 9th grade are omitted.

7. Implications for Future Research, Policy and Practice

As summarized above, we find evidence that taking higher-level math courses increases the likelihood that students will be ready for college math and that taking more rigorous courses increases high school test scores and the likelihood of graduating from high school and enrolling in a four-year college. The mechanisms, then, by which schools offer advanced courses and the factors associated with students taking of advanced courses helps us unpack how we might think about policy and practice. Schools are more likely to offer AP/IB courses in response to having more students who enter high school far above the median student and to having more students who are the lowest performers. This complicated relationship deserves greater attention to better understand whether or not schools are responding to real demand by students and families or are driven by schools' perceived demand for courses. Further while there are significant gaps in advanced course taking among students along racial/ethnic, income and gender lines, much of the gap can be ameliorated by schools. However, over time, rather than ameliorating the gap, more recently schools appear to be exacerbating the gap.

With respect to future research, quantitative analyses such as those summarized here are very helpful for us to understand generalized patterns of behavior and how different factors are associated with different outcomes of interest. But, they do not provide us with insight into how these relationships develop or what specific programs and practices might be driving the results. Research efforts, such as those conducted by the

National Center for Scaling Up Effective Schools, dig deeper and offer evidence from qualitative data collection and analyses as to what are the essential components of reform. Thus, the first implication of our studies for future research is to join in on efforts to bring mixed methods to bear on these larger questions so that we can at once draw general conclusions and offer deeper perspectives.

Certainly, one area that I have started to explore that would benefit from mixed methods, is that of teacher assignment. We actually know very little about teachers in high schools – their effectiveness overall and with particularly sub-groups of students, how they are assigned to courses and what is the most strategic ways of deploying them within schools. In the initial findings of a study that is its early stages, Niu Gao and I have found that there are significant disparities in the distribution of teachers and that most of the disparities are driven by within school differences, sorting of teachers within schools. Racial/ethnic minority students and low-income students tend to have more teachers who are not certified in the appropriate subject area, who have lower education levels and less experience than their white and higher-income counterparts. There are also notable differences in the qualifications, education and experience of teachers who teach higher level courses and this is true across all subjects. Those who teach advanced courses are more likely to be certified in the subject area, have advanced degrees and more experience. Further research on factors associated with assignment and how students and teachers are assigned to courses and specific sections is critical.

While our data do capture periods of increased advanced course taking, further research is needed on better understanding how students prior preparation impacts their ability to take higher level courses. Moreover, it is critical to better understand how

heterogeneity within course sections impacts learning for all students. Clearly, as we expand advanced course offerings and more students take advanced courses, we need more evidence on which instructional approaches or strategies are most effective for students. This is all the more critical when we look to have all students taking more rigorous courses.

One cannot help but think about the role of middle schools as they too have been overshadowed by reforms aimed at elementary school levels. Middle schools are the link between the lower and upper grades. As we are now aiming to hold high schools accountable for college preparedness, perhaps we need to hold schools accountable for high school preparedness.

While our studies do not offer specific advice to policymakers and practitioners, the evidence we provide suggests that advanced or more rigorous courses do matter and that schools can play an important role in ameliorate disparities across students in their access to courses and patterns of course takings. Attention must be given to better preparing students for high school. Further, attention must also be given to the quality and rigor of course as we find that the returns to the course do differ. In terms of getting more schools to offer advanced course, we too argue that building a critical mass of well-prepared students is essential. Suggestions have been made that middle and high school curricular need to be better aligned. There is also a role for policymakers and practitioners to play in terms of generating or shaping students demand for more rigorous courses – perhaps through incentives to take the courses and exams and for success in both.

TABLES & FIGURES

Table 1:

Readiness for College Math and Means of Covariates, by Socio-Demographic Group

			Socio-Demographic Group							
		All Students	White	Black	Hispanic	Asian	Non-poor	Poor	Male	Female
	Percent Ready for College Math	***64%***	***72%***	***42%***	***56%***	***81%***	***71%***	***48%***	***67%***	***62%***
Demog.	White	60%	100%	0%	0%	0%	76%	25%	62%	58%
	Black	18%	0%	100%	0%	0%	9%	36%	16%	20%
	Hispanic	18%	0%	0%	100%	0%	10%	33%	18%	18%
	Asian	3%	0%	0%	0%	100%	3%	3%	4%	3%
	Free or Reduced Price Lunch (i.e. "Poor")	32%	13%	64%	60%	34%	0%	100%	30%	33%
	Male	43%	44%	37%	43%	49%	44%	40%	100%	0%
Educational Needs	Limited English Proficient (LEP)	14%	2%	12%	54%	30%	5%	32%	14%	13%
	Exited LEP Status	12%	2%	10%	49%	25%	5%	29%	13%	12%
	(Non-Gifted) Exceptional	6%	7%	6%	6%	3%	6%	7%	9%	5%
8th Grade Math Test	Standardized Score	0.57	0.77	0.08	0.34	0.85	0.73	0.23	0.64	0.52
	Missing 8th Grade Math Test	19%	18%	17%	22%	21%	19%	18%	20%	18%
Highest Math Course	Calculus or Pre-Calculus	22%	25%	14%	19%	45%	25%	16%	24%	21%
	Adv. Algebra / Trig. / Other "Level 3" Course	30%	33%	25%	28%	30%	33%	25%	28%	32%
	Algebra 2	31%	28%	38%	35%	17%	28%	36%	30%	31%
	Geometry	9%	7%	13%	11%	4%	7%	12%	10%	8%
	Algebra 1 or Below	8%	7%	11%	7%	3%	6%	10%	8%	7%
	Number of Observations	73,261	43,779	13,204	12,924	2,308	50,039	23,222	31,316	41,945

Sample: progressive cohort of Florida public school students who started 8th grade in the 1998-99 school year, restricted to those who 1) were observed in at least 3 of the 4 high school grades (9th, 10th, 11th, 12th); 2) highest math course was categorizable; 3) entered a Florida, public, postsecondary institution by 2003-04; and 4) had data on their college math readiness.

Source: Long, M. C., Iatarola, P., & Conger, D. (2009). Explaining gaps in readiness for college-level math: The role of high school courses. Education Finance and Policy, 4 (Winter), 1-33.

Table 2:

Decompositions of Gaps in Readiness for College Math

		Black-White			Hispanic-White			Asian-White			Poor-Non-Poor			Male-Female		
		(1)	(2)		(1)	(2)		(1)	(2)		(1)	(2)		(1)	(2)	
Demog.	Black	1.8%			1.1%			-0.3%			2.1%	1.5%	***	0.3%	0.2%	***
	Hispanic											0.5%	***		0.0%	**
	Asian											0.0%			0.0%	
	Poor		1.5%	***		1.0%	***		-0.4%	***					0.1%	***
	Male		0.3%	***		0.1%	***		0.1%	***		0.2%	***			
Educ.	LEP	-0.3%	-0.2%		-0.1%	-0.6%		-0.3%	-2.6%	***	-0.5%	-0.4%		-0.2%	0.0%	
Needs	Exited LEP		-0.1%			0.5%			2.2%	***		-0.1%			0.0%	
	Exceptional		0.0%			0.0%	*		0.1%	***		0.0%	***		-0.2%	***
Campus	8th Gr. FE	2.9%	2.9%	***	3.8%	3.8%	***	0.8%	0.8%	***	1.8%	1.8%	***	0.3%	0.3%	***
8th Grade	Std. Score	13.0%	13.0%	***	7.7%	7.8%	***	0.9%	0.3%	***	8.1%	8.0%	***	2.0%	1.7%	***
Test Score	Missing Score		0.0%			-0.1%	*		0.6%	***		0.1%	***		0.3%	***
Highest	Calc./Pre-Calc.	8.3%	4.7%	***	5.4%	3.5%	***	7.5%	8.2%	***	7.9%	4.0%	***	-0.7%	0.9%	***
HS	Trig, Etc.		5.4%	***		4.4%	***		1.7%	***		5.6%	***		-1.2%	***
Math	Algebra 2		-1.7%	***		-2.1%	***		-2.1%	***		-1.4%	***		-0.5%	***
Course	Geometry		-0.1%			-0.4%	***		-0.3%	***		-0.3%	***		0.1%	**
Raw gap		30.0%			15.5%			9.7%			22.9%			5.2%		
Explained gap		25.8%			17.8%			8.6%			19.4%			1.7%		
Unexplained gap		4.2%			-2.3%			1.1%			3.5%			3.4%		
Percent of Gap Explained by Highest HS Math Course		28%			35%			77%			34%			-13%		

Source: Long, M. C., Iatarola, P., & Conger, D. (2009). Explaining gaps in readiness for college-level math: The role of high school courses. Education Finance and Policy, 4 (Winter), 1-33.

Table 3:

Propensity Score Matching Estimates of the Effects of Taking a Level-3 Math Course by Fall of 10th Grade

	Number of other subjects in which the student took a level-3 course										Weighted Average	
	0		1		2		3		4			
10th Grade Math FCAT	0.26	***	0.19	***	0.23	***	0.27	***	0.33	***	0.25	***
	(0.02)		(0.02)		(0.02)		(0.02)		(0.04)		(0.01)	
10th Grade Reading FCAT	0.06	***	0.04	**	0.06	***	0.08	***	0.09	‡	0.06	***
	(0.02)		(0.02)		(0.02)		(0.02)		(0.05)		(0.01)	
HS Diploma	9.5%	***	3.4%	***	1.2%	‡	2.2%	***	1.7%		6.3%	***
	(1.2%)		(0.9%)		(0.7%)		(0.6%)		(1.5%)		(0.7%)	
4-Year College	10.6%	***	9.6%	***	14.5%	***	13.4%	***	8.3%	***	11.3%	***
	(1.4%)		(1.5%)		(1.3%)		(1.2%)		(3.0%)		(0.9%)	
2-Year College	2.0%		-2.7%	‡	-6.6%	***	-9.2%	***	-6.6%	**	-1.7%	‡
	(1.5%)		(1.5%)		(1.4%)		(1.1%)		(2.6%)		(0.9%)	
Full Sample Size	72,000		15,134		13,661		21,414		6,180			
Untreated	70,649		12,865		8,359		7,464		865			
Treated	1,351		2,269		5,302		13,950		5,315			

Note: Figures in parentheses reflect the standard error of the treatment effect. ***, **, and ‡ reflect two-tailed significance at the 1%, 5%, and 10% levels.

Source: Long, M. C., Conger, D., & Iatarola, P. (2012). Effects of high school course-taking on secondary and postsecondary success. *American Educational Research Journal*, *49(2)*, 285-322.

Table 4:
Sample Descriptive Statistics

	5 Year Ave	2001-02	2005-06
Course Offerings			
Offer AP/IB Math	76.0%	74.8%	78.3%
Offer AP/IB Science	71.7%	71.5%	75.3%
Offer AP/IB English	80.0%	79.2%	82.5%
Offer AP/IB Social Studies	79.4%	77.0%	82.8%
Number Taking AP/IB Courses			
Number taking AP/IB Math	44	37	50
	(62)	(55)	(69)
Number taking AP/IB Science	50	42	59
	(71)	(62)	(79)
Number taking AP/IB English	99	82	117
	(146)	(125)	(161)
Number taking AP/IB Social Studies	123	91	159
	(163)	(129)	(193)
Teacher Characteristics and Student Preparation			
School's number of instructional staff	101	98	104
	(47)	(43)	(48)
Percent of teachers with advanced degrees	36.2	35.7	35.0
	(12.0)	(11.6)	(13.1)
Teachers' average years of experience	13.4	13.8	13.1
	(2.9)	(2.8)	(2.8)
Total number of students in October	1,754	1,753	1,759
	(987)	(984)	(968)
Number "slightly above average" on math	797	781	817
(Math FCAT 0 to 1 standard deviation above the median)	(467)	(450)	(468)
Number "far above average" on math	235	235	239
(Math FCAT more than 1 standard deviation above the median)	(212)	(206)	(215)
Number "slightly above average" on reading	769	756	784
(Reading FCAT 0 to 1 standard deviation above the median)	(449)	(435)	(449)
Number "far above average" on reading	250	246	257
(Reading FCAT more than 1 standard deviation above the median)	(202)	(196)	(205)
Student Characteristics			
Percent of students who are:			
Asian	1.9	1.8	2.0
Black	22.8	22.2	23.0
Hispanic	16.7	14.9	18.4
White	56.8	59.6	54.3
Ever receive free- or reduced-priced lunch (FRPL)	50.0	47.3	51.8
Ever designated as limited English proficient (LEP)	13.8	12.6	14.9
Disabled (ever designated as having a mental, behavioral, or learning disability)	12.9	12.8	12.7
Male	50.2	50.1	49.9
Percent of 9-12th grade students who are in 11th or 12th grade	41.5	40.3	42.5
Number of observations	1,935	365	401

Notes: i) Sample includes all 'regular' public high schools serving 9th-12th grades and with an enrollment greater than 20 and excludes schools in the deaf/blind district and university laboratory schools; ii) Standard deviations are in parentheses.
AP = Advanced Placement; IB = International Baccalaureate.

Source: Iatarola, P., Conger, D., & Long, M. C. (2011). Determinants of high schools' advanced course offerings. Educational Evaluation & Policy Analysis, 33, 340-359.

Table 5:
Advanced Course-Taking by Demographic Group, Class of 2002-03

		Demographic Group							
	All	White	Black	Hispanic	Asian	Non-poor	Poor	Female	Male
Took AP/IB Course In:									
Math	11%	13%	5%	8%	35%	15%	5%	11%	11%
Science	11%	13%	5%	10%	37%	16%	5%	12%	11%
English	16%	18%	8%	13%	38%	21%	7%	19%	12%
Social Studies	18%	21%	9%	15%	43%	24%	8%	20%	15%
Observations	118,050	67,989	27,096	20,130	2,835	69,386	48,664	60,844	57,206

Notes: i) AP/IB refers to Advanced Placement or International Baccalaureate. ii) Poor refers to students who were eligible for free or reduced price lunch at any point in the 8th grade or in their high school years.

Source: Conger, D., Long, M. C., & Iatarola, P. (2009). Explaining race, poverty, and gender disparities in advanced course-taking. Journal of Policy Analysis and Management, 28 (4), 555-576.

Table 6:

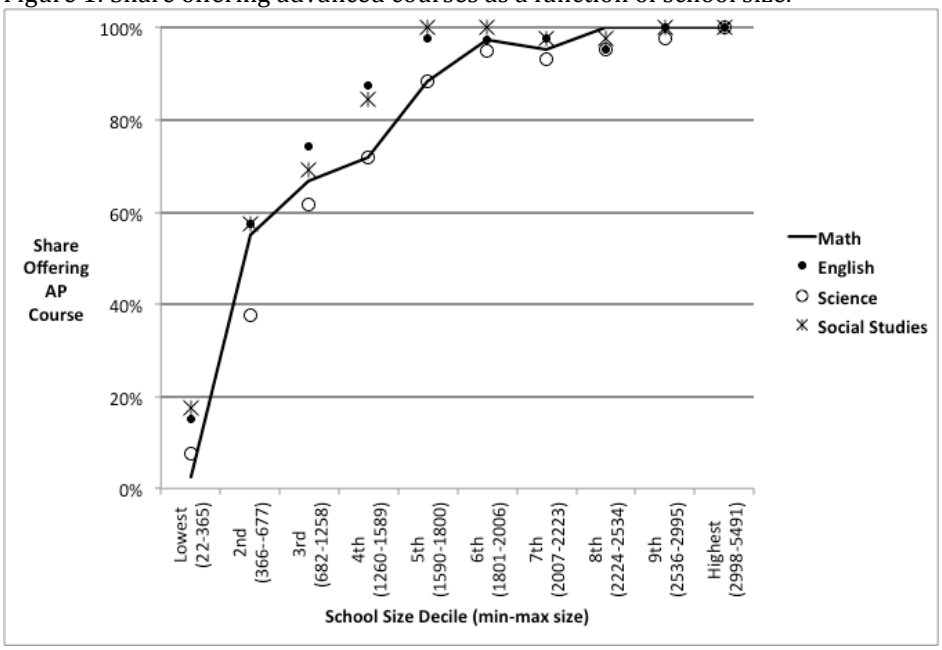
Raw and Adjusted Demographic Differences in AP/IB Course-Taking, Class of 2002-03

Raw Gaps and Mean Marginal Effects	Math		Science		English		Social Studies	
Black Relative to White								
Raw Difference	-8.4	(0.2)	-8.4	(0.2)	-10.2	(0.3)	-11.8	(0.3)
Test Score, Demographics, & Needs Adjusted	5.7	(0.7)	4.1	(0.8)	7.2	(1.1)	6.6	(1.0)
+ High School Offer Adjusted	5.9	(0.8)	4.4	(0.9)	7.2	(1.2)	6.8	(1.1)
+ High School Adjusted	2.0	(0.3)	-0.6 ms	(0.3)	0.7	(0.4)	0.9	(0.4)
Hispanic Relative to White								
Raw Difference	-5.2	(0.2)	-3.7	(0.3)	-5.9	(0.3)	-5.9	(0.3)
Test Score, Demographics, & Needs Adjusted	2.1	(0.5)	3.8	(0.8)	4.3	(0.9)	5.2	(0.9)
+ High School Offer Adjusted	1.8	(0.6)	3.5	(0.8)	4.1	(0.9)	5.0	(0.9)
+ High School Adjusted	0.7	(0.3)	0.7	(0.3)	0.7 ms	(0.4)	1.5	(0.4)
Asian Relative to White								
Raw Difference	22.4	(0.6)	23.2	(0.6)	19.4	(0.7)	22.6	(0.7)
Test Score, Demographics, & Needs Adjusted	11.3	(0.9)	14.2	(1.1)	11.9	(1.1)	15.0	(1.1)
+ High School Offer Adjusted	11.5	(1.0)	15.0	(1.5)	12.1	(1.1)	15.2	(1.1)
+ High School Adjusted	9.5	(0.6)	11.9	(0.7)	9.4	(0.7)	12.0	(0.8)
Poor Relative to Non-Poor								
Raw Difference	-10.6	(0.2)	-10.4	(0.2)	-14.0	(0.2)	-15.6	(0.2)
Test Score, Demographics, & Needs Adjusted	-2.4	(0.3)	-2.7	(0.4)	-3.7	(0.4)	-5.1	(0.4)
+ High School Offer Adjusted	-2.4	(0.4)	-2.6	(0.5)	-3.7	(0.5)	-4.8	(0.5)
+ High School Adjusted	-2.4	(0.2)	-2.2	(0.2)	-4.1	(0.3)	-4.2	(0.3)
Male Relative to Female								
Raw Difference	-0.4	(0.2)	-1.4	(0.2)	-7.1	(0.2)	-5.1	(0.2)
Test Score, Demographics, & Needs Adjusted	-0.8	(0.2)	-1.2	(0.2)	-5.9	(0.2)	-3.9	(0.3)
+ High School Offer Adjusted	-1.0	(0.3)	-1.4	(0.3)	-6.7	(0.3)	-4.6	(0.3)
+ High School Adjusted	-0.8	(0.2)	-1.3	(0.2)	-6.5	(0.2)	-4.5	(0.2)

Notes: i) The four AP/IB subjects are estimated jointly using a mulitvariate probit specification. "Pre High School Adjusted", "High School Offer Adjusted", and "High School Adjusted" specifications control for race, gender, poverty, LEP, exceptionality, and 8th grade reading and math scores. "High School Offer Adjusted" and "High School Adjusted" results are restricted to students in high schools that offer AP/IB courses in all four subjects. "High School Adjusted" adds high school dummies to the regression. ii) All mean marginal effects are statistically significant at $p<0.05$ except those indicated with an "ns" for non-significant and "ms" for marginally significant ($p<.10$). iii) Full results are available from the authors.

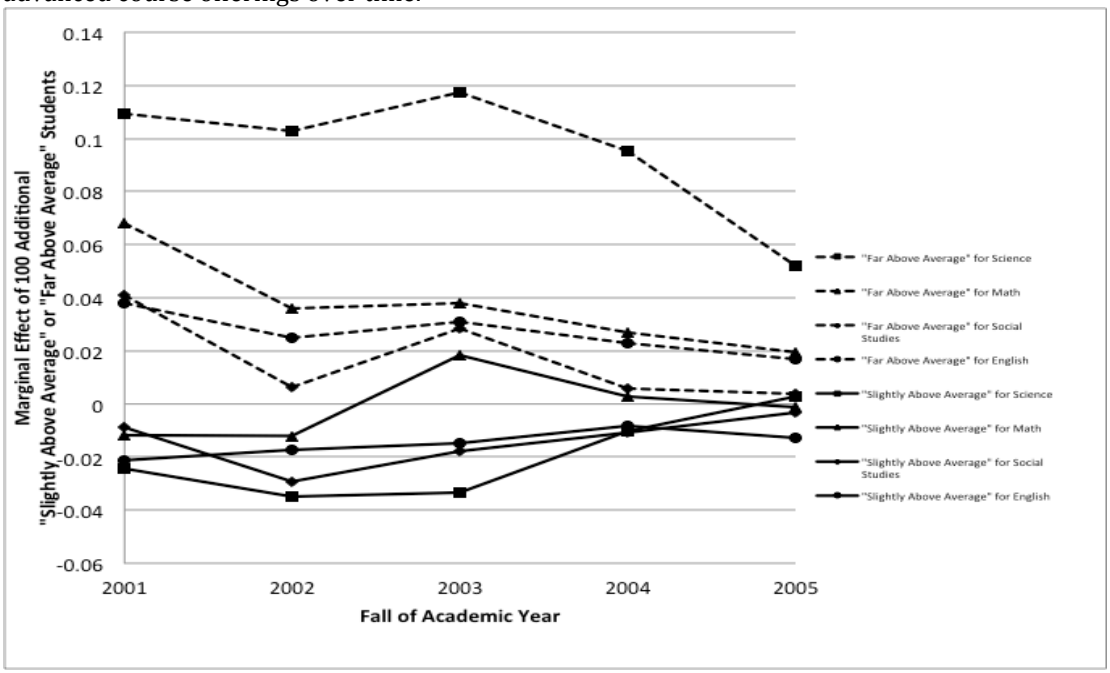
Source: Conger, D., Long, M. C., & Iatarola, P. (2009). Explaining race, poverty, and gender disparities in advanced course-taking. Journal of Policy Analysis and Management, 28 (4), 555-576.

Figure 1: Share offering advanced courses as a function of school size.



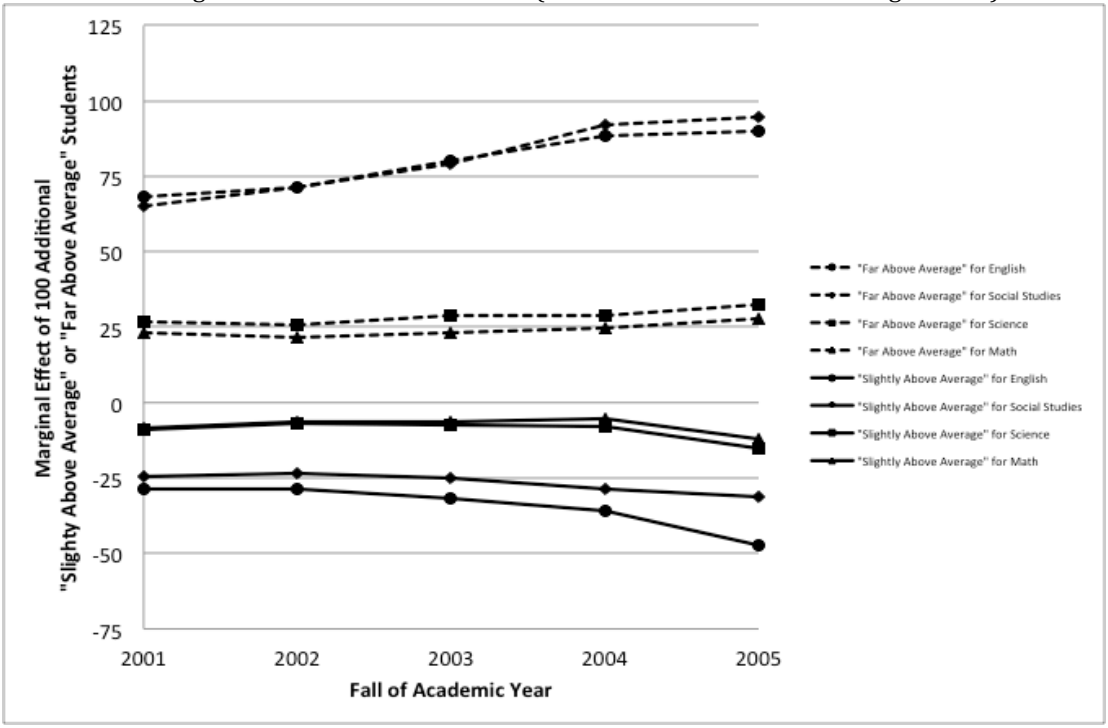
Source: Iatarola, P., Conger, D., & Long, M. C. (2011). Determinants of high schools' advanced course offerings. Educational Evaluation & Policy Analysis, 33, 340-359.

Figure 2: Change in marginal effects of "slightly above average" and "far above average" students on advanced course offerings over time.



Source: Iatarola, P., Conger, D., & Long, M. C. (2011). Determinants of high schools' advanced course offerings. Educational Evaluation & Policy Analysis, 33, 340-359.

Figure 3: Change in marginal effects of "slightly above average" and "far above average" students on number of students taking advanced courses over time (conditional on the course being offered).



Source: Iatarola, P., Conger, D., & Long, M. C. (2011). Determinants of high schools' advanced course offerings. Educational Evaluation & Policy Analysis, 33, 340-359.

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