Middle School Predictors of High School Achievement in Three California School Districts

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ABSTRACT

This paper explores early predictors of high school graduation and success. Employing 7th grade cohorts from three large California school districts (San Francisco, Fresno, and Long Beach), we investigate the role of several key middle school academic performance measures in identifying diploma receipt, passing the California High School Exit Examination on the first attempt, and students' 11th grade academic performance. We find that standardized assessments, timing of algebra, and course failures in middle school provide useful indication of students' high school academic success. Our aim is not to identify any causal mechanism by which middle school achievement leads to high school success or failure, but rather to describe important associations that may aid policymakers and school leaders to develop strategies early in students' educational pursuit of the high school diploma.

Introduction

High school completion is a critical requisite to economic prosperity. Recent estimates suggest that the U.S. high school graduation rate is at about 77% overall, and only at about 65% for African Americans and Hispanics (Heckman & LaFontaine, 2007). The economic costs of high school dropouts are substantial to individuals and society. High school dropouts are less likely to hold down regular jobs, earn about $260,000 less over a lifetime than high school graduates and pay about $60,000 less in taxes (Rouse, 2005). Moreover, high school dropouts are more likely to face health problems (Muennig, 2005), to be involved in criminal activity (Moretti, 2005), and to require public assistance (Waldfogel, Garfinkel, & Kelly, 2005). Belfield and Levin (2007) estimate the economic losses in California from a cohort of dropouts over their lifetimes is as much as $9.5 billion (a combination of lost state and local tax revenues, health expenditures, crime expenditures, and welfare costs). Of course there are also numerous civic costs to high dropout rates, including active participation in democratic society via voting and other forms of civic participation (Junn, 2005).

In this paper we investigate early predictors of high school graduation and success. Employing 7th grade cohorts from three large California school districts, we investigate the role of several key middle school academic performance measures in identifying diploma receipt, passing the California High School Exit Examination, and students' 11th grade academic performance. Our aim is not to identify any causal mechanism by which middle school achievement leads to high school success or failure, but rather to describe important associations that may aid policymakers and school leaders to develop strategies early in students' educational pursuit of the high school diploma. Thus, the goal of the paper is to facilitate districts, schools,

and policymakers' ability to identify the kinds of students most at risk of not graduating from high school.

II. Previous Literature

High School Completion

There is an extensive body of research on high school completion. From this work we know that prior academic achievement (Rumberger, 2004; Goldschmidt and Wang, 1999; Alexander, Entwisle, and Horsey 1997; Alexander, Entwisle, and Kabbani 2001), pauses in schooling and school mobility (Rumberger, 2004; Swanson and Schneider, 1999; Neild and Balfanz, 2006), student attitudes and engagement in school (Alexander, Entwisle, and Horsey, 1997; Swanson and Schneider, 1999; Rumberger, 1987), and high achieving peers (Carbonaro, 1998; Kasen, Cohen, and Brook, 1998) are all associated with high school completion. The risk of dropping out also increases with age; students who have been retained are more likely to drop out (Roderick, 1994; Hauser et al., 2004). Such students may experience disengagement from school early in their schooling careers, which leads them to drop out at higher rates (Roderick, 1994).

Demographic characteristics such as race/ethnicity, gender, language, and social class are also important predictors of high school completion (Hauser, Simmons, and Pager, 2004), yet their influence on the propensity of dropping out is substantially reduced upon control for academic achievement and other demographic characteristics such as social class (Rumberger, 2004; Jencks and Phillips, 1998). Nationally, female students graduate high school at higher rates than males, and whites and Asians graduate high school at higher rates than Hispanics and Blacks (Swanson, 2004). Graduation rates across districts also vary by concentrations of poverty and of minority students; districts with higher enrollment of students from low socioeconomic

backgrounds and/or minority populations have graduation rates substantially lower than those that serve more advantaged and less diverse populations (Balfanz and Legters, 2204; Swanson, 2004). Family context, as represented by familial stress and parents' attitudes and values towards schooling are also significant predictors of high school dropout (Alexander, Entwisle, and Horsey, 1997). Additionally, differences in neighborhood and community characteristics (e.g. resources, after school programs, concentrations of poverty, unemployment rates) may also help explain differences in dropout rates (Brooks-Gunn, Duncan, Klebanov, and Sealand, 1993; Crane, 1991).

At the school level, important structural features of schools—public/private (Bryk & Thum, 1989) and size (Roderick, Jacob and Byrk, 2002) predict differences in dropout rates. In addition, other research has tied school resources, such as pupil/teacher ratio, and school policies, such as disciplinary practices, attendance rates, academic programs and climate in schools to differences in dropout rates (Rumberger, 2004). More recently, in a case study investigating schools in California that are "beating the odds," school leaders credit their success of high graduation rates—relative to schools with similar demographics, in part, to four key components: connecting with students, engaging parents and community to support school efforts, providing interventions and supports to students at-risk of dropping out, and creating a culture of accountability and high expectations (Socias, Dunn, Parrish, Muraki, and Woods, 2007).

There are numerous factors that have been identified with high school students' decision to dropout. The primary reasons identified from direct surveys of high school dropouts include: lack of interest in classes, and school in general; falling behind as a result of absences; failing courses; and, too much freedom (Bridgeland, DiIulio, and Morison, 2006; Rumberger, 2004).

Over a third of high school dropouts report that failing school was one of their top five reasons for leaving (Rubmberger, 2004). Many begin to fall behind in elementary and middle school, unable to catch up by the time they enter high school (Bridgeland, DiIulio, and Morison, 2006).

Research on high school exit has also been focused on identifying early risk behaviors among students. Specifically, failing courses in earlier years (Allensworth and Easton, 2005; Neild & Balfanz, 2006), attendance patterns (Neild & Balfanz, 2006), and misbehavior (Stroup and Robins, 1972), have all been identified as key determinants of the propensity to drop out. The focus on the middle school years is an important one, given ample evidence that early adolescent years can occupy negative changes in academic behavior and motivation (Eccles, Lord, & Midgley, 1991). Students' engagement with and attitudes toward school develop over time, and may influence their ultimate decision to withdraw prematurely (Rumberger, 2004). In fact, in several longitudinal studies researchers have identified the importance of behaviors as early as the first grade in predicting high school dropout (Alexander, Entwisle, and Horsey, 1997: Ensminger and Slusarcick 1992). The early school transition is a critical one as students' "clean slate fills rapidly [before] students' performance patterns and habits of conduct are established, their ideas about self and school begin to solidify, and other persons form impressions of their competence and character" (Alexander, Entwisle, and Horsey (1997:98).

Much, if not all, of the dropout/graduation research is descriptive or correlational in nature. Most studies (the present one included) share the same methodological challenges in accounting for a host of unobservable characteristics, behaviors, or attitudes that may be associated with dropping out. As a result, we must interpret the findings from this body of work not as causal explanations for who graduates, but as important descriptive associations useful for

identifying important disparities in outcomes between different groups, and for developing critical indicators on the road to high school completion.

In addition to the typical selection challenges in dropout studies, there is also the possibility that students who drop out of high school may return to finish a traditional diploma or enroll in an alternative program, such as a General Educational Development (GED) preparation course of study. Applying a longitudinal dataset of Baltimore students, Entwisle, Alexander and Olson (2004) make an important distinction between temporary and permanent dropouts. They find clear differences in the "dropout-return" patterns and in the school-work relationships between advantaged and disadvantaged students, and between students from different racial/ethnic backgrounds (Entwisle, Alexander and Olson, 2004). In fact, a large majority of dropouts resume their education in some form, either to complete the diploma, obtain a GED certificate, or enroll in some vocational schooling (Boesel, Alsalam and Smith, 1998). As such, most longitudinal studies of educational attainment also suffer from some censoring; attainment that is measured at the last point of data collection may or may not accurately represent respondents' true attainment levels. Nevertheless, given that the economic and social costs to dropouts may accrue immediately, it is useful to evaluate their influence at the point of expected graduation.

Identifying High School Dropouts and Graduates

In California, the dropout crisis is receiving increased attention, as evidenced by the work of the California Dropout Research Project.[1]. The California Department of Education reports an overall state dropout rate of 14.1% for the class of 2005-06 (CDE), which based on recent

[1] http://www.lmri.ucsb.edu/dropouts

research, is likely to be a major underestimate (Heckman & LaFontaine, 2007).[2] The dropout rate also varies by demographic characteristics, Whites (8.3%) and Asians (5.7%) are more likely to graduate from high school than Blacks (24.4%) or Hispanics (19%) (CDE). However, dropout figures utilizing alternate methods suggest that as many as 30% of students in California do not graduate from high school (Socias et al., 2007).

The challenge to measuring the dropout rate is now a ubiquitous one in education research (Heckman & LaFontaine, 2007; Orfield 2005, Socias et. al, 2007, Warren & Halpern-Manners, 2007; NCES-Kaufman). There is an ongoing important debate about who should be counted as a dropout and how dropout rates should be calculated. The main problem in identifying an accurate dropout rate is that students migrate in and out of different districts. The California Department of Education (CDE) considers a dropout a student who no longer attends the school and has not reenrolled in another school, received a GED, moved out of the United States, is too sick to enroll, has died, or has enrolled in a post-secondary institution. While schools can sometimes tell if a student has transferred out of the district, most data is limited to students' presence in the district. The four-year dropout rates provided by the CDE represent the dropout rate based on a single year of data collection. The rate, also used by the National Center for Education Statistics, is calculated by subtracting the product of the proportions of the total enrollment from each year of school (grades 9–12) that did not drop out from one. This measure is not particularly informative about any one cohort, but rather gives a snapshot of a district as a whole. Our study only considers graduation rates, and therefore does not accurately represent the status of a dropout. Students from our cohort who do not graduate are not necessarily dropouts in that, similar to the challenges of identifying dropouts, we cannot account for possible inter-district mobility which results in non-completers.

[2] http://dq.cde.ca.gov/dataquest/

Like the dropout rate, the graduation rate has been the subject of debate. A simple, but flawed, way to calculate a graduation rate is to divide the number of students finishing twelfth grade by the number of ninth grade students four years earlier. This measure, called the Basic Completion Ratio, does not take into account students who transferred in or out of the district or those who graduated early or late (Swanson, 2004). Warren (2005) suggests calculating the number of graduates divided by the number of first-time ninth grade students four years before and adjusting with a migration factor for each state. Our paper does not attempt to measure the graduation rate for the district overall, only for our specific subset of the 7th grade cohort. Our method and sample therefore limit the accuracy of the estimate as a definitive graduation rate, as it does not factor in migration in and out of the school district. However, it is useful for our purposes of identifying early predictors of high school completion and success for a cohort of 7th grade students tracked longitudinally through 12th grade.

The California High School Exit Exam

California is one of many states to implement high school exit examinations in the last two decades. As of 2005, 20 states had high school exit exam requirements, and a half dozen more had plans to implement such a requirement in the near future. By 2009, over 70% of U.S. students will be subject to such exam requirements (see, e.g., Center on Education Policy 2004; Center on Education Policy 2005; Dee and Jacob 2006; Warren, Jenkins et al. 2006). For the most part, the adoption of such policies is driven by the beliefs that a) some high school graduates lack basic skills necessary for success in the modern economy; and b) that a high school exit exam requirement will create incentives both for schools to provide better instruction

for such students and for these students to work harder and learn more in school (for discussion, see Dee & Jacob, 2006; Reardon & Galindo, 2002; Warren, Jenkins, & Kulick, 2006).

Because the California High School Exit Exam (CAHSEE) is new, there has been little time to assess its impact on schools and students. Studies in other states and using national data have found somewhat mixed evidence of the effects of exit exams on high school dropout/completion rates. Several studies using individual-level data from nationally-representative samples (mostly from cohorts of students graduating high school in the early 1990s) have found that state high school exit exams increase high school dropout rates among low-achieving students (Jacob, 2001; Bishop & Mane, 2001) or Black males (Dee, 2003), though one similar study found no such effects (Warren & Edwards, 2005). In contrast, a set of studies examining the relationship between state exit exam policies and state-level graduation rates generally finds no effect of exit exams on dropout rates (Carnoy & Loeb, 2003; Greene & Winters, 2004; Warren & Jenkins, 2005; Marchant & Paulson, 2005, but see Amerin & Berliner, 2002 for a different result), though some of these studies have important methodological shortcomings (discussed at length in Dee and Jacob 2006; Warren et al. 2006). Two newer studies that correct many of the methodological shortcomings of these studies, however, find that high school dropout rates tend to increase, on average, when states implement exit exams (Dee and Jacob 2006; Warren et al. 2006). Moreover, Dee and Jacob (2006) find that these effects are concentrated among Black students and students in high-poverty schools. In sum, while there are more studies that find negative effects on high school dropout rates than studies that find no effect (and find these effects concentrated among low-achieving student populations), the number of high-quality empirical studies is relatively small.

Analyzing the effect of the CAHSEE on high school completion is beyond the scope of this report (see Reardon, et al [in prep] for an analysis of the impact of the CAHSEE on students' educational trajectories). However, we include CAHSEE passing rates as one of our outcomes of interest, given the importance of the state high school exit exam as a necessary condition of diploma receipt and as a signal for students' academic performance. Statewide, 91.4% of California seniors in 2005-06 passed both sections of the CAHSEE by July 2006. Whites (97.4%) and Asians (95.3%) had higher passing rates than Hispanics (85.7%) and African Americans (84.1%); and, the passing rates of economically disadvantaged students (86.0%) and English Learners (76.4%) are substantially lower than the state average (California Department of Education, 2006).

The purpose of this paper is to provide a detailed descriptive picture of high school completion and achievement for a 7th grade cohort of students from three of California's largest urban school districts. Specifically, we investigate the influence of middle school achievement indicators in facilitating high school completion, achievement and CAHSEE passing.

III. Methods

Sample Description

The sample contains detailed information from one 7th grade cohort of students from three large urban California school districts (Fresno, Long Beach and San Francisco) from the 2000-2001 to the 2005-2006 school year.[3] The cohorts are limited to seventh grade students in the 2000-2001 school year who are present in the district two years later at what would be ninth grade, or the beginning of high school for most students. Students who attended seventh grade in 2000-2001 would have graduated in 2005-2006 if they were not retained. Since our focus is on

[3] Although, most students enter middle school in 6th grade, we only have full cohort data from our three districts starting at 7th grade.

the middle school determinants of high school completion and success, our analyses do not include students entering the district at or later than ninth grade or students leaving the district before the beginning of ninth grade.

We compare the means of the outcomes and controls for our cohort and the entire ninth grade cohort for each of these districts in Table A1 in the Appendix. The differences between our sample cohort of ninth graders and the entire ninth grade cohort can be attributed to students who entered the district in the eighth and ninth grades. Table A2 in the Appendix shows the percentage of students remaining in the district by 2005-2006 (12^{th} grade) by year for each district, for both our analytic sample and the 9^{th} grade cohort by comparison.

District Descriptions

Fresno Unified School District had a district-wide enrollment of 79,046 students in 2005-2006, and was comprised of 63 elementary schools, 16 middle schools, 12 high schools, 3 special education schools, 2 alternative schools, 5 continuation schools, and 1 community day school. In 2005-2006, Long Beach Unified School District has a district-wide enrollment of 93,589 students in 61 elementary schools, 15 middle schools, 8 high schools, 1 K-12 school, 2 alternative schools, 1 continuation school, and 2 community day schools. San Francisco Unified School District is the smallest of the three districts, with an enrollment of 56,236 students in 74 elementary schools, 18 middle schools, 22 high schools, 1 alternative school and 2 continuation schools in 2005-2006,.

Table 1 shows the racial/ethnic composition of the three districts and the state of California as a whole. Table 1 also indicates the academic characteristics of the three districts compared to the state of California. As discussed above, the four-year dropout rate for 2005-2006 shown in Table 1 is an estimate from the California Department of Education based on one

year of data collection, and does not represent any specific cohort.[4] As expected, our analysis yields different results than the California Department of Education estimates. Our cohort-based sample is limited to seventh grade students in 2000-2001 who stayed in the district until 2002-2003 (ninth grade), and our graduation variable does not account for transfers in or out of the district. Thus, our analysis should not be considered as providing an accurate representation of the district's dropout rate, since we only have student exit data. Relying on our completion rates to identify the dropout rate would clearly suggest an overestimate of dropouts for the districts and for our sample cohort given likely transfers to other districts and subsequent diploma receipt among dropouts.

Measures

The outcome measures we investigate are high school completion and performance. We measure completion as graduation or diploma receipt. We measure high school performance in two ways, grade point average (GPA) in the third year of high school, and passing the California High School Exit Exam (CAHSEE) on the first attempt. While students are not required to pass the CAHSEE on the first attempt, we feel that it is important to measure the first experience students have with the exit exam, and that first attempts at the exams are critical for establishing interventions to improve passing rates for students struggling to pass the high school exit exam. The eventual passing of the CAHSEE is also partly captured by the high school graduation measure. Descriptive statistics on each of these variables is available in Table 2, additional details about the outcomes variables' construction is found in Table A3 in the Data Appendix.

[4] The four-year dropout rate was obtained by calculating percentage of non-returning and untrackable or officially dropped students from each high school grade (9-12) in 2005-2006 to estimate the percent of students who may drop out in a four-year period for that district.

Our primary predictors are students' middle school academic performance. To capture middle school academic performance, we include several measures. First, students' GPA in the 7th grade provides an overall picture of a student's academic achievement. Second, we include the number of core courses (English language arts, mathematics, science, and social studies) that students failed in 7th and 8th grade respectively. Previous literature has suggested that early course failure in school is a critical indicator of high school completion (Allensworth and Easton, 2005). Third, we include the timing of algebra course taking; the research base is extensive on the importance of algebra course-taking in predicting secondary and post-secondary success (Adelman, 1999). Fourth, we include the California Standards Test (CST) English language arts and mathematics assessments, which are used to assess the academic achievement of every student in the state of California on a yearly basis. Descriptive statistics on each of these variables is available in Table 2, additional details about the predictor variables' construction is available in Table A3 in the Data Appendix.

We also include an important set of controls that represent students' demographic characteristics, including race/ethnicity, gender, and socioeconomic status (SES). Some of our controls are student characteristics that are specific to their middle school years. We include a measure of whether or not a student receives special education services in seventh grade and whether or not a student is classified as an English language learner (ELL) in seventh grade. We also include a control for if a student was retained at some point in middle or high school and whether a student is over-age for seventh grade, (suggesting either late entry into the school system or retention before seventh grade).

Analytic Strategy

We rely on two primary descriptive methods using detailed longitudinal student-level data from each district to examine the middle school determinants of academic performance and diploma receipt. In all analyses the districts are treated separately. First we analyze a set of cross-tabulations of key predictor variables against each outcome variable. The cross-tabulations display how each outcome varies by important characteristics, which is helpful in determining relationships between types of middle school achievement characteristics and each of our outcomes. [5]

Second, we fit a set of Ordinary Least Squares and logistic regression models for each outcome of interest. The regressions each include three sets of models. The first set of models regress the outcome measure on all of the key middle school achievement predictors; in model two, we regress the outcome measure on all of the key middle school achievement predictors and demographic controls, and in model three we regress the outcome measure on all predictors and controls, utilizing school fixed effects to account for students' enrollment in particular schools, which may differ, on average, on these outcomes.[6] These regressions allow us to determine relationships between groups of students holding constant other predictors and controls. To further explore the results from these models, we display some of these relationships in graphs in the results section.

[5] We remove observations with missing data on the outcomes explored in each respective set of regressions. We impute missing data on the predictors as follows: GPA using course history files, 7th grade SES identifier with 8th grade SES. Finally, we use list-wise deletion for observations missing 8th grade CST scores or course history in 8th grade, which leads to a loss of 9.1% of the Long Beach sample (n=577), 4.8% of the San Francisco sample (n=304), and 9.9% of the Fresno sample (n=513).

[6] The school fixed effects includes the school nearest to the time that the outcome occurs. If the student's school is not known that year, we used the student's school in the next closest year before the occurrence of the outcome.

IV. Results

The graduation (diploma receipt) rate in 2005-2006 for the 7th grade cohorts utilized in this analysis is 55% for Fresno, 59% for Long Beach, and 65% for San Francisco (Table 2). It is important to reiterate that these rates are underestimating the actual overall graduation rates for these districts, since some students may have exited the district to another district or a private high school and subsequently graduated. In addition, others who dropped out may return to school or enroll in an alternative program and subsequently obtain a high school diploma. Among our 7th grade cohorts, 60% of Fresno, 69% of Long Beach, and 77% of San Francisco students pass the CAHSEE on their first attempt (Table 2). It is interesting to note that across all districts, graduation rates are lower than CAHSEE passing rates at first attempt, which suggests that students may not be graduating as a result of other district graduation requirements such as credit accumulation, or that some students exit the districts either to transfer or as dropouts *after* passing the CAHSEE.

Table 3 displays our outcomes—high school graduation and CAHSEE passing at first attempt by key student demographics. Although there are clearly differences across districts, several important trends by student characteristics across all districts are noteworthy. First, English Learners have lower graduation and CAHSEE passing rates relative to non-English Learners. Second, across all districts, special education students have lower graduation and CAHSEE passing rates relative to non-special education students. Third, in Long Beach and Fresno, students from lower socioeconomic backgrounds fare worse in graduation rates relative to their more affluent counterparts; interestingly, this is not the case in San Francisco, where low socioeconomic students appear to have similar or even higher outcomes relative to non-low

socioeconomic students.[7] Fourth, females have higher graduation rates and higher CAHSEE passing rates at first attempt, relative to males. Lastly, not surprisingly, students who are retained in middle or high school, or who are overage in 7th grade (largely as a function of being retained or behind in earlier grades) are less likely to graduate or to pass the CAHSEE at first attempt than their counterparts who were not retained or who are of average grade age.

The high school graduation rates across all three school districts are lower for Black, Hispanic and American Indian students, relative to White, Asian and Pacific Islander students. Graduation rates by race/ethnicity for our 7th grade cohort of students in Fresno reaching high school indicate 44% of African Americans, 63% of Whites, 50% of Hispanics, 59% of Pacific Islanders, 65% of Asians, and 56% of American Indians obtain a high school diploma. For Long Beach, 53% of African Americans, 72% of Whites, 51% of Hispanics, 69% of Pacific Islanders, 72% of Asians, and 20% of American Indians obtain a high school diploma. Finally, for San Francisco, the graduation rates by race/ethnicity are 36% for African Americans, 64% for Whites, 44% for Hispanics, 86% for Asians, 63% for Pacific Islanders, and 37% for American Indians. Similar racial/ethnic patterns are present for CAHSEE passing rates at first attempt across each of the three school districts.

Cross-Tabulations by Middle School Achievement

Students with higher achievement levels in middle school, as measured by timing of algebra, course failures and test scores are more likely to graduate and pass the CAHSEE at first attempt than their counterparts with weaker middle school achievement records. Specifically, 54% of students in Fresno who had completed algebra by the 8th grade obtained a diploma, and

[7] This is likely, in part, to the high presence of high performing, low socioeconomic Asian students present in San Francisco.

62% passed the CAHSEE in their first attempt, as compared with 22% of students who were still enrolled in algebra before high school obtaining a high school diploma, and 9% passing the CAHSEE on the first attempt (Table 4). Moreover, we note the big difference in graduation rates and CAHSEE pass rates across the number of course failures. Students who have failed two or more courses have substantially lower graduation and CAHSEE passing rates (Table 4). In Long Beach, 37% of students with two or more Fs in 7th grade graduate, as compared with 75% of those with no reported Fs in 7th grade. In San Francisco, where the graduation and CAHSEE passing rates are higher overall, the disparities by algebra enrollment are not as great. However, we note large differences in graduation rates by middle school course failures: only 23% of students who receive two or more Fs in 7th grade obtain a high school diploma, and 39% pass the CAHSEE on the first attempt, as compared to the 74% who graduate and the 83% who pass CAHSEE with no reported Fs in 7th grade. Table 5 displays graduation and CAHSEE passing by 8th grade CST English and mathematics score. Across all three districts, we note low graduation and CAHSEE passing rates at first attempt for students who score far below or below basic on the California standardized assessments in 8th grade.

Multivariate Models of High School Completion and Success

Tables 6-8 include the coefficients and standard errors from three sets of models for each of our outcomes by district. The first column of models in each table includes the predictors of interest, middle school achievement variables: 7th grade GPA, whether or not a student completed algebra by 8th grade, whether or not a student received more than one F in 7th and 8th grade respectively, and students' scores on the 8th grade California standardized assessment tests in English and mathematics respectively. The second column includes these predictors as well as

a set of controls, including: English Learner status in 7th grade, special education status in 7th grade, whether or not a student is classified as low socioeconomic status, race/ethnicity, gender, whether or not a student was retained at one point after 7th grade, and over-age indicating a student may have been retained prior to 7th grade. Finally, column three includes all of the variables in column two, as well as school dummies to account for students' clustering in high schools, and the unique characteristics that may be associated with them. As such, the results in column three can be thought of as the *within-school* association (as opposed to the *within-district* association) between each of these predictors and the outcome.

Tables 6 and 7 present results from fitted logistic regression models predicting high school graduation (degree receipt) and CAHSEE passing at first attempt respectively. From the results in Table 6 we note that 7th grade GPA is consistently a significant predictor of high school completion, controlling for a variety of other characteristics. Students who have higher achievement, as measured by GPA, are more likely to graduate, on average, relative to their lower achieving counterparts, controlling for a variety of background characteristics. Math and English CST scores have a similar relationship with high school completion, but their effect is less consistent across the models for San Francisco, controlling for GPA and other variables likely to be correlated with test scores. We also note that Fs in 8th grade appear to have some negative influence on high school completion, controlling for all other variables. The odds that a student with two or more Fs in 8th grade will graduate, versus a student with none or one F in 8th grade, is .39 in Fresno, .64 in Long Beach, and .44 in San Francisco (based on results from fixed effects models, in Table 6).

Turning to the demographic controls, we note relatively little consistent influence of individual characteristics on our outcomes, controlling for prior achievement. Specifically,

English Learners and special education students in 7th grade do not appear to have higher risks of not graduating, controlling for prior achievement. Students from lower socioeconomic backgrounds are less likely to graduate from high school, controlling for prior achievement and other individual characteristics in Fresno and Long Beach. However, in San Francisco the reverse is true; low socioeconomic students are more likely to graduate controlling for all else. Although this may seem like a surprising finding, we note first that the socioeconomic distribution in each of these districts differs substantially, and second that San Francisco has a large proportion of low SES Asian students with relatively higher outcomes on average than higher SES students in the district. Race/ethnicity does not have a significant impact on high school graduation, controlling for a variety of other characteristics, save for Fresno and Long Beach where Black students are, on average, more likely to graduate relative to their White counterparts, controlling for prior academic achievement and a host of other characteristics. We also note that in Long Beach and San Francisco Asian students have significantly higher graduation rates, on average, than their White counterparts, controlling for prior academic achievement and a host of other characteristics. Finally, being retained in middle or high school (retain) or earlier than 7th grade (overage) is associated with lower likelihoods of high school completion.

Looking at the results presented in Table 7, it is clear that middle school achievement, (as measured by 7th grade GPA, having completed algebra by 8th grade, and CST scores) has a strong positive influence on passing CAHSEE at the first attempt. The odds that a student who has taken algebra by 8th grade will pass the CAHSEE on the first attempt, versus a student who has not, is 10.44 in Fresno, 2.89 in Long Beach and 2.49 in San Francisco (based on results from fixed effects models, in Table 7). Individual background and demographic controls do not hold a

consistent influence on CAHSEE passing rates, above and beyond achievement across the three districts. However, there are some interesting district-specific effects. In Fresno, we note the significant effect of English Learner status; EL students are, on average, less likely to pass the CAHSEE at the first attempt, even when controlling for prior achievement and a variety of other characteristics. Special education students in Long Beach and San Francisco, also have significantly lower CAHSEE pass rates at first attempt, controlling for prior achievement and other individual characteristics. Unlike the graduation outcome, here we note that controlling for prior achievement and other demographic characteristics, African American students have on average, lower CAHSEE passing rates at first attempt, relative to White students. We also note an interesting significant effect of gender across the three districts, such that controlling for prior achievement and other demographic characteristics, male students have, on average, higher CAHSEE passing rates at first attempt, relative to female students. Across all districts we note the importance of the variables overage and/or retain, indicating students that were retained in early or later grades have, on average, lower CAHSEE passing rates at first attempt.

Turning to achievement in high school, Table 8 presents OLS regression results predicting 11th grade GPA. Again, not surprisingly, we note the significant influence of middle school achievement, specifically, 7th grade GPA, number of Fs in 8th grade, and mathematics and English 8th grade CST scores. We also note that male students, on average, have significantly lower GPAs, relative to female students, controlling for all else in the model. There were no consistent findings on racial/ethnic differences other than for Latinos, where in all three districts, Latinos appear to fare worse relative to Whites in their 11th grade achievement, controlling for early achievement and all other background characteristics. In San Francisco, African American students have, on average, lower 11th grade GPAs relative to Whites, controlling for prior

achievement and background characteristics. Socioeconomic status was a significant predictor of 11th grade point averages, interestingly in a similar way as in the other models—low SES students fare worse in Fresno and Long Beach and better in San Francisco on 11th grade GPA, controlling for early achievement patterns and a variety of other background characteristics.

To further interpret our findings from the multivariate analysis we present several prototypical plots. We first display plots that indicate the predicted outcomes in each district for students with demographic and academic characteristics typical of the "average" student across the three districts. Following this, we display plots for each district separately that show predicted outcomes for students typical of the average student in the specific district. The first set of figures (Figures 1 and 2) allows descriptive comparison of outcomes for similar students across the three districts; the latter set of figures (Figure 3) provides a description of outcomes for the "average" student in each district.

Looking first at high school graduation, Figure 1 presents the fitted probabilities of diploma receipt as a function of 7th grade GPA for the "average" student *across* the three districts (so, for students with the same average characteristics).[8] In each of the three districts we note a strong association between middle school achievement and students' likelihood of exiting high school prior to graduation. Turning to high school academic performance, Figure 2 presents the probability of passing the CAHSEE on the first attempt, again for the "average" student *across* the three districts as a function of students' 8th grade CST mathematics score. We note several important findings from this graph. First, in all districts, the relationship between CST scores and the probability of passing the CAHSEE on the first attempt is quite similar, with students scoring basic, proficient, or advanced in 8th grade having much higher probabilities of passing

[8] Combining our districts, the "average" student has a 2.56 GPA, about 48% likely to have taken algebra by 8th grade, score about 315 on the CST ELA and 313 on the CST math in 8th grade.

the CAHSEE on their first attempt, relative to students with lower CST scores. Not surprisingly, we also note much more variation across the three districts in the probability of passing the CAHSEE at the first attempt for students who score far below or below basic on the CST. It is important to note the differences in the proportion of students in each CST cut score category across our three districts. For example, in Fresno, 17% of students score "far below basic" on their 8th grade CST, as compared to 10% in Long Beach and 11% in San Francisco. It is also noteworthy that San Francisco students that score below basic on the CST still have high probabilities of passing the CAHSEE on the first attempt; however, the first time passing rate on CAHSEE for San Francisco students is substantially higher than that of similar students in the other districts (77%, relative to 60% in Fresno and 69% in Long Beach).

In contrast to Figures 1 and 2, Figure 3 presents the fitted probability of graduation as a function of 7th grade GPA and course failures for the "average" student in *each respective* district.[9] First, we note again that, on average, the higher students' middle school achievement the more likely they are to graduate, controlling for a variety of other characteristics. Second, students with more than two reported Fs in a core subject in 8th grade have a lower probability of

[9] Holding all other variables in the model constant at the district specific means, the "average" student in each of these districts is quite different, and as such the probabilities of high school completion as a function of middle school GPA and number of Fs vary considerably across the three districts. The "average" student in Fresno has a 32% chance of being an ELL student in 7th grade, a 10% chance of receiving special education services in 7th grade. In terms of race/ethnicity, 48% of Fresno students are Hispanic, 11% are African American, 20% are white, 20% are Asian, and less than 1% are Pacific Islander and/or Native American. This "average" student in Fresno also has a 24% chance of being retained at some point between 7th grade and 12th grade, a 13% chance that the student is overage in 7th grade, and a 77% chance of being economically disadvantaged. The "average" student in Long Beach has a 30% chance of being an ELL student in 7th grade, a 7% chance of receiving special education services in 7th grade. The racial/ethnic representation in Long Beach is 43% Hispanic, 19% African American, 19% White, 13% Asian, 5% Pacific Islander, and less than 1% Native American. This "average" student in Long Beach also has a less than 1% chance of being retained at some point between 7th grade and 12th grade, a 13% chance that the student is over-age in 7th grade, and an 81% chance of being economically disadvantaged. The "average" student in San Francisco has a 27% chance of being an ELL student in 7th grade, a 13% chance of receiving special education services in 7th grade. In terms of race/ethnicity, 15% of San Francisco students are African American, 20% are Hispanic, 10% are White, 40% are Asian, 7% are Pacific Islander, and less than 1% is Native American. This "average" student also has a 28% chance of being retained at some point between 7th grade and 12th grade, a 10% chance that the student is over-age in 7th grade, and a 42% chance of being economically disadvantaged.

graduating, on average, than their counterparts with none or one course failure. Although the magnitude of this effect may differ across the three districts (as represented in the distances between the lines on each respective graph), it is nevertheless present and statistically significant for all three districts.

Finally, although our results don't directly speak to school characteristics that may facilitate positive outcomes, we can look descriptively at key differences in outcomes across schools within each district. Figures 4-6 present the "status" of students by the 12th grade in each school for each district respectively. We identify status as one of five states: (1) students who are present in the district in the 12th grade and passed both sections of the CAHSEE on the first attempt in 10th grade; (2) students present in the district in the 12th grade and passed both sections of the CAHSEE on later attempts; (3) students who have passed both sections of the CAHSEE and have left the district, either as dropouts or to transfer to another district; (4) students who are present in the 12th grade, but have still not passed the CAHSEE; and finally (5) students who have left the district, either as dropouts or to transfer, and have not passed the CAHSEE.

Looking at these states, we can identify important differences between schools within each of the districts. Clearly, there are big differences by school in initial CAHSEE passing rates. But, perhaps more importantly, there are also big differences in improvement rates in CAHSEE passing between the first attempt in 10th grade and the fourth attempt in 12th grade. Finally, we might also be concerned about the differences in the bars indicating district exit by school, given that district exit is one—albeit not precise—proxy for high school dropout.

V. Conclusion

The goal of this paper is to aid schools, districts, and education policymakers to identify the students most at risk of dropping out of high school prematurely, or who are struggling to pass the California High School Exit Exam. Many districts and schools are developing early warning systems to support students deemed at risk, either as a result of weak academic performance, and/or specific behavior, such as absenteeism (Bridgeland, DiIulio, & Morison, 2006).We find several important middle school determinants of high school success that can be utilized to target students early.

First, standardized assessments provide useful indication of students' likelihood of graduation and CAHSEE failure. Students scoring far below basic on the California assessments had very low rates of CAHSEE passing at first attempt, 22% in Fresno, 18% in Long Beach, and 27% in San Francisco. This is an important finding given that mathematics on the CAHSEE exam is largely at the 8th grade level. In fact, much earlier assessments provide strong indication of later success. Utilizing data from San Diego Unified School District, Zau and Betts (2008), find students' 4th grade test scores to be significant predictors of CAHSEE passing.

Second, corroborating with earlier research (Adelman, 2006; Smith, 1996; Evan, Gray, & Olchefske, 2006), timing of algebra is a strong predictor of students' high school success. In two of our three districts, there was a 30 percentage point difference in graduation rates between students who had completed algebra by the 8th grade and those that had not.

Third, we find that retention in earlier (and later) years is a strong predictor of high school completion, a finding that is also supported by previous research on high school completion (Entwisle, Alexander, and Olson, 2004; Roderick, 1994).

Fourth, middle school course failures also proved to be an important indicator of likelihood of graduation, and for forecasting CAHSEE passing at first attempt.

Overall, although there were important district differences in our results, the patterns were overwhelmingly similar. Moreover, despite the likely differences between schools along these outcomes, our results on the middle school indicators were robust when adjusting for school fixed effects. We find overall modest effects of student demographic characteristics, above and beyond academic performance measures; however these were not consistent across districts or outcomes, and were often not stable across the different model specifications. One exception is the socioeconomic status indicator; for two of the three districts, there are clearly persistent negative effects of low socioeconomic status on high school diploma receipt and overall 11th grade GPA. This suggests that school systems might attend particularly to students from low-income homes when targeting dropout prevention programs, since these students have lower 11th-grade GPAs and 12th-grade completion rates than students from higher-income homes who have similar middle-school academic outcomes.

By many different calculations, California is facing a high school dropout crisis (Rumberger & Arellano, 2007). Belfield and Levin (2007) estimate the economic benefits of raising the rate of high school graduation in California to $115,000 to the federal government and $54,000 to state and local government, and the total social gains at $392,000 for each additional graduate over a lifetime.[10] The potential benefits of raising the graduation rates in

[10] These are based on increased productivity among high school graduates resulting in higher earnings and therefore tax payments; reduced reliance on health services, public assistance, and criminal justice system (see Belfield and Levin, 2007 for detailed discussion).

California clearly outweigh the likely additional investments necessary to produce more graduates in the state (Belfield and Levin, 2007).[11]

Over the last two years, California has made a substantial investment in trying to improve passing rates on the high school exit exam. The Budget Act of 2006 and Assembly Bill 1811 created nearly $70 million specifically targeted to improving passing rates.[12] However, these monies are restricted to interventions post-10th grade (when students typically first take and either pass or fail the CAHSEE). This is far too late in students' high school graduation trajectories, given what we know from middle school indicators. The primary purpose of identifying students at risk of dropping out prematurely or not meeting graduation requirements is to target interventions early. There is no doubt that the transition from middle school to high school is one of great challenge for many students. An extensive body of research in adolescent development and behavior suggests that many students experience a decline in academic motivation and engagement in the middle school years (Eccles & Midgley, 1991). These declines are manifest in increasing self doubt, a lack of confidence in one's abilities, and rising academic pressures, among other factors (Eccles, forthcoming). While behaviors of disengagement, apathy, or stress may be difficult to target in middle school students, indicators of weak academic performance can provide useful information to teachers, school leaders, and parents of struggling students.

Our findings are consistent with a growing body of research that has identified early signals of academic failure and high school dropout. These signals include course failures in

[11] A cost-benefit analysis of educational investments that might improve California's high school graduation rate suggest that investments, such as raising teacher quality, reducing class size, publicly funded pre-school, head start, and after school programs are likely to yield positive returns, albeit at a greater cost to state and local governments (Belfield and Levin, 2007).

[12] California Department of Education Notice of the Apportionment for the California High School Exit Examination Intensive Instruction and Services Fiscal Year 2006-07. http://www.cde.ca.gov/fg/fo/r19/cahseeiis06apptltr.asp

core academic subjects in middle school (Allensworth & Easton, 2007; Neild & Balfanz, 2006), grade retention (Roderick, 1994), early achievement (Zau and Betts, 2008), and timing of algebra enrollment (Adelman, 2006). Moreover, other studies have also identified additional behavioral signals such as truancy (Allensworth & Easton, 2007; Neild & Balfanz, 2006) or elementary school behavior (Zau and Betts, 2008) that, although not explored in this study, may further reveal risk of academic failure. Our results indicate that schools and districts have the necessary information in middle school to identify students at risk of not completing high school and/or not passing the California High School Exit Exam. Policymakers may in fact witness the desired improvements in CAHSEE passing rates and graduation outcomes if substantial investments were directed for early interventions.

TABLES & FIGURES

Table 1: Academic and Demographic Characteristics of Districts and the State

2005-2006 Race/Ethnicity in Districts A, B, C and the state of California								
	African American	American Indian / Alaska Native	Asian	Filipino	Hispanic or Latino	Pacific Islander	White	Multiple or No Response
Fresno	11%	1%	15%	1%	57%	0%	16%	0%
Long Beach	18%	0%	9%	4%	50%	2%	17%	0%
San Francisco	13%	1%	44%	6%	22%	1%	9%	4%
California	8%	1%	8%	3%	48%	1%	30%	2%
Source: California Department of Education: http://dq.cde.ca.gov/dataquest/								

2005-2006 Academic data from Districts A, B, C and the state of California								
	Enrollment	Special Ed. Enrollment (Age 5-21)	English Learners	4 Yr Drop Rate (9-12)	Free or Reduced Price Meals	Language Arts Percent Proficient and Above	Math Percent Proficient and Above	API
Fresno	79,046	9%	28%	16%	82%	27%	27%	658
Long Beach	93,589	8%	24%	13%	69%	41%	41%	722
San Francisco	56,236	11%	29%	7%	55%	48%	48%	753
California	6,312,436	10%	25%	13%	51%	42%	41%	
Source:California Department of Education: http://dq.cde.ca.gov/dataquest/								

Table 2: Summary Statistics (Number of Observations, Mean, and Standard Deviations) for each School District on key variables

		Fresno			Long Beach			San Francisco		
	Variable Description	Obs	Mean	SD	Obs	Mean	SD	Obs	Mean	SD
Outcome variables										
Graduate	Diploma Receipt	5175	0.55	0.5	6336	0.59	0.49	3856	0.65	0.48
Pass CAHSEE	Student passed both sections on first attempt	4520	0.6	0.49	5585	0.69	0.46	3402	0.77	0.42
GPA 11th	GPA in third year of HS	5174	2.39	0.74	3153	2.33	0.84	3163	2.53	1.03
Predictor variables										
GPA 7th	7th grade cum. GPA	5166	2.54	0.89	6269	2.53	0.88	3856	2.79	1
GPA 8th	8th grade cum. GPA	5171	2.53	0.83	6145	2.53	0.85	3778	2.81	0.97
8th Grade Algebra	In algebra class in 8th grade	4960	0.96	0.21	5753	0.25	0.44	3687	0.23	0.42
2+ Fs in 7th	0-1, or 2+ Fs in 7th grade	5163	0.26	0.44	6255	0.32	0.47	3845	0.11	0.32
2+ Fs in 8th	0-1, or 2+ Fs in 8th grade	4989	0.29	0.45	5815	0.39	0.49	3766	0.3	0.66
CST 8 ELA PL	performance level for CST english 8th grade	4662	2.5	1.1	5909	2.83	1.11	3555	2.96	1.19
CST 8 Math PL	performance level for CST math 8th grade	4669	2.41	0.95	5907	2.79	1.03	3562	3	1.16
CST 8 ELA	scale score for CST english 8th grade	4662	303.3	47.5	5909	318.2	48.92	3555	324.53	52.91
CST 8 Math	scale score for CST math 8th grade	4669	297.08	46.29	5907	317.2	54.66	3552	331.17	67.09

Table 2 *Continued*: Summary Statistics (Number of Observations, Mean, and Standard Deviations) for each School District on key variables

		FRESNO			LONG BEACH			SAN FRANCISCO		
	Variable Description	Obs	Mean	SD	Obs	Mean	SD	Obs	Mean	SD
Control Variables										
ELL 7th	ELL status in 7th grade	5175	0.32	0.47	6336	0.3	0.46	3856	0.27	0.44
Special Ed. 7th	Special education status in 7th grade	5175	0.1	0.3	6336	0.07	0.26	3856	0.13	0.33
Low SES	low socioeconomic status	5174	0.77	0.42	6336	0.81	0.39	3856	0.43	0.49
Black	African American	5175	0.11	0.32	6336	0.19	0.39	3856	0.15	0.35
White	White	5175	0.2	0.4	6336	0.19	0.39	3856	0.1	0.3
Hispanic	Hispanic	5175	0.48	0.5	6336	0.43	0.5	3856	0.2	0.4
Pacific Islander	Pacific Islander	5175	0.01	0.08	6336	0.05	0.23	3856	0.07	0.26
Asian	Asian	5175	0.19	0.39	6336	0.13	0.33	3856	0.39	0.49
American Indian	American Indian	5175	0.01	0.09	6336	0	0.06	3856	0.01	0.08
Male	Male	5175	0.51	0.5	6336	0.52	0.5	3856	0.52	0.5
Retained	student was retained at some point in 7^{th}-12^{th} grade	5175	0.24	0.43	6336	0	0.05	3856	0.28	0.45
Over Age	Student was over age (>+1 year) at 7^{th} grade	5175	0.13	0.35	6336	0.13	0.34	3856	0.1	0.3

Table 3: Graduation and CAHSEE Passing Rates at First Attempt for the 7th grade cohort by Key Student Characteristics

	Fresno		Long Beach		San Francisco	
	Graduate	Pass CAHSEE	Graduate	Pass CAHSEE	Graduate	Pass CAHSEE
Overall	55%	60%	59%	69%	65%	77%
ELL in 7th grade	52%	45%	43%	45%	63%	69%
Not ELL in 7th	56%	67%	66%	78%	66%	80%
Special Ed. In 7th	31%	25%	48%	24%	45%	33%
Not Special Ed. In 7th	58%	63%	60%	72%	68%	83%
Low SES	49%	53%	54%	63%	68%	76%
Not Low SES	74%	82%	80%	91%	63%	78%
Male	50%	60%	55%	67%	61%	76%
Female	61%	61%	63%	71%	70%	78%
Retain	22%	32%	--	43%	40%	53%
Not Retained	66%	69%	59%	69%	75%	86%
Overage	41%	50%	51%	61%	41%	51%
Not Overage	57%	62%	60%	70%	68%	79%
Black	44%	43%	53%	55%	36%	41%
White	63%	80%	72%	88%	64%	84%
Hispanic	50%	53%	51%	60%	44%	57%
Pacific Islander	59%	91%	69%	79%	63%	71%
Asian	65%	68%	72%	81%	86%	94%
Amer Indian	56%	50%	20%	60%	37%	63%

Table 4: Graduation and CAHSEE Passing Rates at First Attempt for the 7th grade cohort by middle school mathematics level and course failures

	Overall	*Alg. In 8th*	*Not Alg. In 8th*	*Fs in 7th grade*			*Fs in 8th grade*		
				0	*1*	*2+*	*0*	*1*	*2+*
Fresno									
graduate	55%	54%	22%	71%	45%	24%	75%	49%	25%
pass cahsee	60%	62%	9%	74%	49%	31%	73%	53%	36%
Long Beach									
graduate	59%	81%	53%	75%	54%	37%	78%	60%	40%
pass cahsee	69%	96%	58%	84%	64%	45%	85%	68%	49%
San Francisco									
graduate	65%	82%	62%	74%	35%	23%	77%	42%	17%
pass cahsee	77%	93%	74%	83%	52%	39%	83%	57%	38%

Table 5: Graduation and CAHSEE Passing Rates at First Attempt for the 7th grade cohort by middle school standardized achievement test scores

	Overall	*CST 8th English*					*CST 8th Math*				
		Far Below Basic	*Below Basic*	*Basic*	*Proficient*	*Advanced*	*Far Below Basic*	*Below Basic*	*Basic*	*Proficient*	*Advanced*
Fresno											
graduate	55%	32%	52%	69%	83%	88%	34%	50%	73%	82%	89%
pass cahsee	60%	22%	46%	80%	96%	100%	24%	46%	86%	98%	100%
Long Beach											
graduate	59%	31%	45%	68%	81%	87%	30%	46%	69%	81%	92%
pass cahsee	69%	18%	44%	82%	97%	100%	17%	42%	86%	99%	100%
San Francisco											
graduate	65%	39%	52%	73%	85%	91%	39%	49%	74%	87%	94%
pass cahsee	77%	27%	59%	87%	99%	100%	29%	51%	92%	99%	100%

Table 6: Parameter estimates and standard errors from logistic regression models predicting diploma receipt

Graduation

	Fresno			*Long Beach*			*San Francisco*		
	Model 1	Model 2	Model 3 (school fixed effects)	Model 1	Model 2	Model 3 (school fixed effects)	Model 1	Model 2	Model 3 (school fixed effects)
GPA 7th	0.8255***	0.7771***	0.7660***	0.6088***	0.6336***	0.6216***	0.8925***	0.7030***	0.7000***
	(0.0684)	(0.0742)	(0.0776)	(0.0586)	(0.0616)	(0.0676)	(0.0699)	(0.0744)	(0.0818)
8th Grade Algebra	0.7703***	0.6959**	0.8838***	0.0279	-0.0120	0.0035	-0.0859	-0.1075	0.0417
	(0.2150)	(0.2447)	(0.2537)	(0.0923)	(0.0942)	(0.1020)	(0.1219)	(0.1259)	(0.1475)
2+ Fs in 7th	0.0652	0.1462	0.1927	-0.2150**	-0.2221**	-0.2564**	0.1760	0.1454	0.1622
	(0.1144)	(0.1184)	(0.1241)	(0.0796)	(0.0804)	(0.0875)	(0.1772)	(0.1816)	(0.1913)
2+ Fs in 8th	-1.0117***	-0.9066***	-0.9313***	-0.4966***	-0.4739***	-0.4325***	-1.0349***	-0.9457***	-0.8169***
	(0.0906)	(0.0954)	(0.0997)	(0.0729)	(0.0743)	(0.0805)	(0.1701)	(0.1747)	(0.1817)
CST 8 ELA	0.0087***	0.0073***	0.0075***	0.0054***	0.0054***	0.0053***	0.0021	0.0040**	0.0032
	(0.0011)	(0.0013)	(0.0013)	(0.0011)	(0.0012)	(0.0013)	(0.0013)	(0.0014)	(0.0017)
CST 8 Math	0.0029**	0.0025*	0.0024*	0.0060***	0.0055***	0.0043***	0.0079***	0.0042***	0.0040**
	(0.0011)	(0.0011)	(0.0012)	(0.0009)	(0.0010)	(0.0011)	(0.0011)	(0.0011)	(0.0013)
ELL 7th		0.1430	0.0994		-0.1127	-0.1227		0.1526	0.1163
		(0.0991)	(0.1037)		(0.0913)	(0.0988)		(0.1190)	(0.1295)
Special Ed 7th		0.0254	0.0098		0.5892***	0.5126***		0.2018	0.3262
		(0.1529)	(0.1580)		(0.1390)	(0.1487)		(0.1558)	(0.1714)
Low SES		-0.5518***	-0.4908***		-0.5773***	-0.5004***		0.3914***	0.3893***
		(0.1089)	(0.1158)		(0.1131)	(0.1226)		(0.0954)	(0.1053)
Black		0.3346*	0.5022**		0.4552***	0.4764***		-0.3164	-0.2895
		(0.1546)	(0.1628)		(0.1251)	(0.1407)		(0.1647)	(0.1858)
Hispanic		0.2650*	0.1982		0.2217	0.2273		-0.2776	-0.1418
		(0.1182)	(0.1230)		(0.1191)	(0.1308)		(0.1441)	(0.1677)
Pacific Islander		-0.4683	-0.4400		0.3214	0.2892		0.1895	0.1232
		(0.4939)	(0.5118)		(0.1739)	(0.1947)		(0.1866)	(0.2073)
Asian		-0.0539	-0.0282		0.5188***	0.3878*		0.6488***	0.4535**
		(0.1483)	(0.1567)		(0.1456)	(0.1588)		(0.1366)	(0.1567)
American Indian		0.6441	0.7572		-1.2351	-0.6974		-0.9103	-0.7883
		(0.4220)	(0.4385)		(0.6454)	(0.6974)		(0.4682)	(0.5478)
Male		0.0387	0.0652		0.1231	0.1392		-0.0944	-0.2467*
		(0.0765)	(0.0797)		(0.0689)	(0.0742)		(0.0946)	(0.1056)
Retained		-1.0653***	-0.8399***					-0.5711***	-0.4515***
		(0.0933)	(0.1109)					(0.1033)	(0.1172)
Over Age		-0.4379***	-0.4063***		-0.3845***	-0.4142***		-0.4923**	-0.6225***
		(0.1160)	(0.1216)		(0.0936)	(0.1005)		(0.1627)	(0.1721)
Constant	-5.6212***	-4.4456***	-5.9804***	-4.2932***	-3.9893***	-4.1311**	-4.6807***	-3.6780***	-4.4563***
	(0.3594)	(0.4868)	(1.1635)	(0.2933)	(0.4044)	(1.3956)	(0.3324)	(0.4780)	(0.9881)
Goodness of Fit Statistics									
N	4517	4517	4478	5413	5408	5221	3403	3403	3300
Chi2	1430.02	1623.51	1815.81	1295.69	1387.55	1681.08	995.55	1130.12	1339.59
Pseudo R2	0.2344	0.2661	0.3011	0.1808	0.1939	0.248	0.2397	0.2721	0.3435
BIC	4730.25	4629.33	4475.37	5930.77	5915.06	5337.21	3213.99	3168.88	2836.06

Table 7: Parameter estimates and standard errors from logistic regression models predicting passing CAHSEE on the first attempt

Passing the CAHSEE on the first attempt

	District A			***District B***			***District C***		
	Model 1	Model 2	Model 3 (school fixed effects)	Model 1	Model 2	Model 3 (school fixed effects)	Model 1	Model 2	Model 3 (school fixed effects)
GPA 7th	0.6710***	0.6743***	0.6854***	0.3797***	0.4571***	0.4728***	0.5392***	0.4767***	0.4691***
	(0.0835)	(0.0927)	(0.0944)	(0.0807)	(0.0854)	(0.0893)	(0.0941)	(0.1019)	(0.1069)
8th Grade Algebra	2.1565***	2.2104***	2.3456***	1.1895***	1.0890***	1.0617***	0.7664***	0.7701***	0.9160***
	(0.4194)	(0.4419)	(0.4607)	(0.1756)	(0.1775)	(0.1801)	(0.2127)	(0.2220)	(0.2412)
2+ Fs in 7th	-0.0052	0.0492	0.0715	-0.0644	-0.0876	-0.0592	0.0007	-0.0628	-0.1068
	(0.1390)	(0.1447)	(0.1468)	(0.1087)	(0.1100)	(0.1127)	(0.2198)	(0.2236)	(0.2314)
2+ Fs in 8th	-0.2090	-0.2129	-0.2034	-0.1723	-0.2316*	-0.2207*	0.0522	0.0790	0.0462
	(0.1121)	(0.1195)	(0.1208)	(0.1009)	(0.1031)	(0.1056)	(0.2041)	(0.2094)	(0.2159)
CST 8 ELA	0.0238***	0.0232***	0.0236***	0.0211***	0.0195***	0.0198***	0.0190***	0.0180***	0.0173***
	(0.0014)	(0.0017)	(0.0017)	(0.0016)	(0.0018)	(0.0019)	(0.0020)	(0.0022)	(0.0024)
CST 8 Math	0.0241***	0.0231***	0.0231***	0.0317***	0.0301***	0.0303***	0.0320***	0.0268***	0.0265***
	(0.0015)	(0.0016)	(0.0016)	(0.0017)	(0.0017)	(0.0017)	(0.0021)	(0.0022)	(0.0023)
ELL 7th		-0.4688***	-0.4564***		-0.2491*	-0.2055		0.0870	0.0385
		(0.1196)	(0.1222)		(0.1238)	(0.1269)		(0.1617)	(0.1697)
Special Ed 7th		0.0400	0.0792		-0.5458**	-0.6690**		-1.0626***	-1.0833***
		(0.1879)	(0.1888)		(0.2054)	(0.2142)		(0.1975)	(0.2058)
Low SES		-0.2639	-0.1496		-0.3190	-0.1881		-0.0637	-0.0505
		(0.1362)	(0.1437)		(0.1789)	(0.1846)		(0.1332)	(0.1392)
Black		-0.7049***	-0.6071**		-0.5232**	-0.3603		-0.5553*	-0.4545
		(0.1870)	(0.1937)		(0.1905)	(0.2026)		(0.2248)	(0.2388)
Hispanic		-0.3221*	-0.2519		-0.2610	-0.0748		-0.3083	-0.2269
		(0.1495)	(0.1538)		(0.1921)	(0.2000)		(0.2046)	(0.2224)
Pacific Islander		1.5953*	1.6806*		-0.4000	-0.0864		-0.0567	0.0633
		(0.6862)	(0.7034)		(0.2664)	(0.2804)		(0.2576)	(0.2717)
Asian		0.0631	0.1259		-0.1326	-0.1042		0.5600*	0.4766*
		(0.1905)	(0.1969)		(0.2288)	(0.2377)		(0.2265)	(0.2390)
American Indian		-1.0195*	-0.8958		-0.6218	-0.2942		-0.5480	-0.5528
		(0.5161)	(0.5152)		(0.8588)	(0.9062)		(0.7004)	(0.8078)
Male		0.8496***	0.8625***		0.5409***	0.5511***		0.2911*	0.3240*
		(0.0969)	(0.0981)		(0.0990)	(0.1011)		(0.1369)	(0.1432)
Retained		-0.7094***	-0.7307***		0.4903			-0.3319*	-0.4199**
		(0.1110)	(0.1150)		(1.3581)			(0.1384)	(0.1464)
Over Age		-0.3762*	-0.3503*		-0.2928*	-0.2750*		-0.4285	-0.4899*
		(0.1474)	(0.1493)		(0.1349)	(0.1389)		(0.2321)	(0.2408)
Constant	-17.2392***	-16.4211***	-16.2278***	-16.0870***	-14.8094***	-33.3913***	-15.4560***	-13.2889***	-12.9591***
	(0.7019)	(0.8139)	(1.4017)	(0.5837)	(0.7008)	(1.4818)	(0.7107)	(0.8458)	(1.5066)
Goodness of Fit Statistics									
N	4150	4150	4117	4896	4896	4837	3139	3139	3028
Chi2	2207.09	2399.86	2391.59	2807.10	2872.22	2917.10	1517.01	1597.69	1572.93
Pseudo R2	0.4014	0.4365	0.4396	0.4731	0.484	0.4971	0.4871	0.513	0.5272
BIC	3349.05	3247.92	3281.69	3186.09	3214.43	3188.54	1653.51	1661.41	1667.41

Table 8: Parameter estimates and standard errors from OLS regression models predicting student grade point averages in 11th grade

	GPA in 11th grade								
	District A			***District B***			***District C***		
	Model 1	Model 2	Model 3 (school fixed effects)	Model 1	Model 2	Model 3 (school fixed effects)	Model 1	Model 2	Model 3 (school fixed effects)
GPA 7th	0.4930***	0.4291***	0.4514***	0.3820***	0.3636***	0.3336***	0.4690***	0.2840***	0.2900***
	(0.0238)	(0.0251)	(0.0241)	(0.0208)	(0.0212)	(0.0210)	(0.0254)	(0.0254)	(0.0256)
8th Grade Algebra	-0.0182	-0.0303	-0.1274	0.0782**	0.0642*	0.0642*	0.0585	0.0586	0.0482
	(0.0745)	(0.0841)	(0.0804)	(0.0276)	(0.0273)	(0.0269)	(0.0380)	(0.0355)	(0.0358)
2+ Fs in 7th	0.2183***	0.2130***	0.2080***	-0.0337	-0.0335	-0.0319	0.1768*	0.1216	0.0797
	(0.0435)	(0.0432)	(0.0413)	(0.0309)	(0.0303)	(0.0296)	(0.0727)	(0.0677)	(0.0673)
2+ Fs in 8th	-0.2077***	-0.1556***	-0.1898***	-0.3198***	-0.2927***	-0.2697***	-0.2230**	-0.0667	-0.1754**
	(0.0356)	(0.0363)	(0.0347)	(0.0274)	(0.0269)	(0.0264)	(0.0684)	(0.0640)	(0.0643)
CST 8 ELA Scale	0.0032***	0.0024***	0.0024***	0.0023***	0.0021***	0.0021***	0.0016***	0.0017***	0.0017***
	(0.0004)	(0.0004)	(0.0004)	(0.0003)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
CST 8 Math Scale	0.0026***	0.0026***	0.0025***	0.0027***	0.0028***	0.0026***	0.0026***	0.0013***	0.0014***
	(0.0004)	(0.0004)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
ELL 7th		-0.0469	-0.0275		0.0011	-0.0228		0.0454	0.0422
		(0.0336)	(0.0324)		(0.0309)	(0.0303)		(0.0377)	(0.0374)
Special Ed 7th		-0.0102	-0.0005		0.3167***	0.2748***		0.0843	0.0849
		(0.0548)	(0.0522)		(0.0512)	(0.0501)		(0.0549)	(0.0543)
Low SES		-0.1181***	-0.1213***		-0.1117***	-0.1065***		0.0878**	0.0797**
		(0.0343)	(0.0343)		(0.0308)	(0.0301)		(0.0290)	(0.0287)
Black		-0.1044*	-0.0930		0.0600	-0.0110		-0.1349*	-0.1619**
		(0.0515)	(0.0498)		(0.0385)	(0.0390)		(0.0605)	(0.0604)
Hispanic		-0.1316***	-0.1152**		-0.0849*	-0.0874*		-0.2615***	-0.3061***
		(0.0374)	(0.0363)		(0.0360)	(0.0354)		(0.0505)	(0.0522)
Pacific Islander		-0.0135	-0.0482		0.0204	-0.0408		-0.0333	-0.0181
		(0.1398)	(0.1330)		(0.0490)	(0.0497)		(0.0636)	(0.0644)
Asian		0.0650	0.0583		0.1169**	0.0556		0.0562	0.0935*
		(0.0473)	(0.0464)		(0.0402)	(0.0404)		(0.0398)	(0.0396)
American Indian		-0.4142**	-0.3448*		-0.6436**	-0.4003		-0.1686	-0.2276
		(0.1404)	(0.1342)		(0.2398)	(0.2348)		(0.2043)	(0.2012)
Male		-0.1276***	-0.1104***		-0.1172***	-0.1218***		-0.0644*	-0.0401
		(0.0257)	(0.0245)		(0.0218)	(0.0213)		(0.0291)	(0.0288)
Retained		-0.1791***	-0.4561***		-0.5864	-0.6956		-0.7301***	-0.8003***
		(0.0343)	(0.0366)		(0.5336)	(0.5200)		(0.0381)	(0.0385)
Over Age		0.0093	-0.0311		-0.0097	-0.0064		-0.1145	-0.1245*
		(0.0395)	(0.0377)		(0.0319)	(0.0310)		(0.0597)	(0.0587)
Constant	-0.7834***	-0.0772	0.0249	-0.2599**	-0.0655	0.1422	-0.2468*	0.9149***	0.8762***
	(0.1145)	(0.1587)	(0.1535)	(0.0930)	(0.1233)	(0.1226)	(0.1103)	(0.1521)	(0.1650)
Goodness of Fit Statistics									
N	3978.0000	3978.0000	3978.0000	2713	2713	2713	2877	2877	2877
Pseudo R2	0.3661	0.3834	0.3979	0.566	0.5885	0.5175	0.3473	0.4396	0.3854
BIC	9399.6717	9380.4612	8960.4703	4456.62	4399.18	4251.79	6997.97	6647.06	6516.02

Figure 1: Probability of Graduation by 7th grade GPA

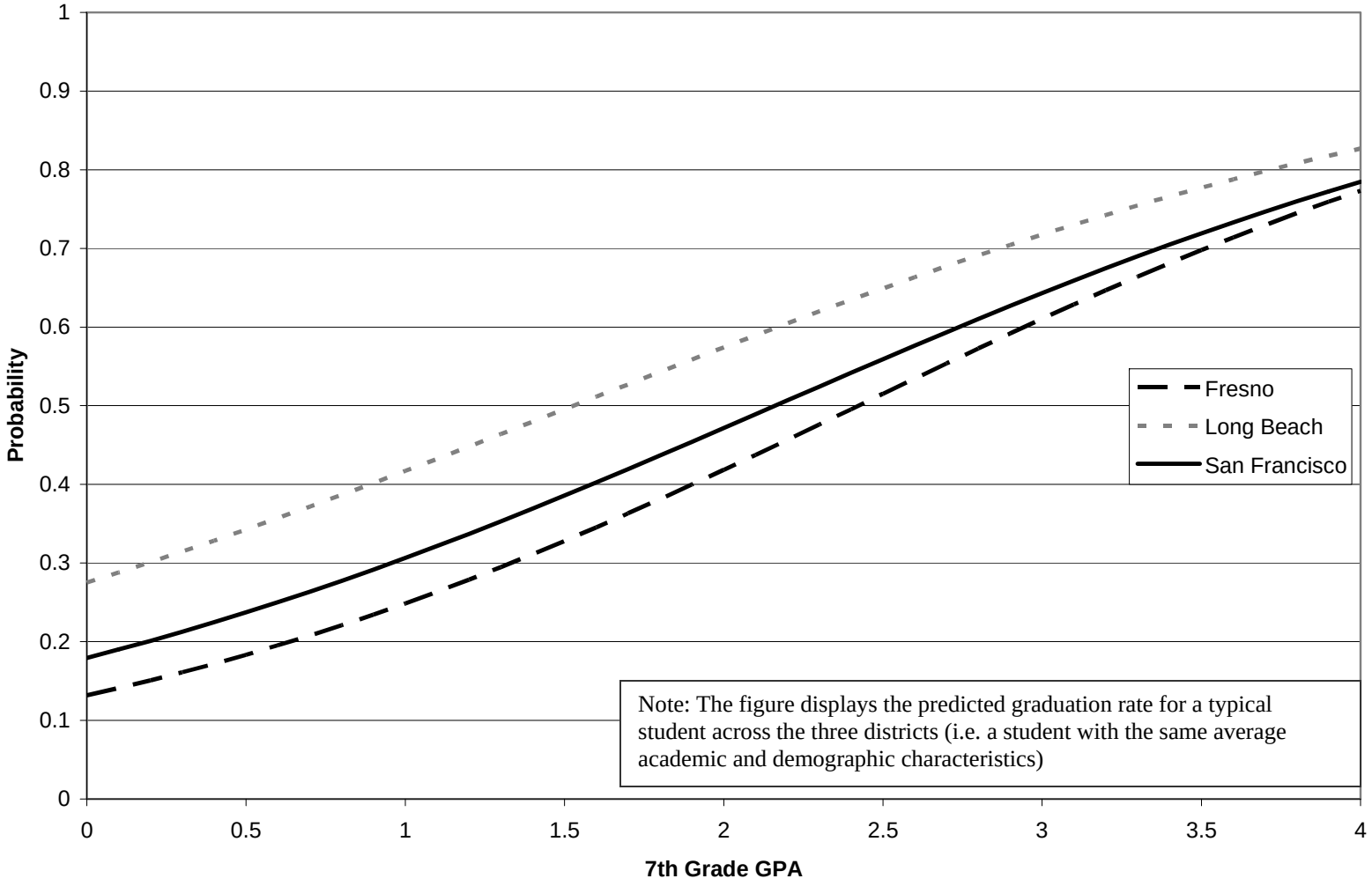


Figure 2: Probability of Passing Both Sections of the CAHSEE on the First Attempt by 8th Grade English Language Arts CST Score

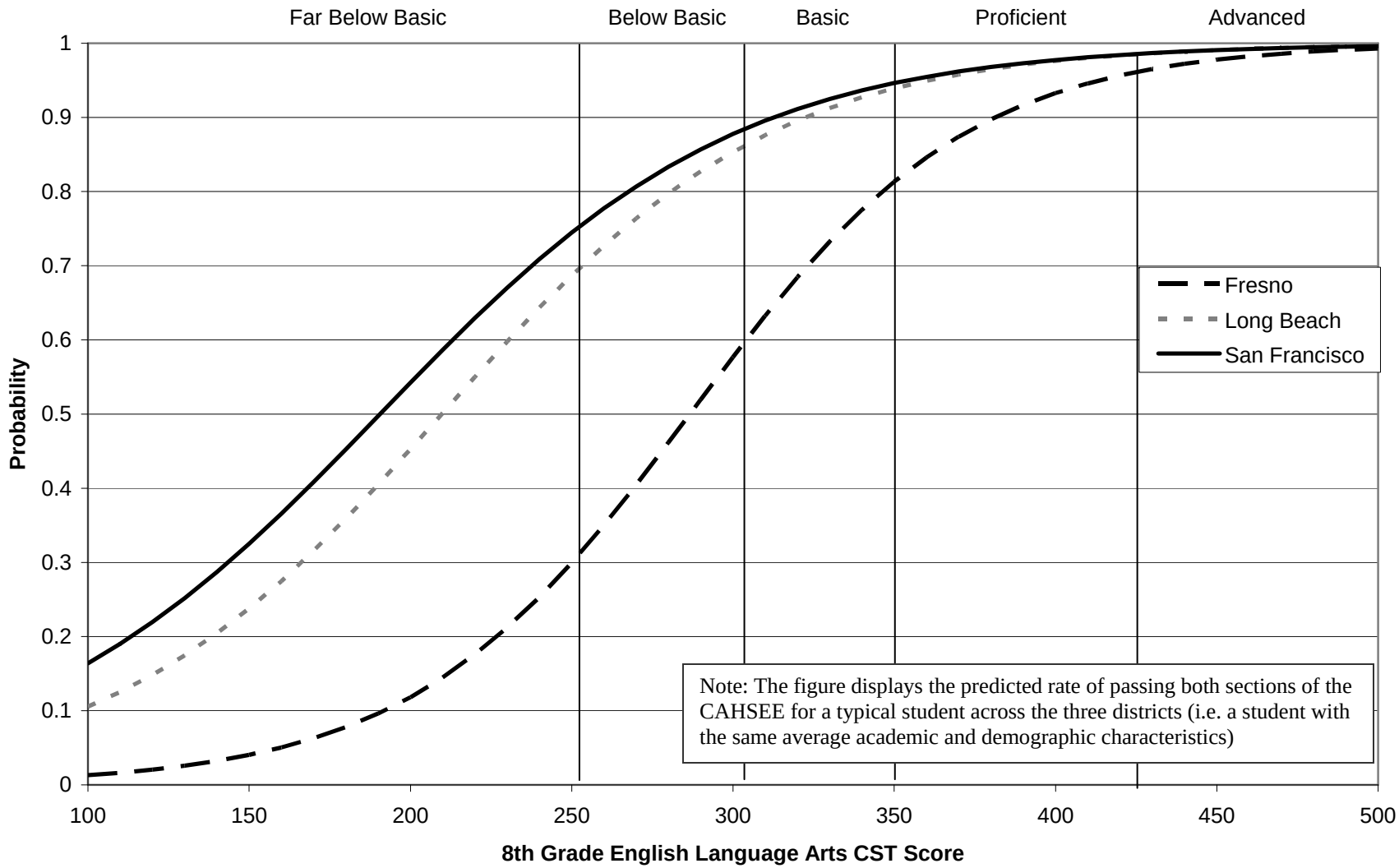
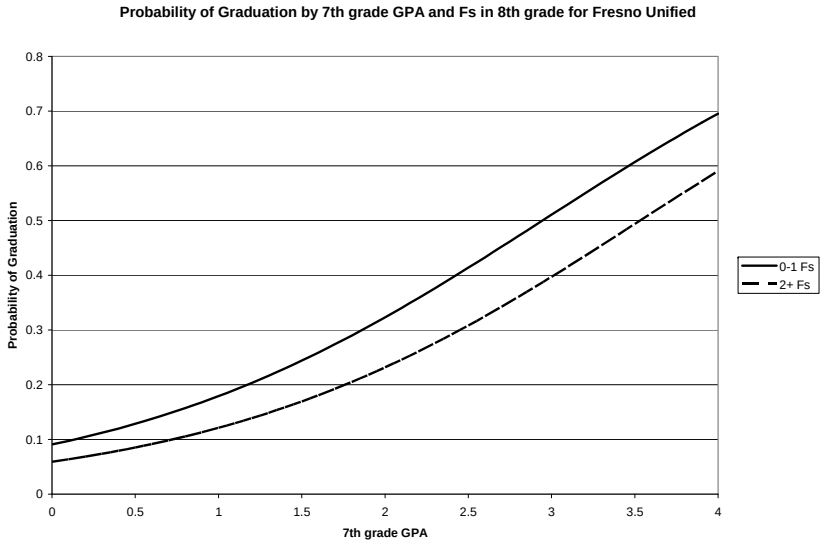
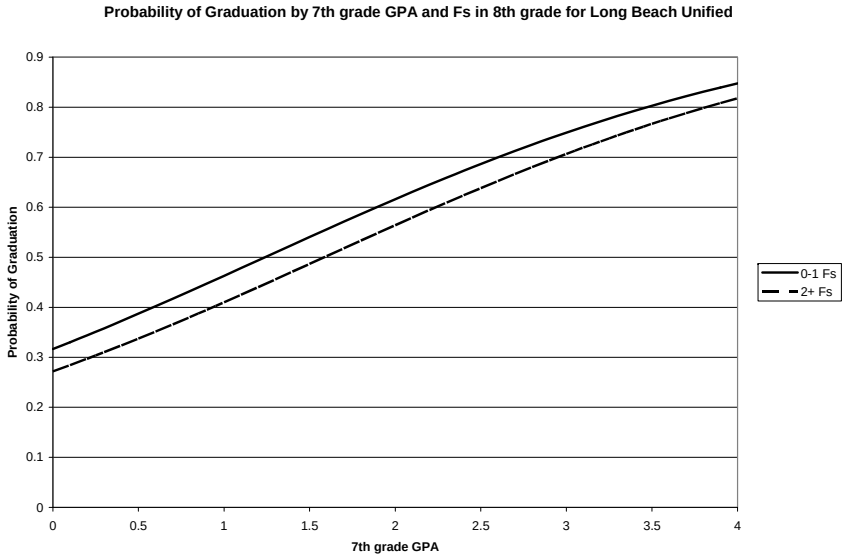
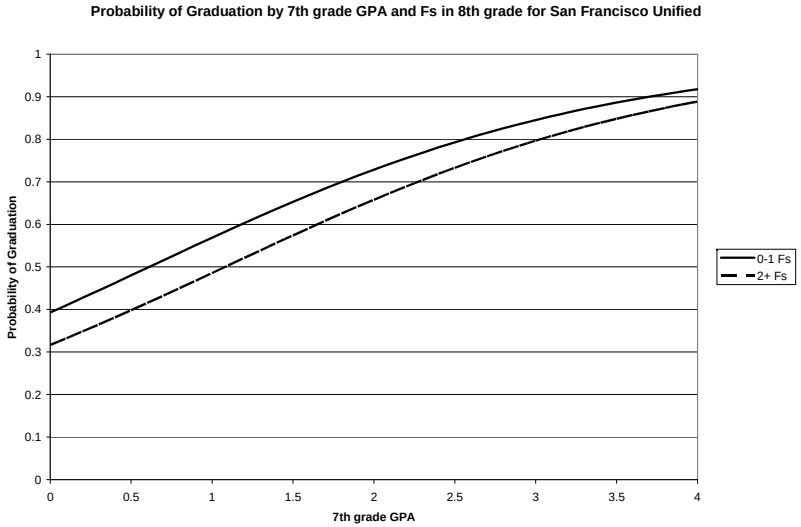


Figure 3:







Note: The figures display the predicted graduation rate for a typical student in each of the respective three districts (i.e. a student with the average academic and demographic characteristics specific to the district)

Figure 4

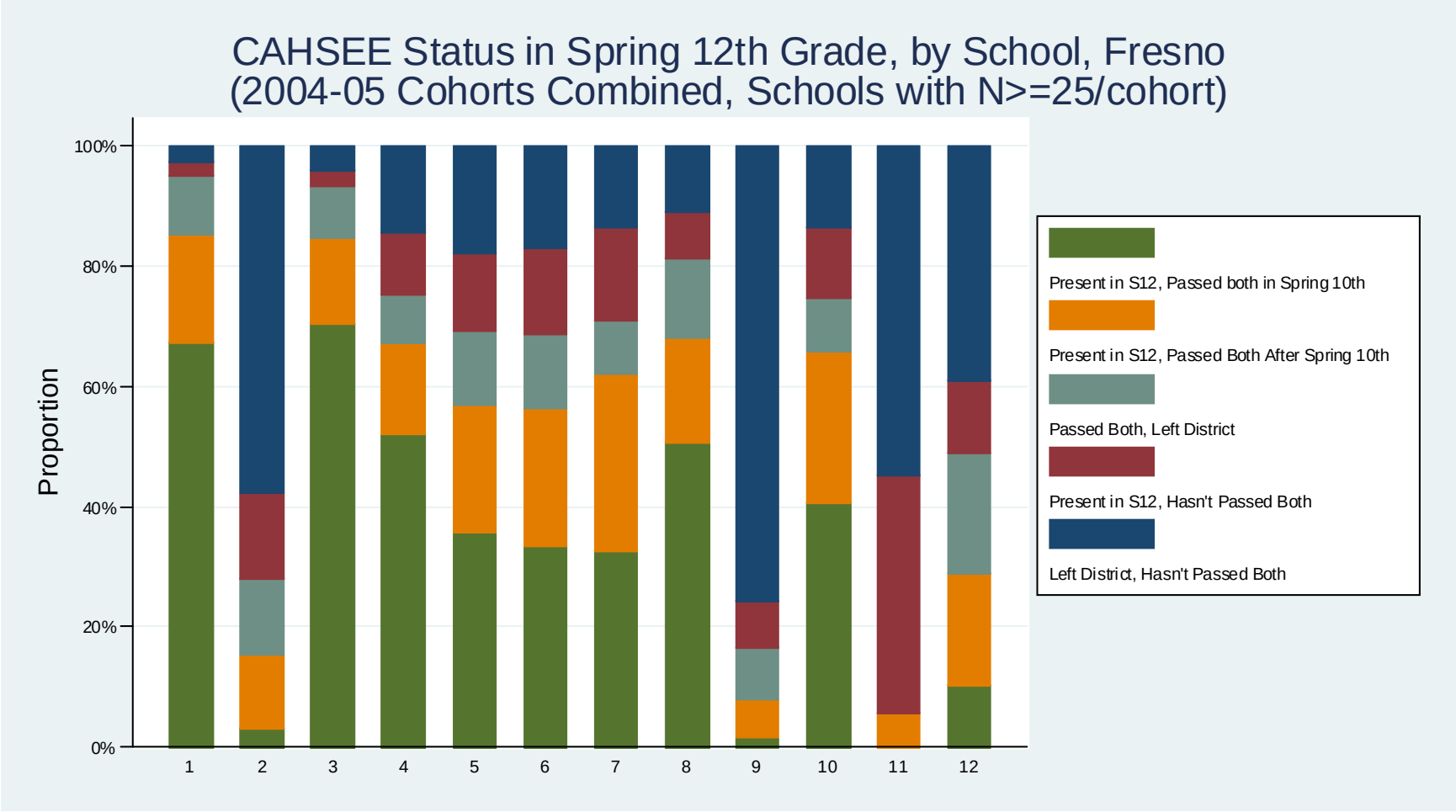

CAHSEE Status in Spring 12th Grade, by School, Fresno
(2004-05 Cohorts Combined, Schools with N>=25/cohort)
Proportion
100%
80%
60%
40%
20%
0%
1
2
3
4
5
6
7
8
9
10
11
12
Present in S12, Passed both in Spring 10th
Present in S12, Passed Both After Spring 10th
Passed Both, Left District
Present in S12, Hasn't Passed Both
Left District, Hasn't Passed Both

Figure 5

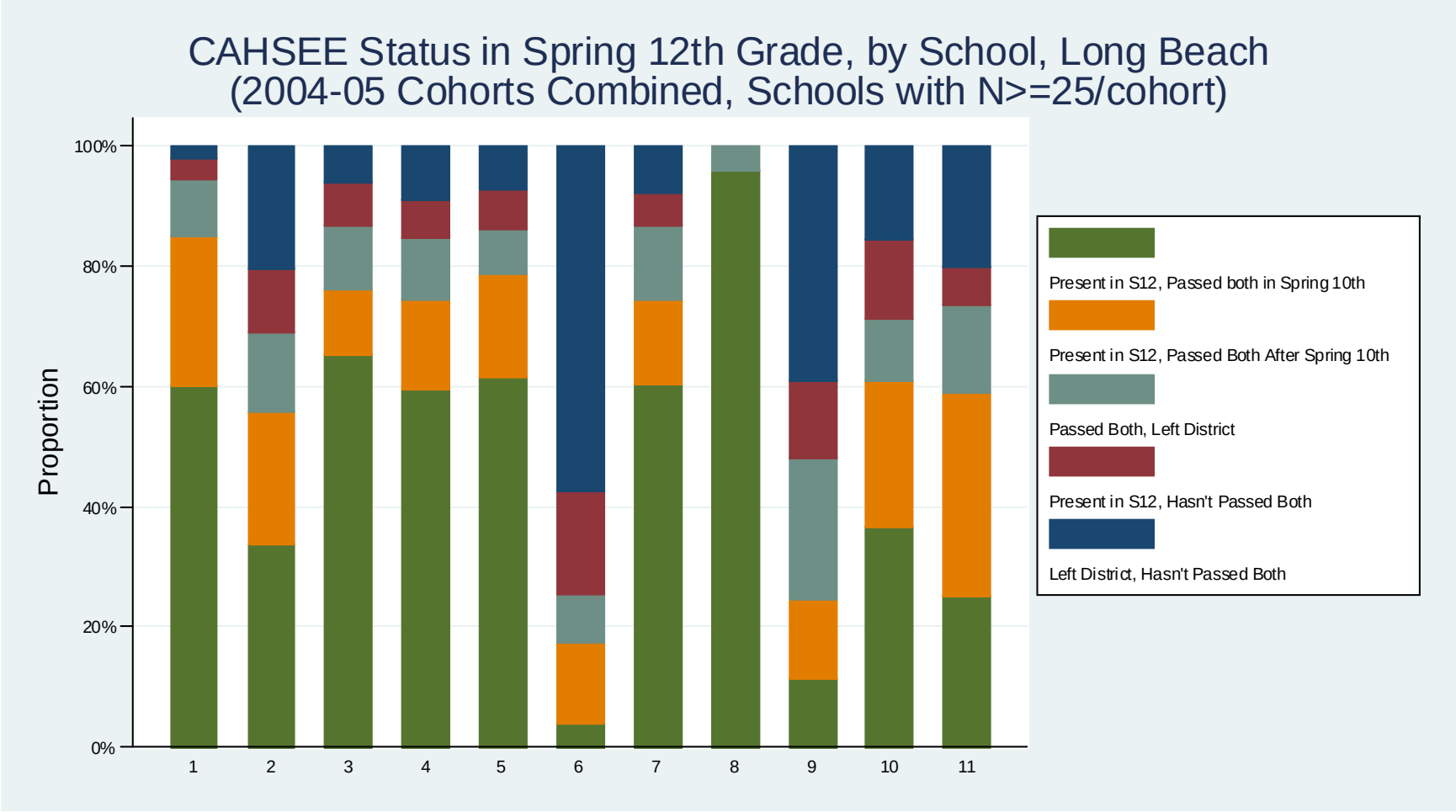
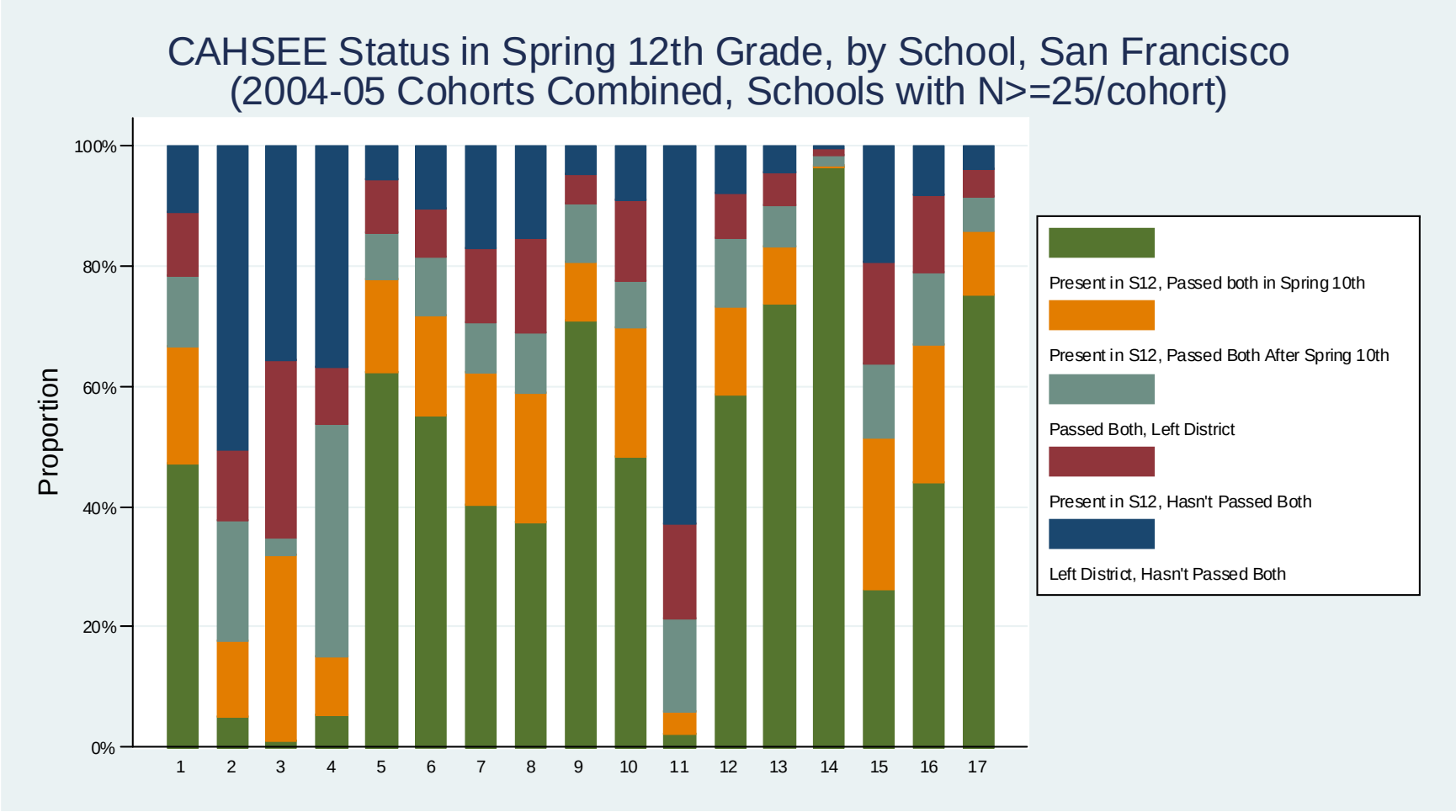

CAHSEE Status in Spring 12th Grade, by School, Long Beach
(2004-05 Cohorts Combined, Schools with N>=25/cohort)
Proportion
100%
80%
60%
40%
20%
0%
1
2
3
4
5
6
7
8
9
10
11
Present in S12, Passed both in Spring 10th
Present in S12, Passed Both After Spring 10th
Passed Both, Left District
Present in S12, Hasn't Passed Both
Left District, Hasn't Passed Both

Figure 6


CAHSEE Status in Spring 12th Grade, by School, San Francisco
(2004-05 Cohorts Combined, Schools with N>=25/cohort)
Proportion
100%
80%
60%
40%
20%
0%
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Present in S12, Passed both in Spring 10th
Present in S12, Passed Both After Spring 10th
Passed Both, Left District
Present in S12, Hasn't Passed Both
Left District, Hasn't Passed Both

DATA APPENDIX

Table A1: Mean Comparisons between our analytic sample of the 7th grade cohort and Districts' overall 9th grade cohorts

Fresno		
Outcome Variables		
Variable	Mean 7th grade	Mean 9th grade
graduate	0.55	0.44
pass_cahsee	0.60	0.54
gpa11	2.39	2.28
Control Variables		
Variable	Mean 7th grade	Mean 9th grade
ell7	0.32	0.27
sped7	0.10	0.27
low_ses	0.77	0.78
black	0.11	0.11
white	0.20	0.19
hispanic	0.48	0.52
pac_island	0.01	0.01
asian	0.19	0.17
amer_indian	0.01	0.01
male	0.51	0.50
retain	0.24	0.22
overage	0.13	0.31

Long Beach		
Outcome Variables		
Variable	Mean	Mean
	7th grade	9th grade
graduate	0.66	0.66
pass cahsee	0.69	0.66
gpa11	2.33	2.36
Control Variables		
Variable	Mean	Mean
	7th grade	9th grade
ell7	0.30	0.24
sped7	0.07	0.25
low_ses	0.81	0.77
black	0.19	0.20
white	0.19	0.19
hispanic	0.43	0.42
pac_island	0.05	0.06
asian	0.13	0.12
amer_indian	0.00	0.00
male	0.52	0.52
retain	0.00	0.00
overage	0.13	0.07

San Francisco		
Outcome Variables		
Variable	Mean	Mean
	7th grade	*9th*
graduate	0.65	0.65
pass_cahsee	0.77	0.76
gpa11	2.53	2.56
Control Variables		
Variable	Mean	Mean
	7th grade	*9th*
ell7	0.27	0.22
sped7	0.13	0.09
low_ses	0.43	0.41
black	0.15	0.13
white	0.10	0.09
hispanic	0.20	0.20
pac_island	0.07	0.08
asian	0.39	0.39
amer_indian	0.01	0.01
male	0.52	0.53
retain	0.28	0.25
overage	0.10	0.19

Table A2: Percent of remaining students on track to graduate by 12th grade (2005-06) in our middle school sample still present in 9th grade, and in the full 9th grade cohort.

Analytic Sample: 7th Grade Cohort that is in district at 9th grade

		9th (02-03)	10th (03-04)	11th (04-05)	12th (05-06)
Fresno	%	100%	94%	88%	75%
	N	(5175)	(4875)	(4359)	(3872)
Long Beach	%	100%	93%	85%	76%
	N	(6339)	(5880)	(5419)	(4790)
San Francisco	%	100%	96%	90%	80%
	N	(3856)	(3685)	(3454)	(3088)

Full 9th Grade Cohort

		9th (02-03)	10th (03-04)	11th (04-05)	12th (05-06)
Fresno	%	100%	88%	78%	61%
	N	(7103)	(6219)	(5512)	(4337)
Long Beach	%	100%	93%	86%	76%
	N	(7264)	(6791)	(6236)	(5525)
San Francisco	%	100%	93%	85%	76%
	N	(5020)	(4658)	(4283)	(3816)

Note: "on track to graduate" is defined simply as present in the district in each subsequent year, regardless of CAHSEE passing, grade retention, or credit accumulation.

Table A3: Variable Construction Information

Variable Name	*Variable Description*
Graduate	A binary variable provided by the two of the districts. 1 = graduated in 2004-2005 or 2005-2006, 0 = student did not graduate from the district by 2005-2006
Pass CAHSEE	A binary variable calculated using district CAHSEE passing data. 1 = passed both sections of the CAHSEE on the first attempt, 0 = did not pass one or both sections of the CAHSEE on the first attempt
GPA 11	Aggregate GPA of a student in 2004-2005, or 11th grade for on-time students
GPA 7th	Aggregate GPA of a student in 2000-2001, or 7th grade
8th Grade Algebra	A binary variable created using the course history of the student. A course was classified as an algebra course if "Algebra" was included in the course title. One-year and two-year algebra sequences could not be separated. 1 = took algebra in 2001-2002, or 8th grade for on-time students, 0 = did not take an algebra course in 2001-2002
2+ Fs 7th	A binary variable created using the course history of the student that measures the number of core courses failed in the 7th grade school year. Core courses included langauge arts/reading, science, social science, and mathematics, and were identified by course titles. 0 = zero or one F, 1 = two or more Fs
2+ Fs 8th	A binary variable created using the course history of the student that measures the number of core courses failed in the 8th grade school year (2001-2002). Core courses included langauge arts/reading, science, social science, and mathematics, and were identified by course titles. 0 = zero or one F, 1 = two or more Fs
CST 8 ELA	The scale score of the student on an english CST test in the 2001-2002 school year, or likely 8th grade, provided by the district.
CST 8 Math	The scale score of the student on an mathematics CST test in the 2001-2002 school year, or likely 8th grade, provided by the district.
ELL 7th	A binary variable indicating whether a student is designated as an English language learner in 7th grade (2000-2001 school year) 1 = was designated ELL in 7th grade, 0 = was not designated ELL in 7th grade
Special Ed. 7th	A binary variable indicating whether a student received special education services in 7th grade (2001-2002). 1 = received special education services in 7th grade, 0 = did not receive special education services in 7th grade
Low SES	A binary variable indicating whether a student was designated as a low socioeconomic status student. In District A and C, the student was classified by the district as economically disadvantaged. In District B, student received free/reduced lunch or both parents had did not have a high school degree. 1 = classified as low socioeconomic status, 0 = not classified as low socioeconomic status
Black	A binary variable indicating whether or not a student is African-American. 1 = African-American, 0 = not African American
White	A binary variable indicating whether or not a student is white. 1 = white, 0 = not white
Hispanic	A binary variable indicating whether or not a student is Hispanic. 1 = Hispanic, 0 = not Hispanic
Pacific Islander	A binary variable indicating whether or not a student is a Pacific Islander. 1 = Pacific Islander, 0 = not Pacific Islander
Asian	A binary variable indicating whether or not a student is African-American. 1 = Asian, 0 = not Asian
American Indian	A binary variable indicating whether or not a student is Native American. 1 = Native American, 0 = not Native American
Male	A binary variable indicating whether or not a student is male. 1 = male 0 = female
Retained	A binary variable created using the grade level for each student from each year which indicates whether or not a student was retained in this dataset (after 7th grade). 1 = retained in the dataset, 0 = not retained in the dataset (on time to graduate in 2005-2006)
Over Age	A binary variable created using student listed birthdays indicating whether or not a student was born before the date of December 2, 1987, the cut-off date that on-time 7th grade students were born after. 1 = student is overage, 0 = student is not overage

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