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Determinants of School Performance in the San Diego Unified School District

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The Public Schools Accountability Act of 1999 was the outcome of SB 1 sponsored by Dede Alpert and signed into law by Governor Gray Davis in March of 1999. This law mandates the ranking of all California public schools based on their Academic Performance Index (API). The law also establishes annual growth targets for each school. Schools that meet their growth targets will be eligible for financial incentives; schools that do not meet their growth targets could be identified as underperforming and as such be targeted for intervention.

1999 is the base year for the API, which is constructed solely from the results of the state-mandated Stanford 9 achievement test which was administered to all schools in California in the Spring of 1999.[2] While the legislation requires that other information be incorporated into the API such as graduation and attendance rates, the state currently does not have systems in place to collect this information accurately. However, it should also be noted that even with the addition of these additional factors, the law mandates that at least 60 percent of the API will be comprised of test results. This legislation offers an unprecedented opportunity to look more closely at school performance – albeit on a single and limited measure – because for the first time, a variety of measures are standardized and centralized into a single data set that can be downloaded from the California Department of Education web site.

Schools are ranked based on their API in two ways. First, all schools are ranked statewide solely on the basis of their API and then divided into decile groupings and assigned a number on that basis. Second, schools are ranked within groupings of schools that share similar characteristics on the following measures which are measured on the school level by percentages: pupil mobility, the racial breakdown of the school's population, the socioeconomic status of the school's population (measured by eligibility for reduced or free lunch), teachers' credentials (fully-credentialed or emergency credentialed), the number of English learners at the school, the average class size by grade level, and whether or not the school has a multi-track year-round program. These characteristics were compiled

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[2] The SAT 9 is a norm-referenced achievement test produced by Harcourt Brace which has been administered statewide in California beginning in the Spring of 1998.

into an index for each school that allowed comparison groups to be created for each school that then formed the basis for a decile ranking.

Given the information now available, it is possible to do a more sophisticated analysis using linear regression models with the API as the dependent variable. This technique provides us with a number of advantages over the two rankings described above. First, it provides a summary measure of how much variance in the API can be explained based on the characteristics contained in the similar schools index (the R-square statistic). Second, by using nested regression equations, we can assess how much more variance is explained in the entire model by incrementally adding factors of interest and using an F-test to assess the significance of the difference in the R-squares between models. Finally, we can look at the residuals (or the difference between a school's actual score and the its predicted score) to assess the relative effectiveness of individual schools. This last measure gives us a more precise indicator of a school's success on the SAT 9 test net of the factors that affect a school's success that are in a sense beyond the control of the individual school given the long and deep patterns of residential segregation by race and class that have shaped school populations. For the purposes of this discussion, I will focus on the first two, leaving aside the question of the effectiveness of individual schools.

The sample for this analysis is all elementary schools in the San Diego Unified School District with complete information on all variables. This sample was drawn from the full sample of schools in the state by selecting all schools classified as elementary schools in the San Diego Unified School District in the data made available on January 24, 2000 through the California Department of Education web site.[3] Of this original sample of 120, four cases were excluded because of missing information on some of the variables in the analysis for a total sample of 116. As noted above, the dependent variable in the analysis is the state-constructed school API index which combined individual student scores (based on their national percentage rank or NPR) in each subject area into a single number (California Department of Education Office of Policy and Evaluation 2000: 9). For elementary school scores, subject areas were weighted in the following manner: mathematics 40%, reading 30%, language 15% and spelling 15%.

The independent variables are measured at the school level: percent of students eligible for reduced or free lunch; mobility (the percent of students who first attended the school within the current school year who were also students within the district the previous year); the percent of students school-wide reported as English learners; and the racial breakdown of the student body of the entire school (percentage of students in each of seven categories: white, African American, Asian, Filipino Hispanic, and Pacific Islanders); the percentage of teachers that are fully credentialed, percentage of teachers with emergency credentials; and a series of variables denoting the parents' education (the highest educational level of the parent as measured by percentage of parents within the tested population who have reached a particular educational transition). In addition, two class size variables were included in the initial analysis (average class size of grades kindergarten through third grade and average class size of grades four through six) because these variables were included in the similar schools index constructed by the

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[3] The data currently available exclude schools that had fewer than 100 students or were non-traditional schools of various types.

state; however they were dropped from the models presented here because they had little effect on the model.[4] The state-constructed index also contained a variable for whether or not the school runs year-round multi-track educational programs which was also omitted here because only two schools in the San Diego Unified School District were operating on this basis. It should be also noted that the variables for parental education were not included in the state-constructed similar schools index, however this variable is included in the present analysis as it has long been a staple in sociological analyses of educational and occupational attainment. Table 1 presents descriptive statistics for all variables and Table 2 presents bivariate correlations.

Table 1: Descriptive Statistics for All Variables

Variable (N=116)	Mean (Standard Deviation)
API score	651.37 (124.39)
Percent of Students Receiving Reduced/Free Lunch	56.45 (24.03)
Mobility	17.79 (10.65)
Percent English Language Learner	29.71 (21.94)
Percent Fully-Credentialed	92.88 (12.31)
Parent Education Variables	
Percent without High School Diploma	19.80 (19.00)
Percent High School Graduates	33.80 (15.03)
Percent with Some College Education	20.27 (9.08)
Percent College Graduates	18.38 (13.11)
Percent with Graduate Education	7.80 (9.14)
School Racial Demographics	
Percent African American	16.99 (14.94)
Percent American Indian	0.59 (0.72)
Percent Asian	7.73 (7.25)
Percent Filipino	6.42 (12.48)
Percent Hispanic	37.45 (22.44)
Percent Pacific Islander	0.94 (0.94)
Percent White	29.67 (21.52)

Insert Table 2: Bivariate Correlations for All Variables here

[4] Not only were the coefficients for the individual variables not statistically significant, but inclusion of these two variables had minimal impact on the entire model (a slight increase in R-square of 0.2%).

The base model in the analysis is comprised of three variables: percentage of students participating in the reduced or free-lunch program, and percentage of English learners in the school, mobility.[5] A second model added the variable measuring teacher credentials. A third model added the series of variables measuring the parents' educational level. A final model added the variables measuring the racial composition of the school's population. The same sample of cases was used across models, thus the significance of the difference in R-squares of each model to the prior model can be assessed using the F-statistic.

Insert Table 3: Nested Regression Models Using School API Scores as the Dependent Variable here

What is notable from the nested regression analysis is that only a few of the variables in the collection of variables used to derive the similar schools index drive the entire model: percent of students eligible for reduced or free lunch; mobility, percent English learners (see Model 1). These three variables together explain 80.6% of the variance in the API index at the district level. That is to say that these three factors explain approximately 80% of the difference between school scores within the San Diego Unified School district (something we can readily intuit by the much cruder method of comparing the scores of a school in a more affluent section of the school district with a school "south of 8"). Moreover, the negative direction of the individual coefficients is not surprising. For every one percent increase in the number of students receiving reduced or free lunch, the number of English learners, and the number of new students at a school, a school's API index *decreases* by 2.21, 3.21, and 1.58 respectively. Model 2 adds the variable for the percent of teachers at the school that are fully-credentialed, which decreases each of the three original coefficients slightly. In this case, however, the direction of the coefficient is positive. *Thus for every one percent increase in the number of credentialed teachers at a school, a school's API index increases by 1.59.* It is also notable that the coefficient is statistically significant. Similarly, comparing the R-square statistic between Model 1 and Model 2 shows us that adding teacher's credentials explained an additional 2.1% of the variance in API scores (see Model 2), a difference which is statistically significant. Both of these tests indicate that this variable adds to the overall model. In the case of both Models 1 and Model 2, it should also be noted that these variables serve as only rough indicators of the factors of interest. For example, we might expect to see stronger effects if we were to have more precise measures of student income or a teachers' training and/or years of experience at the school level.

In the final two models, a series of variables measuring parent education (Model 3) and the racial composition of the schools' population were added to the model (Model 4).[6] In each case, the effect of

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[5] In the initial analyses, a variable measuring the percent of the students participating in the testing was added to the initial models to control for the possibility that schools who have fewer students participating in the testing program have higher API scores because parents who expect their children to perform poorly on the test – and therefore lower a school's overall API score – are opting out of the test through the waiver process. This variable likewise was not statistically significant and therefore dropped from the final series of analyses presented here.

[6] Because each set of variables are a group of percentages that sum to (approximately) 100%, they are treated as a series of dummy variables whereby a comparison case from each group is omitted. In these models, the percentage of parents at a school without a high school diploma and the percentage of students who are white are omitted, respectively.

each group of variables was statistically significant for the model as a whole. However, given the strong correlations between the variables for racial composition and the factors of interest (see Table 2; for example, the correlation between Percent English Learner and Percent Hispanic is .88 which suggests they are measuring approximately the same thing) and the relatively small number of cases in the sample, while the addition of this final set of variables adds to the overall model, it also obscures the relationships between the main variables of interest (such as school socioeconomic status as measured by percentage of students receiving reduced or free lunch) and a school's API score. Thus Model 3 is the best model for assessing the effect of the individual variables in the model (see Appendix for a more detailed discussion of this point). It should also be noted that the effect of the variable measuring teacher credentials stays fairly consistent across Models 2 and 3.

There are two main conclusions that can be drawn from this exercise. First, the API as it is currently configured is largely driven by three factors that are beyond the school's control – the socioeconomic status of the student population, pupil mobility, and the number of English learners at the school. Thus, the API should be used with care as a instrument for public policy. Second, teacher quality (as measured crudely here by percentage of teachers that are fully credentialed in a school) does make a difference on a school's API score – which is an aggregation of the performance of individual students. This provides indirect evidence that increasing teacher quality at a school will have a strong effect on student achievement. However, the negative and statistically significant bivariate correlations (see the column for PCT_CRED in Table 2) also indicate that credentialed teachers also tend to be concentrated in schools with lower percentages of students receiving reduced or free lunch, schools with more stable school populations, and lower concentrations of English learners (-.26, -.22 and -.33 respectively) all of which are strongly associated with the racial demographics of the school's population. We see the opposite effect with the variable measuring the percentage of teachers in a school that hold emergency credentials (see the column for PCT_EMER in Table 2).[7] This final point is important because taken together, this information tells us that in general, *the schools in most need of high quality teachers are not only lacking, but would benefit from this resource*.

Appendix: Explaining the Impact of Race in Model 4

The strong effect of the series of race variables in Model 4 is disquieting, because it can very easily lead to the facile conclusion drawn by some critics over the years (most recently Richard Herrnstein and Charles Murray in *The Bell Curve*) that there is some inherent difference between racial groups that causes observed differences in various types of test scores. In recent years however, more careful analysts have shed some light on this debate, and their findings can provide some possible explanations for the results obtained here. More specifically it is possible that in these models race serves as a proxy for unmeasured environmental effects, many of which are linked to socioeconomic status. It should be noted that socioeconomic status is very crudely measured in these models as whether or not students qualify for reduced or free lunch. This information is then taken to a further level of abstraction because it is aggregated and reported as a percentage at the school level. Various studies examining the factors

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[7] This variable was not included in the model because it is so strongly associated with percent fully-credentialed teachers, but the comparison is instructive here.

that influence individual level phenomena (for example the factors that influence individuals' educational and occupational attainment) have shown that even at similar income levels – which even if measured by a series of broad categories provide far more detail than this particular variable – there are systematic differences between blacks and whites on other variables such as wealth and probability of living in a high poverty environment. Once these factors are included in a model and therefore taken into account or "controlled," the effect of race on test scores or the effect of test scores on various types of social outcomes is greatly reduced (see the analyses and review in Phillips, Brooks-Gunn, Duncan, Klebanov, and Crane 1998; see also Fischer, Hout, Sanchez Jankowski, Lucas, Swidler and Voss 1996). Thus, it is highly likely that the variable for socioeconomic status included in the models in this analysis does not capture the range of experience and opportunities within this group (students who qualify for reduced or free lunch) which may also vary by race. Given that these variables are not currently available for this analysis,[8] Model 3 provides the clearest picture of the factors that shape the API.

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[8] At least in the dataset as currently provided by the California Department of Education. I am currently investigating the possibility of matching the data in these files with information from other sources. However, I am at the very earliest stages of this process.