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College Acceleration for All? Mapping Racial/Ethnic Gaps in Advanced Placement and Dual Enrollment Participation

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Abstract

This paper estimates the patterns and sources of White-Black and White-Hispanic enrollment gaps in Advancement Placement (AP) and dual enrollment (DE) programs across several thousand school districts and metropolitan areas in the U.S. By merging several data sources, we show that both AP and DE enrollment gaps vary substantially across districts. We find that the vast majority of districts have racial/ethnic gaps in AP and DE participation, and about a quarter of districts have racial/ethnic gaps equal to or larger than 10 and 7 percentage points for AP and DE, respectively. Available district-level characteristics and state-level policies explain much more of the geographic variation in AP enrollment gaps as compared to DE enrollment gaps, and local factors (either district-level or metro-level characteristics) dominate state-level factors in shaping these racial/ethnic participation gaps. Among all the available district-level characteristics, racial/ethnic composition and racial/ethnic income disparity are the strongest correlates of participation gaps, where districts with larger proportions of Black and Hispanic students and greater racial/ethnic income disparity are associated with larger racial/ethnic gaps in both AP and DE enrollment.

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1. Introduction

Advancement Placement (AP) and dual enrollment (DE) are the two most popular programs that allow students to earn college credits while in high school (College Board, 2017). In the 2015-16 school year, for example, 71 percent of high schools offered at least one AP course and 69 percent offered DE opportunities (U.S. Government Accountability Office [GAO], 2018). Both are fast growing. For example, the number of DE participants grew from 680,000 in the 2002-03 school year to 1.4 million in 2010-11 (the most recent national count of DE participants), and the number of AP examinees doubled from 1 to 2 million in the same timeframe (College Board, 2017; see Appendix Figure A1). Researchers have identified several advantages associated with these college acceleration strategies, including increasing students' competitive edge in the college application process, reducing the costs and time it takes to receive a postsecondary degree, and better preparing students for college coursework and therefore easing students' transition from high school to college (e.g., An & Taylor, 2019; Hertberg-Davis, Callahan, & Kyburg, 2006; Klopfenstein & Thomas, 2009; U.S. Department of Education, 2017).

Despite the myriad of benefits AP and DE programs presumably offer, and the fast growth of these programs nationwide, a number of reports identify noticeable racial/ethnic disparities in students' participation in these programs (e.g., ExcelinEd, 2018; GAO, 2018; Theokas & Saaris, 2013). However, little is known about how racial/ethnic gaps are distributed geographically and what factors may mitigate or exacerbate these disparities. These racial/ethnic gaps could vary depending on a number of economic, demographic, and policy variables. Understanding factors that contribute to, or mitigate, racial/ethnic gaps in students' AP and DE participation could suggest policies that can be potentially implemented at scale to reduce these gaps.

Using a newly available national census of AP and DE participation among U.S. high school students in the 2015-16 school year, this study provides a detailed descriptive analysis of the patterns of White-Black and White-Hispanic enrollment gaps in AP and DE programs within every school district and metropolitan area in the U.S. that has a

significant population of Black or Hispanic students.[1] We begin by describing the geographic patterns of racial/ethnic gaps in AP and DE enrollment among school districts and metropolitan areas. Mapping the patterns of AP and DE participation and racial/ethnic gaps geographically provides a rich portrait of how communities across the country have developed these college acceleration opportunities with varying success at providing equal access. We then explicitly examine the extent to which these gaps are correlated with three main categories of factors, including students' neighborhood environments (such as residential segregation), schooling experiences and opportunities (such as average resources and student characteristics in a district), and state-level policies (such as state subsidies for AP testing fees or for DE tuition and fees) that may either exacerbate or ameliorate the racial/ethnic gaps in AP and DE participation.

Our results reveal substantial differences by geography in AP and DE participation. Whereas AP participation appears to be overrepresented in more coastal and urban areas, DE participation is more concentrated in areas in the middle of the country that have more rural areas. Beyond the geographic differences between AP and DE participation overall, both programs have wide variation in racial/ethnic participation gaps between White students and their Black and Hispanic peers across districts and metro areas. Although we observe some metro areas and districts with relatively small gaps in AP and DE participation, we find racial/ethnic gaps in the majority of districts and metro areas, and more specifically we find that about a quarter of districts have racial/ethnic gaps equal to or larger than 10 and 7 percentage points for AP and DE, respectively.

Using a multilevel multivariate regression model where districts are clustered within states, we further find that local factors (either district-level or metro-level characteristics) dominate state-level factors in shaping these racial/ethnic gaps. Depending on the outcome measure, between-state differences account for only 5 percent to 9 percent of racial/ethnic gaps in AP and DE participation. Local-level variables explain a substantial proportion of variation in AP enrollment and racial/ethnic gaps, but only a small proportion of variation in DE participation and racial/ethnic participation

[1] This study primarily draws on data from the 2015-16 Civil Rights Data Collection (CRDC), which is publicly available from the U.S. Department of Education, Office for Civil Rights. Following terminology and conventions from the CRDC, this paper refers to racial/ethnic subgroups of students as "Black," "Hispanic," and "White."

disparity, perhaps due to the heterogeneous nature of DE programs that vary substantially in course content (such as technical versus academic courses), delivery format (online versus face-to-face), and location (delivered at high school versus at colleges). We also find that income disparity (as measured by free lunch rate status) between White students and their Black or Hispanic peers is a consistent and robust predictor of racial/ethnic gaps in both AP and DE enrollment, suggesting that gaps in access to AP and DE programming are stratified both in terms of race/ethnicity and income. Most strikingly, we find that local factors that are associated with higher overall AP and DE participation, such as greater number of AP courses offered and higher average achievement level, also tend to predict wider racial/ethnic gaps in program participation, implying that minoritized[2] students may be less likely to enroll in AP and DE programs than White students especially within districts with substantial program offerings. These results suggest that greater access to college acceleration opportunities generally (e.g., for all students) may give rise to wider racial/ethnic gaps in program participation without intentional efforts to provide more equitable access and support for minoritized students to benefit from these college acceleration programs. Lastly, among the state-level variables, districts in states with strong accountability measures and mandates for access to AP or DE programs are associated with significantly higher AP or DE overall enrollment rates than states without or with weak accountability. Yet, associations between state policies and racial/ethnic gaps in AP or DE participation are less strong and more unclear.

[2] Following the work of other scholars (e.g., Benitez, 2010; Stewart, 2013), we use the term "minoritized" instead of "minority" to call attention to the fact that even in communities where Black and Hispanic students outnumber their White peers, these students still experience race and racism. The term "minoritized" better acknowledges the socially constructed processes of minoritization.

2. Background and Relevant Literature

2.1 Background About AP and DE

During the past six decades, there has been increasing nationwide support for programs that allow high school students to earn college credit while in high school. These include several different models such as Advanced Placement (AP), Dual or Concurrent Enrollment (DE), Early College High Schools (ECHS), and International Baccalaureate (IB). The largest of these programs are AP and DE, which together enroll millions of high school students each year (College Board, 2017)

AP, which is offered by the College Board and covers college-level curriculum content through more than 30 courses, offers students the potential to earn college credits after students achieve a minimum score on a course-specific exam. Officially launched in 1955 under the College Board's administration, AP has grown substantially: With more than 2.6 million exam takers in the academic year of 2015-16, AP has become the largest mechanism through which high school students earn college credit in the U.S. DE is the second largest, with roughly 1.4 million students participating in DE in 2010-11. Forty states have policies governing DE programs. Different from AP courses, which are intended to be taken by high school students and are exclusively taught by high school teachers, DE is a broad category including many types of college course-taking arrangements, and DE courses are taught by either college instructors or college-approved high school teachers and include different instructional modalities including at the college, at the high school, and online/hybrid.

Researchers have noted several benefits of college acceleration programs on students' postsecondary outcomes, particularly their potential to improve college attendance among underrepresented students, with the underlying assumption that the rigorous curriculum tied to the incentive of earning college credits with reduced financial burden is especially valuable and potentially appealing to students from underrepresented groups and therefore might increase their participation in additional postsecondary education and credential accumulation after high school (Berger et al., 2013; Klepfer & Hull, 2012). For policymakers, the rationale for supporting programs to help high school students earn college credits early runs along similar lines. These programs, which provide access to free or heavily discounted courses, may be appealing to state, K–12,

and college leaders given their potential to boost college-going and completion rates and reduce the costs of postsecondary education for families and taxpayers.

In addition to the policy and theoretical support for expanding programs that allow high school students to earn college credits, a number of studies have also provided empirical evidence for the benefits of AP and DE on student academic outcomes. Numerous studies of the AP program have compared the academic performance of non-AP and AP students and generally found that AP students outperform their non-AP peers in a variety of academic achievement measures, such as ACT and SAT scores, college attendance rates, admission to selective colleges, college grade point averages (GPAs), college graduation rates, and time to degree (e.g., Ackerman, Kanfer, & Calderwood, 2013; Flowers, 2008; Hertberg-Davis et al., 2006; Klopfenstein, 2010; Gurantz, 2019; Mo, Yang, Hu, Calaway, & Nickey, 2011). Although studies that control for available student demographic and academic characteristics have generally yielded smaller effect sizes compared with studies that have not taken into account baseline differences between AP and non-AP students (e.g., Klepfer & Hull, 2012; Klopfenstein & Thomas, 2010; McKillip & Rawls, 2013; Sadler & Sonnert, 2010; Warne, Larsen, Anderson, & Odasso, 2015), more recent studies that have used rigorous causal designs (e.g., Gurantz, 2019) suggest that the benefits of AP on student academic outcomes are not likely entirely driven by bias from unobserved student characteristics.

Similarly, a number of studies that have used advanced quantitative methods to estimate the effects of DE have generally identified positive impacts of DE participation on a variety of academic outcomes, including high school graduation, college enrollment, college persistence, college GPA, and postsecondary degree completion (Allen & Dadgar, 2012; An, 2013; An & Taylor, 2019; Hemelt, Schwartz, & Dynarski, 2019;; Giani et al, 2014; Karp, Calcagno, Hughes, Jeong, & Bailey, 2007; Miller et al., 2018; Speroni, 2011; Swanson, 2008; U.S. Department of Education, 2017). Academic subjects such as English, math, social sciences, science, and foreign languages have been found to produce larger effects on degree completion than career and technically oriented DE courses such as computer science, health, and career-technical education (e.g., Giani et al, 2014; Speroni, 2011). A handful of studies have also examined whether the benefits of DE may vary for students from disadvantaged versus more affluent backgrounds, and the results are mixed (e.g., An, 2013; Karp et al., 2007; Miller et al., 2018; Speroni, 2011). For example, in an

exploration of the impact of DE programs on student outcomes in Texas, Miller et al. (2018) found that the effect of participating in DE on student outcomes is more positive for advantaged students. In contrast, using data from two cohorts of all high school students in Florida and controlling for school-level and student-level characteristics, Speroni (2011) found that DE credits induced Black and Hispanic students to enroll in four-year colleges who otherwise would have enrolled in two-year colleges, and the size of the effect (0.09, p <.05) is larger than that among non-minoritized students (0.07, p <.05).

2.2 Existing Evidence on Racial/Ethnic Gaps in AP and DE Participation

Given the likely benefits of AP and DE enrollment on college success for students, racial/ethnic gaps in participation rates would serve as important indicators of educational inequality. Unfortunately, persistent racial/ethnic disparities exist in AP enrollment and success rates, where Black students are most underrepresented: According to the 10th Annual AP report by the College Board (2014), Black students represent only 9 percent of AP test takers in 2013 and less than 5 percent of students with a score of 3 or higher on AP examinations despite making up 15 percent of the 2013 graduating class. There is also substantial between-state variation in AP racial/ethnic equity gaps, where the difference between the percentage of Black AP exam takers and the percentage of Black students in the 2013 graduating class ranges from zero (such as in Idaho) to almost 20 percentage points (such as in South Carolina).

In a similar vein, since the original purpose of DE was to provide options for advanced students who have outgrown the high school curriculum, most states require students to meet eligibility criteria to be admitted to a DE program, such as a teacher-written recommendation, minimum high school GPA, or passing scores on state-determined college readiness assessments.[3] As a result, students eligible to take college coursework through DE are likely to have higher prior academic achievement and be from more affluent backgrounds. Indeed, using the High School Longitudinal Study of

[3] In 2016, six states include minimum high school GPA as a criterion to be admitted to a DE program; 17 states require written permission or a recommendation from a teacher or school official; 25 states require DE candidates to meet course prerequisites set by the departments or institutions offering DE programs; and 24 states include other eligibility criteria, such as completion of certain high school courses or passing scores on state-determined high school or postsecondary assessments (Education Commission of the States [ECS], 2019).

2009 (HSLS:09), the U.S. Department of Education (2019) reported that a lower percentage of Hispanic students (3 percent) and Black students (27 percent) participated in DE programs in high school than did White or Asian students (both 38 percent).

These national patterns of racial/ethnic gaps in DE participation are echoed in studies using data from particular states. For example, based on administrative data from Texas on the enrollment and outcome information for DE participation among 11th and 12th graders from 2000 to 2015, Miller et al. (2018) found that while DE participation rates generally increased during this period of time for all students, there was a persistent racial/ethnic gap which seems to enlarge over time: In 2001, DE participation rates were approximately 11 percent among White students, 7 percent among Asian students, 5 percent among African American students, and 3 percent among Hispanic students; in 2015, the DE participation rate of White students grew to 26 percent, which was 5 percentage points higher than the participation rate among Asian students, 10 percentage points higher than Hispanic students, and 15 percentage points higher than African American students.

While the existing evidence on the national and state-level patterns of racial/ethnic gaps in AP and DE participation provides useful information about overall educational inequality in college acceleration opportunities, these aggregate statistics are less informative about whether these gaps are larger or smaller across smaller geographic units, such as school districts or metro areas, therefore making it difficult to identify local contexts and factors that produce and sustain these gaps. In this paper, we address this knowledge gap by providing detailed descriptive analyses of the patterns of racial/ethnic gaps in AP and DE participation across thousands of school districts and hundreds of metro areas, and by identifying state-, metro-, and district-level factors that are correlated with these gaps.

2.3 Causes and Correlates of Racial/Ethnic Gaps in AP and DE Participation

Drawing on the rich literature and theories on racial and ethnic achievement disparities in the sociology of education, Reardon, Kalogrides, and Shores (2019) have provided a comprehensive framework for understanding the complex relationship between both schooling and non-school factors that may influence racial/ethnic gaps in academic choice and outcomes. More specifically, their model proposes two major

categories of potential sources of racial/ethnic gaps: racial/ethnic disparities in family socioeconomic resources, and education policies and structures. These two categories of factors interact with each other and eventually lead to four types of racial/ethnic disparities that may contribute to student academic participation or outcome gaps: (1) home disparities—racial/ethnic differences in students' opportunities for learning at home, such as household investment in education; (2) neighborhood disparities—racial/ethnic differences in the characteristics of the residential neighborhood (such as average SES) as a result of racial/ethnic residential segregation; (3) between-school disparities—racial/ethnic differences in school experience and opportunities as a result of between-school racial/ethnic segregation as well as between-school differences in resources, such as school facilities and teacher quality; and (4) within-school disparities—racial/ethnic differences in school experience and opportunities within a school due to factors such as tracking and teacher expectations.

We build on the Reardon et al. (2019) model and further adapt it to focus on three sets of possible factors that could contribute to racial/ethnic gaps in AP and DE participation: (1) racial/ethnic differences in students' home resources and neighborhood environments; (2) racial/ethnic differences in students' schooling experiences and AP/DE opportunities; and (3) state-level AP and DE policies. Each of these might encompass several potential mechanisms.

First, differences in students' home resources and neighborhood environments may lead to different in- and out-of-school learning opportunities as well as educational choices (e.g., Bassok, Finch, Lee, Reardon, & Waldfogel, 2016; Chetty & Hendren, 2018; Ludwig et al., 2008). Parents with higher income and education on average are likelier to have more economic, social, and cultural capital to support their children's participation in college acceleration programs. Indeed, using the HSLS:09, the U.S. Department of Education (2019) reported that students whose parents had higher levels of education more commonly took DE courses in high school: 42 percent of students whose parents had earned a bachelor's degree or higher took these courses, compared to 26 percent of students whose parents' highest level of education was lower than a high school diploma. In a similar vein, existing literature has identified strong neighborhood effects on individuals' educational and labor market outcomes (e.g., Chetty & Hendren,

2018; Ludwig et al., 2008). To the extent that family socioeconomic status and local socioeconomic composition may affect students' participation in AP and DE programs, it implies that racial/ethnic differences in socioeconomic status would then lead to racial/ethnic disparities in AP and DE participation.

Second, racial/ethnic differences in students' schooling experiences and opportunities may also result in racial/ethnic gaps in AP and DE participation. One of the major sources of such disparity seems to be unequal college acceleration opportunities that are tightly linked to socioeconomic and racial/ethnic composition at a school. Using data from the Common Core of Data (CCD) and the Civil Rights Data Collection (CRDC), two recent reports—one by the GAO (2018) and the other by Excel*in*Ed (2018)—explored AP and DE offerings across schools, and both reports identified gaps in access to AP and DE at high-minority and high-poverty high schools. For example, the GAO noted that over 80 percent of low-poverty schools offer at least one AP course, compared to about 60 percent of high-poverty schools. In regard to DE courses, 73 percent of low-poverty schools offer DE coursework compared to 54 percent of high-poverty schools. Excel*in*Ed also identified racial/ethnic disparities in access to AP and DE coursework, finding that 38 and 31 percent of high-minority high schools do not offer AP and DE coursework, respectively, whereas 48 and 33 percent of low-minority high schools offer AP and DE courses. By examining between-school disparities in access to AP and DE, these reports offer a potential explanation for racial/ethnic disparities in access to AP and DE coursework—whether or not a school offers AP/DE courses—yet they leave unexamined the possibility of racial/ethnic disparities in participation even within schools that offer such courses.

Finally, state-level AP and DE policies may either exacerbate or ameliorate the racial/ethnic gaps in AP and DE participation.[4] For example, roughly three quarters of

[4] We included state policies outlined by the Education Commission of the States. These are general policies in place in a nontrivial proportion of states. It is important to note that certain states have unique policies to support AP and DE and therefore were not included as predictors in our models. Yet, these policies might also influence AP and DE enrollment and racial/ethnic gaps in AP and DE enrollment. For example, in the state of Colorado, students are eligible for the ASCENT program if they complete 12 credit hours of postsecondary courses prior to completing grade 12. The ASCENT program provides students with one year of concurrent enrollment following grade 12. In another example, in the state of Ohio each public secondary school must develop, in consultation with at least one partnering college, pathways for students to earn college credit.

states include AP and/or DE participation and performance measures in district accountability reports (Education Commission of the States [ECS], 2016, 2019). These measures are often required to be broken down by demographic group. Even though mandates like this do not set thresholds to hold districts accountable for AP and DE enrollment, they do signal to schools that participation and inclusion is important. In addition, considering the additional costs associated with AP (such as AP test fees) and DE programs (such as tuition and books), financial supports to students and institutions can also influence the level of participation in these programs, particularly among low-income students (Dounay, 2007; Klopfenstein & Thomas, 2010). By 2016, 29 states offered fee reductions or waivers to low-income students for taking AP exam; similarly, 19 states and/or school districts either subsidized tuition costs or fully covered them to encourage DE participation.

Lastly, in addition to financial hurdles, minoritized students, particularly those from lower-income families, may—as a result of accumulated educational disadvantage—experience other barriers in accessing college acceleration programs. These barriers may include strict eligibility cutoffs based on GPA or test scores, limited guidance on how to take advantage of AP and DE programs, or other indirect costs of participation such as textbooks and transportation. Therefore, states that implement policies to specifically address these hurdles and expand access to DE programs—such as using multiple eligibility criteria for DE participation rather than setting fixed GPA or readiness test cutoff scores,[5] offering courses virtually or providing support for transportation or textbook costs, actively reaching out to parents and students to inform them of DE opportunities and the potential benefits related to DE participation, and providing academic counseling to prospective DE students—may help in alleviating racial/ethnic gaps in DE participation.

[5] In some states, for example, students are allowed to participate in DE programs with written permission from parents or a recommendation from a teacher.

3. Data and Methodology

3.1 Data Sources

We linked multiple publicly available data sources to document geographic patterns of AP and DE racial/ethnic enrollment gaps among school districts in the U.S. We describe each data source below.

CRDC (Civil Rights Data Collection). CRDC is a biennial survey of all public schools and school districts. The data collection on the 2015-16 school year targeted 17,370 districts and 96,440 schools with 99.8 percent of districts certifying their submitted data. The CRDC has collected information on AP course-taking and school characteristics previously, and the 2015-16 survey included questions about DE program participation for the first time. The CRDC used a broad definition of DE, presumably capturing its many modalities (e.g., including courses taken at the high school, at the college, and online, and taught by high school or college instructors).[6]

ACS (American Community Survey). ACS is an annual, nationwide survey that includes demographic, social, economic, and housing characteristics for school-age children. All iterations contain data for nation, states, and school districts. The data most relevant for our study come from the Education Demographic and Geographic Estimates (EDGE) web portal. The EDGE data come from a special school district-level tabulation of ACS. The data include tabulations of demographic and socioeconomic characteristics of families who live in each school district in the U.S. and who have children enrolled in public school.

CCD (Common Core of Data). CCD is an annual survey of all public elementary and secondary schools in the U.S. The data include basic descriptive information on schools and school districts, including enrollment counts for each grade at each school.

[6] The CRDC instructions define DE programs as "programs [that] provide opportunities for high school students to take college-level courses offered by colleges, and earn concurrent credit toward a high school diploma and a college degree while still in high school. These programs are for high school-enrolled students who are academically prepared to enroll in college and are interested in taking on additional coursework. For example, students who want to study subjects not offered at their high school may seek supplemental education at colleges nearby. DE/dual credit programs do not include the Advanced Placement (AP) program or the International Baccalaureate Diploma Programme." (U.S. Department of Education, Office for Civil Rights, n.d., p. 35). Survey respondents were instructed to report the number of students in grades 9-12 that enrolled in at least one DE/dual credit program, and to include ungraded high school age students in the count.

SEDA (Stanford Education Data Archive). SEDA is a publicly available dataset about American schools, communities, and student success. The dataset includes a range of detailed data on educational conditions, contexts, and outcomes in school districts and counties across the United States. We specifically used district-level measures of racial/ethnic and socioeconomic composition in our analysis.

IPEDS (Integrated Postsecondary Education Data System). IPEDS is a system of interrelated surveys conducted annually by the U.S. Department of Education's National Center for Education Statistics (NCES). IPEDS gathers information from every college, university, and technical and vocational institution that participates in the federal student financial aid programs. We specifically used latitude and longitude data from IPEDS for each college to calculate the nearest college to each high school.

3.2 Constructing Measures for AP and DE Participation

The 2015-16 CRDC data provide new insight into the number of students participating in AP and DE, but a major limitation of this dataset is that it only provides enrollments at the school level (instead of at the school-by-grade level). As a result, for high schools that also offer 8th grade and below, using the total school enrollment as the denominator to calculate AP and DE participation rates is inappropriate, since CRDC specifically instructed districts and schools to only report AP and DE participants among students who are in grades 9 through 12. To provide a more accurate calculation of AP and DE participation rates, the first step is thus to estimate the 9th-12th grade enrollment counts for each high school.

In this section we describe the selection criteria we used to identify eligible high schools to be included in our analytic sample, as well as our methodology for estimating the 9th-12th grade enrollment counts for high schools that offer eighth grade or below. To preview our results, the adjustment did not change the AP and DE participation rates much overall. Yet, participation rates were adjusted upward to a greater extent in certain states, metro areas, and districts where a greater proportion of high schools offer 8th grade and below. These results suggest that, without this additional adjustment, AP and DE participation rates calculated based on total high school enrollment reported in CRDC are likely to be underestimated in certain areas with relatively more high schools offering grades 8 and below.

3.2.1. Identifying Eligible High Schools

Appendix Table A1 summarizes the steps taken to restrict the full CRDC school-level dataset to eligible high schools. The CRDC data collection on the 2015-16 school year gathered data from 96,360 schools in 16,874 districts. We first merged CRDC data with CCD data by school ID, as the latter provides detailed grade-level enrollment for each school. While CRDC and CCD school-level data should align using a unique school identifier in both datasets, approximately a thousand schools did not match on their unique identifier. Through other matching procedures (e.g., school name, state, and district name combinations), we were able to match all but 308 CRDC schools, which were excluded from our analytic sample. We further excluded schools that do not offer 11th or 12th grade (N = 71,309), special education, alternative, and juvenile justice schools (N = 5,512), and virtual schools (N = 556). The final sample includes 18,675 schools identified as eligible high schools located in 11,833 school districts and 917 core-based metro areas.

3.2.2. Adjusting School Enrollments

As mentioned above, the CRDC asked survey respondents to report the number of 9th-12th grade students who participated in AP or DE programs. Thus students in 8th grade or below are ineligible for the purposes of estimating participation in AP and DE and should therefore be excluded from the denominator of AP and DE participation rates. Of the eligible set of high schools, 27 percent offered 8th grade or lower (N = 5,134), and these schools will be referred to as "secondary schools" for the sake of brevity. We used the school-by-grade enrollments from CCD to estimate 9th-12th grade enrollments at these schools through a two-step procedure.[7]

First, if secondary schools had a CCD school enrollment that matched the CRDC school enrollment within +/- 5 percent of the CRDC enrollment, then we replaced the participation rate denominator with the CCD enrollment for grades 9 and above. This replacement was done specifically for all students and subgroups of students by race/ethnicity and gender. Second, if secondary schools did not have a CCD school

[7] More technical details on the procedure used to adjust school enrollments, including results showing the magnitude of the enrollment adjustments by student subgroup and state, can be found in the documentation presented in Fink (2018).

enrollment that matched the CRDC school enrollment within +/- 5 percent of the CRDC enrollment, then we used CCD to create a ratio capturing the proportion of the school enrollment in grade 9 or above. We then used this ratio to weight the CRDC enrollment to estimate the number of students in grade 9 or above.

As a result of this two-step procedure, 6 percent of students in the full sample of eligible high schools were excluded (ranging from 5 to 12 percent by subgroup). Removing ineligible students from the participation rate denominators increased the AP and DE participation rates by 1.2 and 0.5 percentage points, respectively (this ranged between 0 and 2 percentage points by student subgroup). Our examination of the magnitude of these adjustments by state suggests that, without this adjustment, participation in AP and DE would be underestimated in certain states (e.g., Alaska, Alabama, Louisiana) due to overrepresentation of student enrollment in secondary schools (relative to traditional high schools offering grades 9–12).

3.2.3. Outcome Measures and Analytic Samples

For each district and metro area we examined overall rates of participation in AP and DE, as well as the White-Black and White-Hispanic gaps in AP and DE participation. The CRDC instructed schools and districts to count students as having participated in AP if they took at least one AP course during the 2015-16 school year.[8] It is important to note that the CRDC uses a broad definition of participation in a DE program, including all "opportunities for high school students to take college-level courses offered by colleges, and earn concurrent credit toward a high school diploma and a college degree while still in high school" (Fink, 2018).

Participation rates were derived by dividing the number of AP or DE participants in a given district or metro area by the total 9–12 grade high school enrollment in that district or metro area. We also calculated the AP and DE participation rates for each main racial/ethnic group separately. For example, to derive DE participation rates for Black students, we divided the number of Black students participating in DE by the total high school Black student 9–12 grade enrollment. To calculate racial/ethnic gaps in AP and

[8] Note that in order to receive college credit for an AP course, students need to take and receive a qualifying score on an AP test. Our study uses a broader definition of participation in AP, counting students as participating if they ever took an AP course.

DE participation, we subtract Black or Hispanic student participation rates from White student participation rates, reporting *percentage point* gaps, such that positive gaps indicate higher participation among White students and negative gaps indicate higher participation among Black or Hispanic students.

Since the primary focus of our paper is on racial/ethnic gaps in AP and DE participation, we have to condition our outcome measures on some amount of AP or DE participation among either White students or Black/Hispanic students.[9] Therefore, we do not report outcomes for districts or metro areas where there are fewer than 20 students enrolled; similarly, for the participation rate gaps, we only report gaps for districts or metro areas with 20 or more students in each subgroup and with at least one subgroup having a non-zero participation rate. As a result, we use different analytic samples depending on the outcome measure. Appendix Table A2 summarizes the analytic sample for each main outcome measure. It should be noted that although there are substantial decreases in the number of districts as we restrict the analytic samples, these restrictions mainly exclude districts with very few students overall; as a result, districts that remain in the sample still cover at least two thirds of total students enrolled nationwide.

3.3 District-Level and Metropolitan-Area-Level Predictors

Following the theoretical framework outlined in section 2.3, we estimate sources of variation in AP and DE racial/ethnic participation gaps that fall within one of the following three categories: (1) home resources and neighborhood environments, (2) schooling experiences and AP/DE opportunities, and (3) state-level policies for AP and DE. Below we briefly describe the variables included in each category. The full list of explanatory variables used and the data source for them are presented in Appendix Table A3.

To examine sources of variation stemming from racial/ethnic differences in students' home resources and neighborhood environments, we include an indicator for the average family's socioeconomic composition in a district, which is a composite score averaged using the following six variables: median family income, proportion of adults with a bachelor's degree or higher, poverty rates, unemployment rates, Supplemental

[9] For example, it would be misleading to report a zero percentage point gap in White-Black DE participation if the district had zero DE participation for both White and Black students.

Nutrition Assistance Program receipt rates, and single-mother-headed-household rates. These variables were retrieved from ACS-EDGE (2012-2016 tabulation) for families with school-age children enrolled in public schools. We also include race/ethnicity-specific SES composite gap variables; these variables are readily available in the SEDA dataset and were constructed using ACS-EDGE 2006-2010 tabulation data. Lastly, we include in our models free-lunch eligibility, which was retrieved from CCD and indicates the percent of students in each school district eligible to receive a free or reduced-cost lunch.

The second source of variation is related to racial/ethnic differences in students' schooling experiences and AP/DE opportunities. We included in our analysis three sets of variables within this category: (1) indicators of racial/ethnic composition of a school district, measured as the proportion of Black or Hispanic students within a district; (2) measures of racial/ethnic and income segregation across schools within a school district (these measures were constructed using the Thiel index, where higher values indicate greater levels of segregation); and (3) measures of school-level resources, such as per-pupil expenditures, student-teacher ratios, and student-counselor ratios, as well as racial/ethnic differences in these resources within a district. Given that DE opportunities rely on partnerships with local colleges, we also calculated the distance in kilometers to the closest two- or four-year public institution that offers DE or concurrent enrollment for each high school in our analytic sample and then took the average across districts.[10]

Lastly, we included state-level variables reflecting policies that either directly or indirectly influence AP and DE enrollment.[11] For AP enrollment, we identified nine relevant policies, grouped into three categories: (1) accountability and mandates–access (e.g., including AP participation or success in district or high school accountability metrics); (2) accountability and mandates–student outcomes (e.g., including AP exam scores as eligibility criteria for state merit-based scholarships); and (3) financial incentives and program support (e.g., providing funds for start-up costs associated with offering new or expanded AP course offerings). For DE enrollment, we identified 13

[10] IPEDS does not provide an indicator for whether an institution offers dual or concurrent enrollment. We use age to proxy for this indicator, including institutions with at least one student enrolled in fall that is 17 years of age or younger.

[11] Education Commission of the States (ECS) has researched AP and DE policies in all states and provides a comprehensive review of these policies as a resource for public use (ECS, 2016, 2019).

policies and grouped them into the same three categories listed above. Details about specific policies included in each category are available in Appendix Table A4. Each category includes three values that indicate whether a state has strong, moderate, or weak AP/DE policies for that category. A state is identified as having strong policies if it has all policies in place within a category; for example, in regard to AP state policy, financial incentives and program support include providing financial support for AP courses, funding for teacher training, testing fee subsidies, and support to encourage access. A state that has all four policies in place would be considered having strong financial support for AP programs.

3.4 Empirical Model for Exploring Correlates of Racial/Ethnic Gaps

We use multilevel multivariate regression to examine associations between district-level/metro-level measures and racial/ethnic gaps in AP and DE enrollment. We use this strategy as a response to the two-level nested structure of the dataset, where districts or metro areas (level 1) are nested within states (level 2). Taking the analysis for correlates of district racial/ethnic gaps as an example, the multilevel modeling allows us to account for variations at the district level and state level respectively, and also to examine unique variations due to district- and state-level predictors:

$$Y_{ij} = \beta_{0j} + \beta_{1j}X_{ij} + u_{ij} \quad (1)$$

$$\text{Where } \beta_{0j} = \gamma_{00} + \gamma_{01}W_j + \varepsilon_{0j}$$

In this set of equations, Y_{ij} is the racial/ethnic gaps in AP or DE participation for district *i* in state *j*. At level 1 (the district level), we express a district's racial/ethnic gaps in AP or DE (Y_{ij}) as a function of an *intercept* for the state where the district is located (β_{0j}), a vector of district-level predictors, denoted by X_{ij}, which includes both out-of-school neighborhood environments and schooling experiences and AP/DE opportunities, and a random district-level error term that captures unobserved variations between districts within a state *j* (u_{ij}).

At level 2 (the state level), we express the state-level intercepts (β_{0j}) as a function of the overall mean (γ_{00}), a vector of state-level policies that may influence a state's deviation from the overall mean (W_j) and the state-level error that captures unobserved variation across states (ε_{0j}). The random intercept model therefore allows the intercept (or the means

of district racial/ethnic gaps in AP or DE enrollment) to vary across states and allows us to examine whether state policies may play a role in these between-state variations.

4. Results

4.1 Overall Patterns of AP and DE Participation

4.1.1. Districts

Table 1 shows summary statistics for AP and DE participation among school districts. The average district had 11 percent participation rates in AP and DE for all students, and the median district AP and DE participation rates for all students were 8 and 7 percent, respectively. In addition to showing the variation in participation rates among school districts, Figures 1-3 illustrate how the points of centrality, represented by the box and whiskers (box lines represent medians and 25th and 75th percentiles), vary for AP and DE participation across racial/ethnic subgroups. Looking at district averages and medians, there are smaller racial/ethnic gaps in DE participation compared to AP participation. Yet, the racial/ethnic disparities in both AP and DE are much more pronounced when looking at the 75th percentile of districts.

Table 1
Summary Statistics for AP and DE Participation Among School Districts

	N Districts	*M*	*SD*	25th Percentile	Median	75th Percentile
Advanced Placement participation						
All students	11,741	0.110	0.123	0.000	0.080	0.180
Black	4,373	0.102	0.100	0.027	0.082	0.145
Hispanic	5,834	0.116	0.112	0.024	0.094	0.175
White	11,017	0.124	0.135	0.000	0.091	0.204
Dual enrollment participation						
All students	11,741	0.113	0.137	0.004	0.070	0.170
Black	4,373	0.067	.111	0.000	0.028	0.082
Hispanic	5,834	0.082	0.121	0.000	0.040	0.113
White	11,017	0.124	0.144	0.007	0.081	0.187

Figure 1
Distribution of District AP and DE Participation Rates

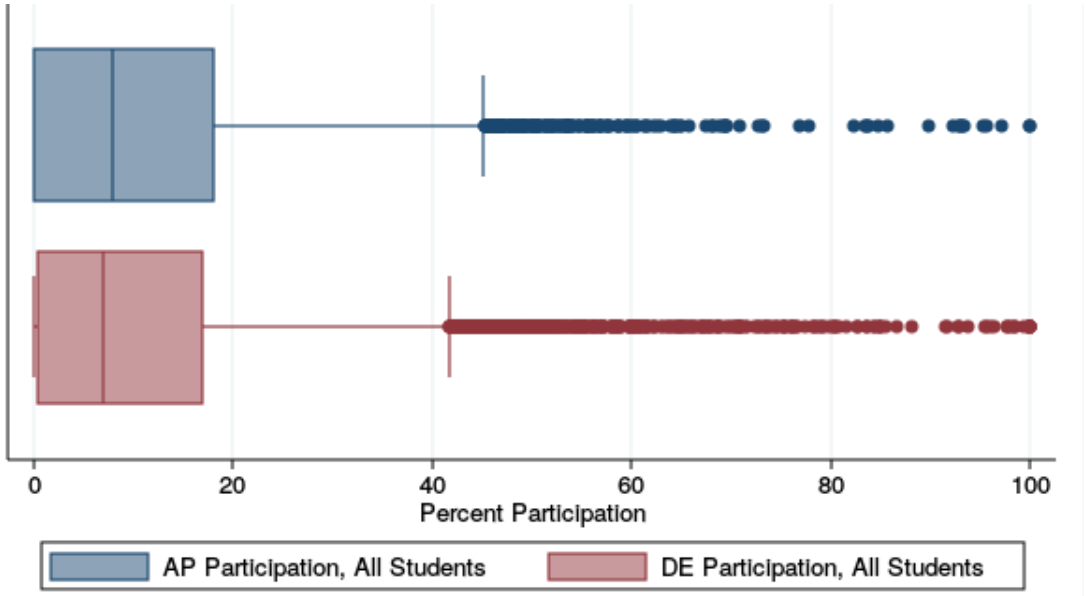


Figure 2
Distribution of District AP Participation Rates, by Student Race/Ethnicity

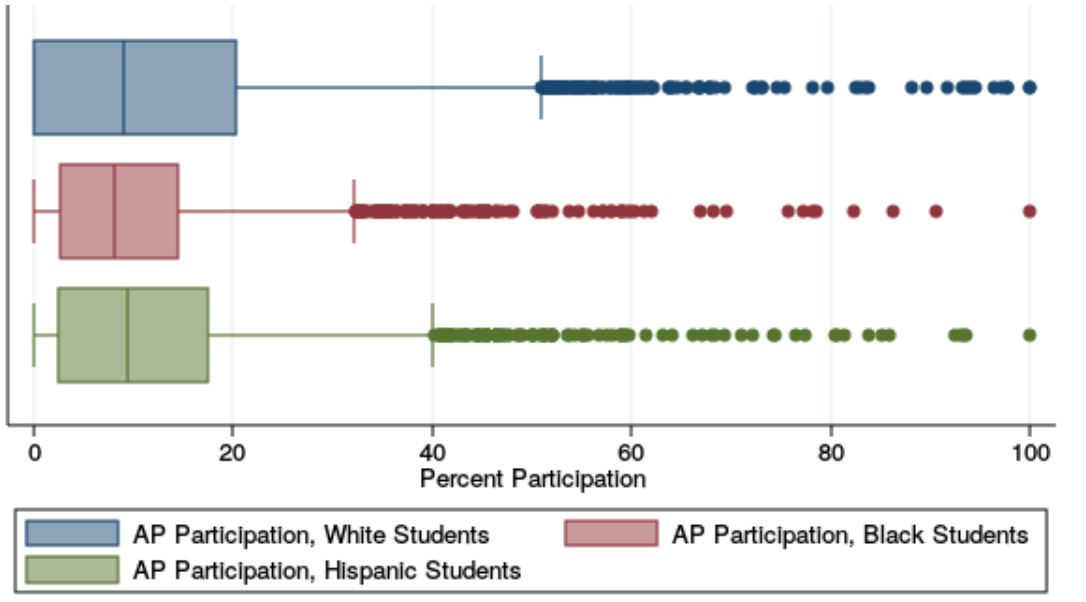


Figure 3
Distribution of District DE Participation Rates, by Student Race/Ethnicity

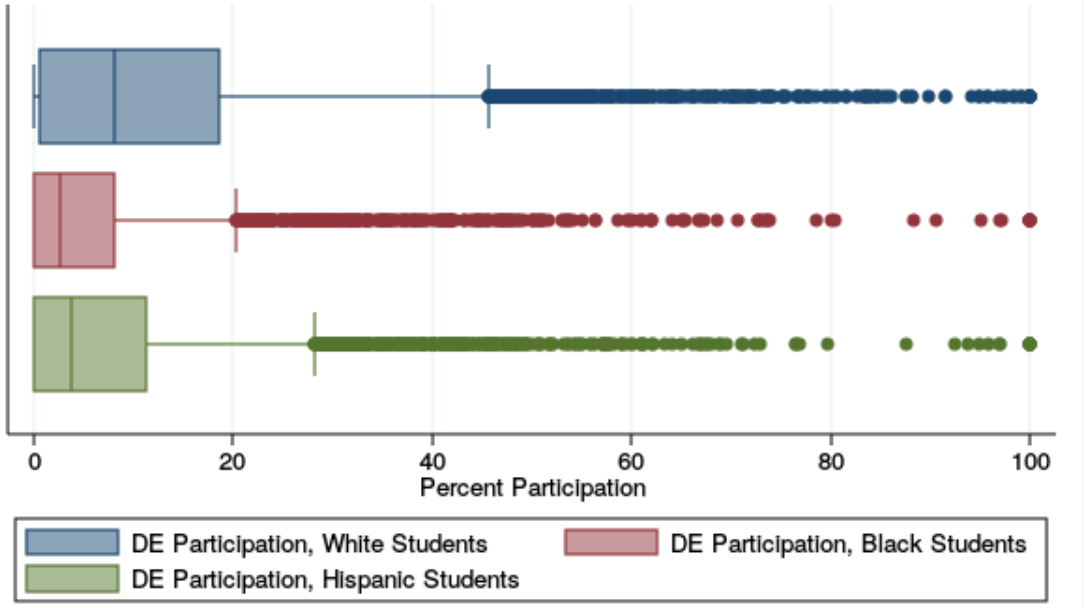


Figure 4 illustrates the distribution of district participation in AP and DE for all students within each state. Separately for AP and DE participation (left and right panels, respectively), states are ranked in descending order by each state's median district participation rate. Figure 4 illustrates the substantial variation in district AP and DE participation both within and across states, and this figure identifies certain states with higher district rates of participation in AP (e.g., Maryland and Connecticut) and DE (e.g., Iowa and Indiana) overall. To geographically represent where in the United States districts have higher and lower rates of participation in AP and DE for all students, Figure 5 presents choropleth maps of district AP and DE participation rates. These maps show districts geographically in progressively darker shades of blue, based on quintiles of all districts' AP and DE participation rates (white areas represent districts for which there are fewer than 20 high school students in our sample).[12] By coloring the districts in this way, readers can compare participation rates within and across each map to gauge places of higher and lower AP or DE participation as well as regions that primarily offer AP or DE programs. For example, the maps in Figure 5 show that districts in the middle of the country have higher participation rates in DE compared to AP, whereas districts in parts of the West and East Coasts tend to have higher participation rates in AP.

[12] Readers may notice that Vermont school districts are not colored in; this is due primarily to merge issues between our school district shapefiles, which use supervisory union geographies, and the CRDC dataset, which reports on the school district level.

Figure 4
Distribution of District DE and AP Participation Rate, by State

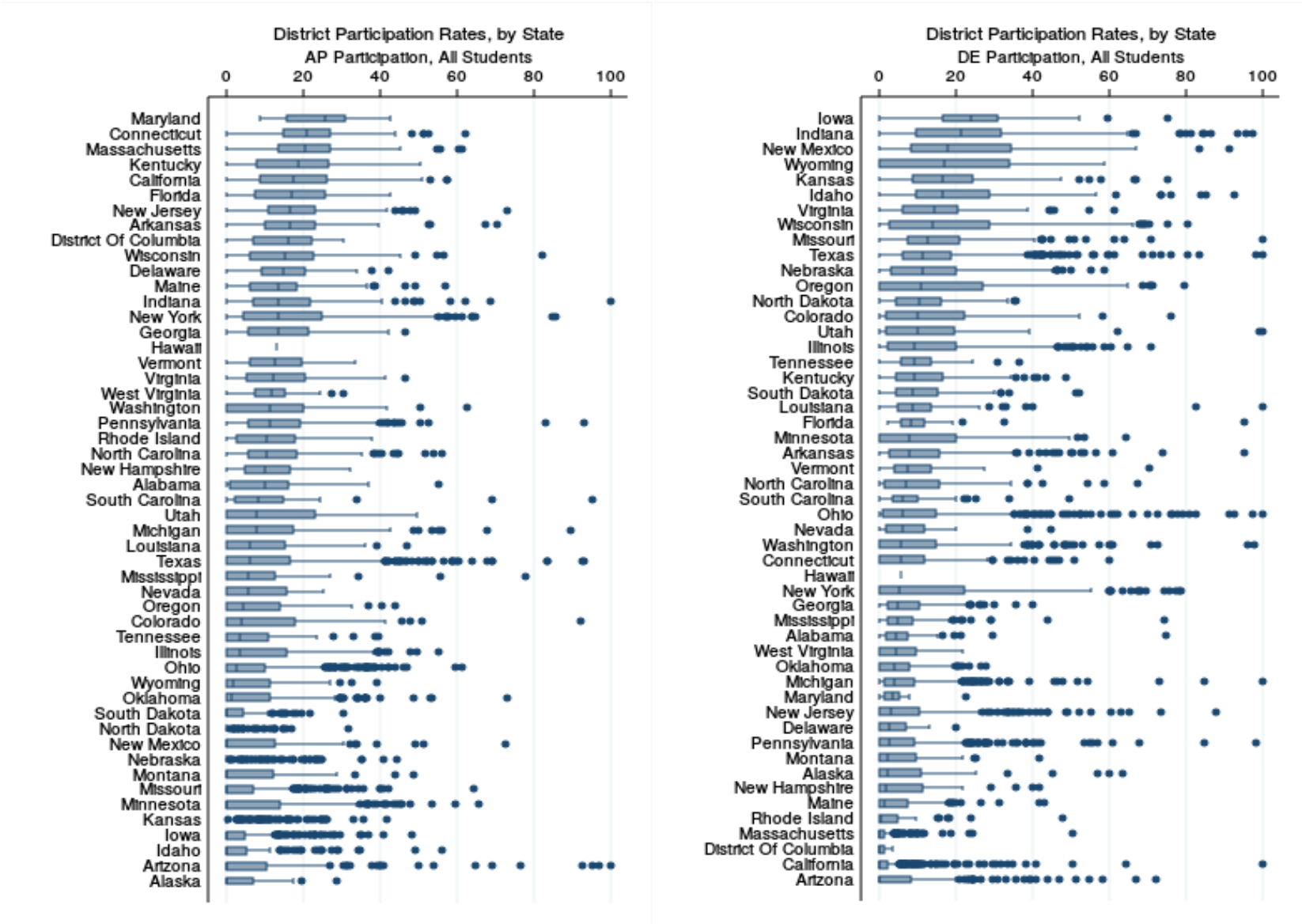
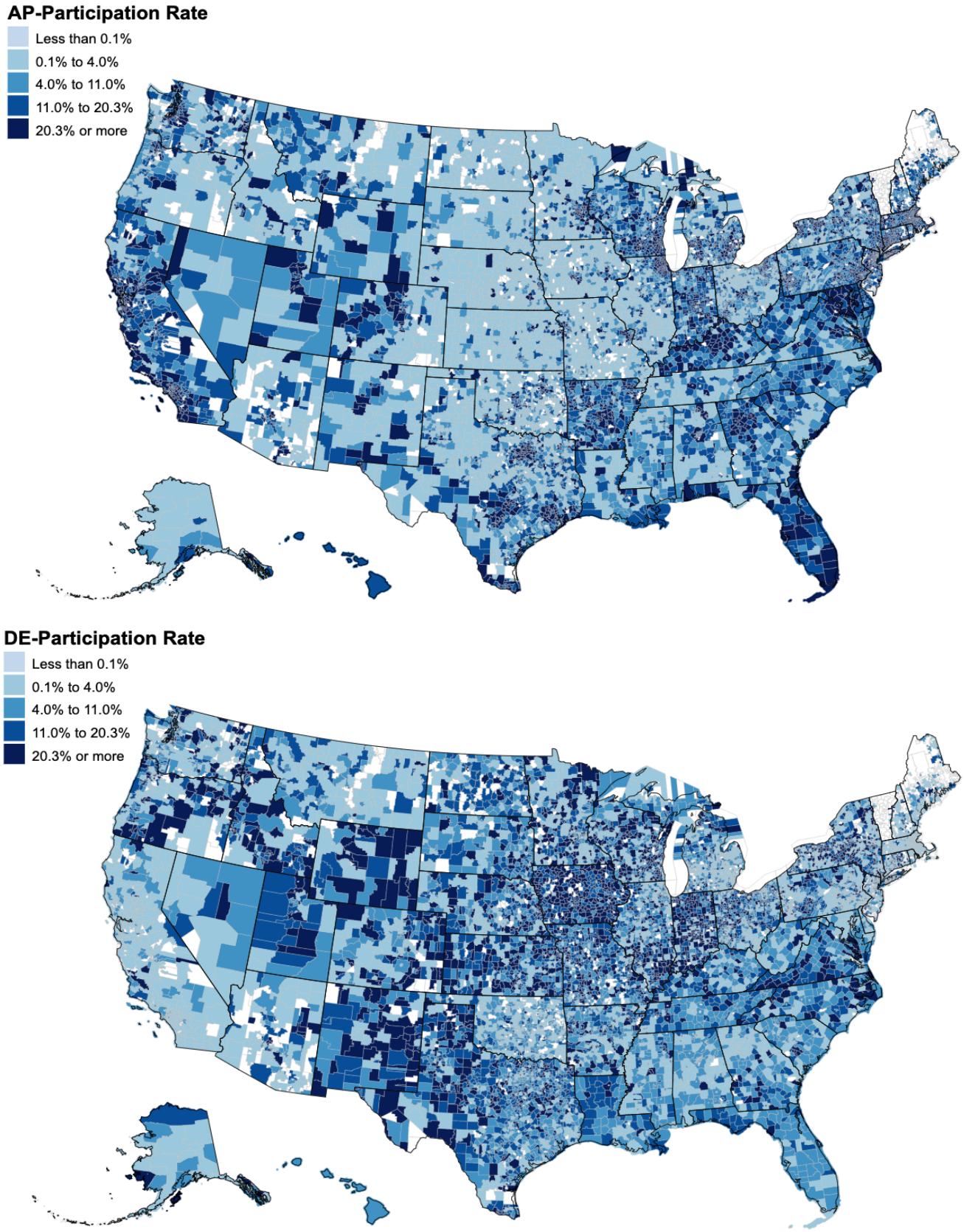


Figure 5
Maps of District AP and DE Participation Rates



4.1.2. Metro Areas

Table 2 shows summary statistics for AP and DE participation among metropolitan areas. The average metro area had 14 and 12 percent participation rates in AP and DE, respectively, for all students, and the AP and DE participation rates for all students in the median metro area were 13 and 9 percent, respectively. There are consistent racial/ethnic disparities in terms of participation in AP and DE when looking at the average, median, 25th, or 75th percentile metro areas. Appendix Figures A2, A3, and A4 show the distribution of metro areas on measures of AP and DE participation for all students and by racial/ethnic subgroups. In addition to showing the variation in participation rates among metro areas, these figures illustrate how the points of centrality, represented by the box and whiskers (box lines represent medians and 25th and 75th percentiles), vary for AP and DE participation across racial/ethnic subgroups.

Table 2
Summary Statistics for AP and DE Participation Among Metro Areas

	N Metros	*M*	*SD*	25th Percentile	Median	75th Percentile
Advanced Placement participation						
All students	917	0.137	0.075	0.079	0.130	0.186
Black	771	0.095	0.068	0.048	0.083	0.130
Hispanic	877	0.113	0.072	0.059	0.106	0.160
White	914	0.155	0.089	0.086	0.149	0.212
Dual enrollment participation						
All students	917	0.115	0.093	0.048	0.091	0.155
Black	771	0.078	0.091	0.021	0.050	0.100
Hispanic	877	0.092	0.095	0.027	0.065	0.122
White	914	0.127	0.096	0.055	0.106	0.174

Appendix Figure A5 shows the top 40 metropolitan areas in terms of rates of participation in AP and DE for all students. In these metro areas about a third or more of high school students participate in AP or DE. Similar to the district maps presented in Figure 5, the metro area AP and DE participation rates are represented geographically in the maps in Appendix Figure A6 with progressively darker shades of blue to indicate the participation rate quintile for each metro area (white areas reflect regions that are not a part of a metro area). The maps for AP and DE participation contrast a bit more using metro areas compared to districts (Figure 5), perhaps due to the inherent favoring of

urban areas in mapping metro areas. Taken together the maps of AP and DE participation in school districts and metro areas suggests that although some areas have high rates of participation in both AP and DE, generally speaking, more rural areas and regions in the middle of the country appear to have higher rates of participation in DE and lower rates of participation in AP. In contrast, more urban areas and coastal regions appear to have higher rates of participation in AP and lower rates of participation in DE.

4.2 Patterns of Racial/Ethnic Gaps in AP and DE Participation

4.2.1. Districts

Table 3 shows summary statistics for racial/ethnic equity gaps in AP and DE participation among school districts. For AP participation, the average district gaps were larger at 9.8 and 6.9 percentage points for the White-Black and White-Hispanic gaps, respectively. The average district had 4.7 and 4.2 percentage point gaps in DE participation between White students and Black and Hispanic students, respectively. The other summary statistics describing the median, 25th percentile, and 75th percentile district gaps in Table 3 indicate substantial variation across districts in the size of gaps, though the racial/ethnic gaps for AP participation are consistently larger than those for DE participation. Figure 6 shows the distribution of districts in terms of White-Black and White-Hispanic percentage point gaps in AP and DE participation. In addition to showing the variation in participation rate gaps among districts, these figures show that for the majority of districts there are sizable racial/ethnic gaps in both AP and DE participation. The distribution of district gaps appears to be slightly more favorable for DE participation. About a quarter of districts have near-zero or negative White-Black and White-Hispanic gaps for DE participation; whereas, less than a quarter of districts have near-zero or negative racial/ethnic equity gaps for AP participation and the White-Black gap in AP participation is particularly skewed in the unfavorable direction.

Table 3
Summary Statistics for AP and DE Participation Rate Gaps Among School Districts

	N Districts	*M*	*SD*	25th Percentile	Median	75th Percentile
Advanced Placement participation gaps						
White-Black gap	3,550	0.098	0.091	0.040	0.090	0.147
White-Hispanic gap	4,625	0.069	0.085	0.018	0.060	0.114
Dual enrollment participation gaps						
White-Black gap	3,134	0.047	0.072	0.006	0.034	0.079
White-Hispanic gap	4,211	0.042	0.079	0.002	0.028	0.072

Figure 6
Distribution of Racial/Ethnic Gaps in AP and DE Participation Among School Districts

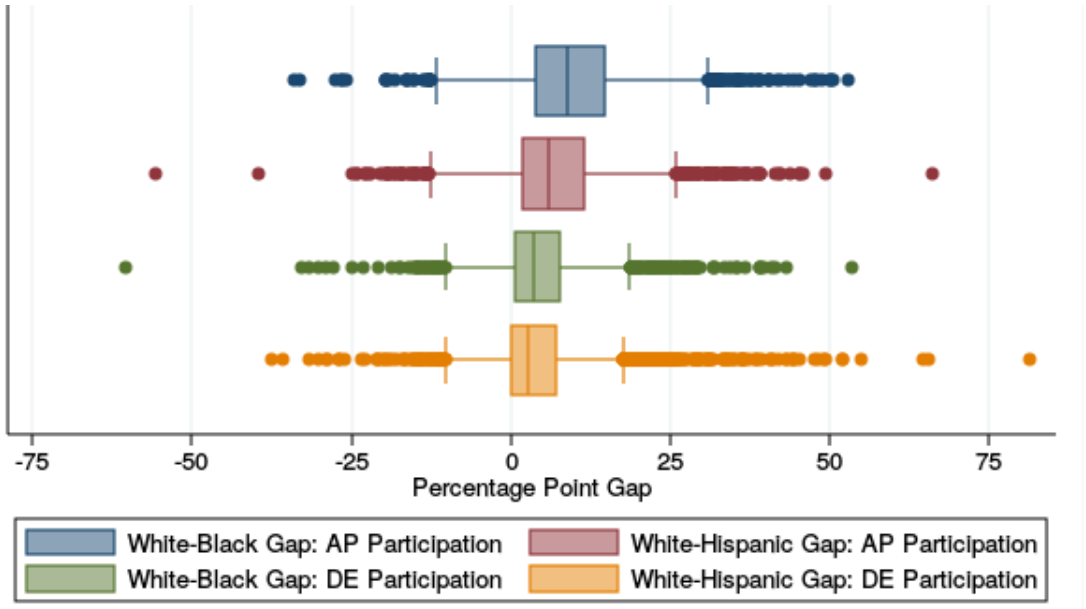


Figure 7 illustrates the distribution of district racial/ethnic gaps in AP and DE participation within each state. Separately for White-Black and White-Hispanic gaps for AP and DE participation, states are ranked in descending order by the states' median district gap. Figure 7 illustrates the substantial variation in district White-Black and White-Hispanic gaps in AP and DE participation both within and across states, and this figure identifies certain states with higher district White-Black and White-Hispanic gaps for AP (e.g., District of Columbia and Maryland) and DE (e.g., North Dakota and Iowa) overall. Figure 8 displays the top and bottom 20 districts nationally in terms of the size of their White-Black and White-Hispanic gaps in AP and DE participation. To geographically represent where in the United States districts have larger and smaller racial/ethnic gaps, Figure 9 presents choropleth maps of district White-Black and White-Hispanic gaps in AP and DE participation rates. These maps show districts geographically, with color in green or purple indicating the size of the district gap (with greener indicating smaller gaps and more purple indicating larger gaps). These maps have substantial regions without color; these are districts without valid data for the gap outcomes (see our sample restriction detail in section 3.3) By coloring the districts in this way, readers can compare participation rate gaps within and across each map to gauge places of larger and smaller White-Black and White-Hispanic gaps in AP and DE participation.

Figure 7
Distribution of Racial/Ethnic Gaps in AP and DE Participation Among School Districts, by State

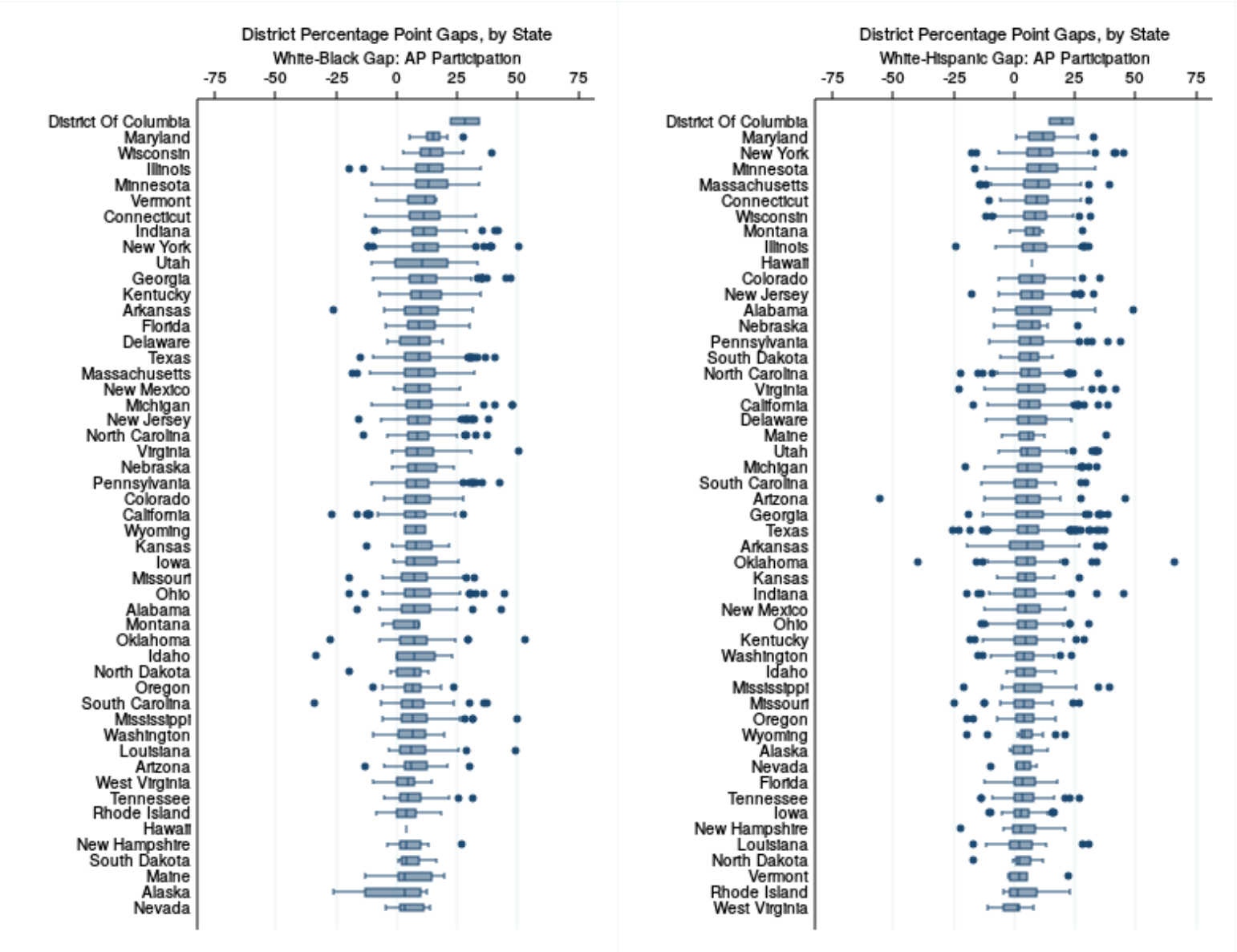


Figure 7 (cont.)
Distribution of Racial/Ethnic Gaps in AP and DE Participation Among School Districts, by State

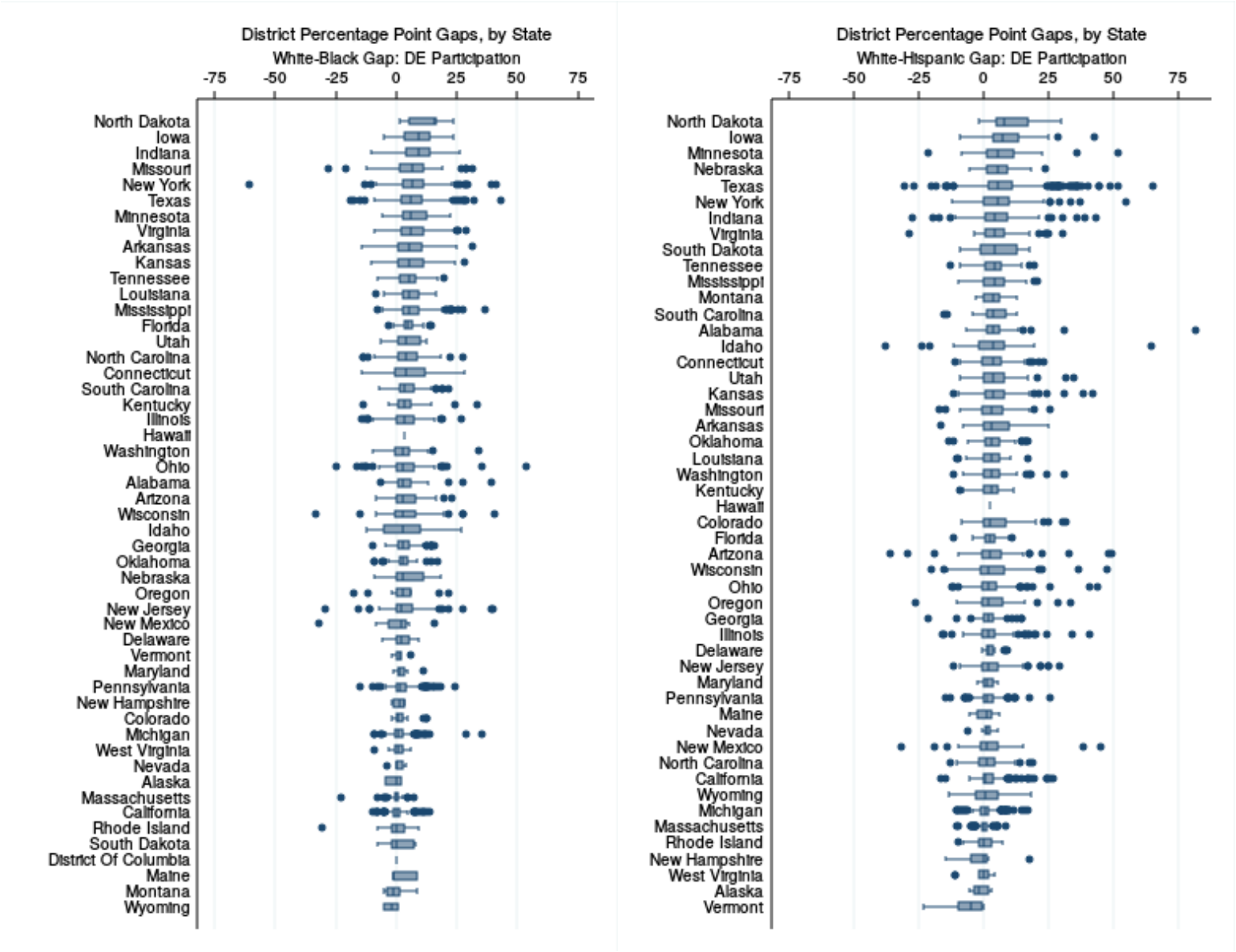


Figure 8
Percentage Point Racial/Ethnic Gaps in AP and DE Participation: Top and Bottom 20 Districts

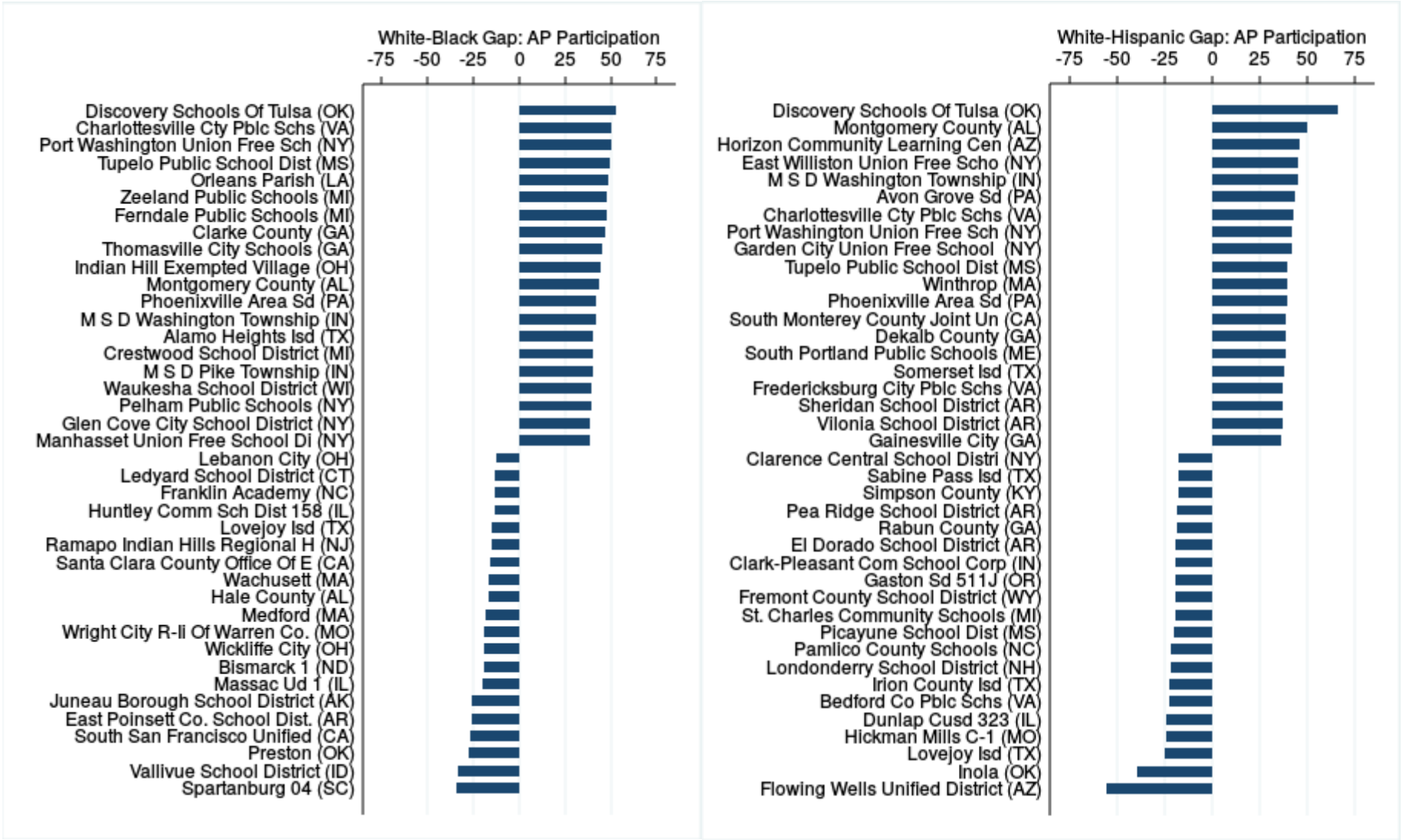


Figure 8 (cont.)
Percentage Point Racial/Ethnic Gaps in AP and DE Participation: Top and Bottom 20 Districts

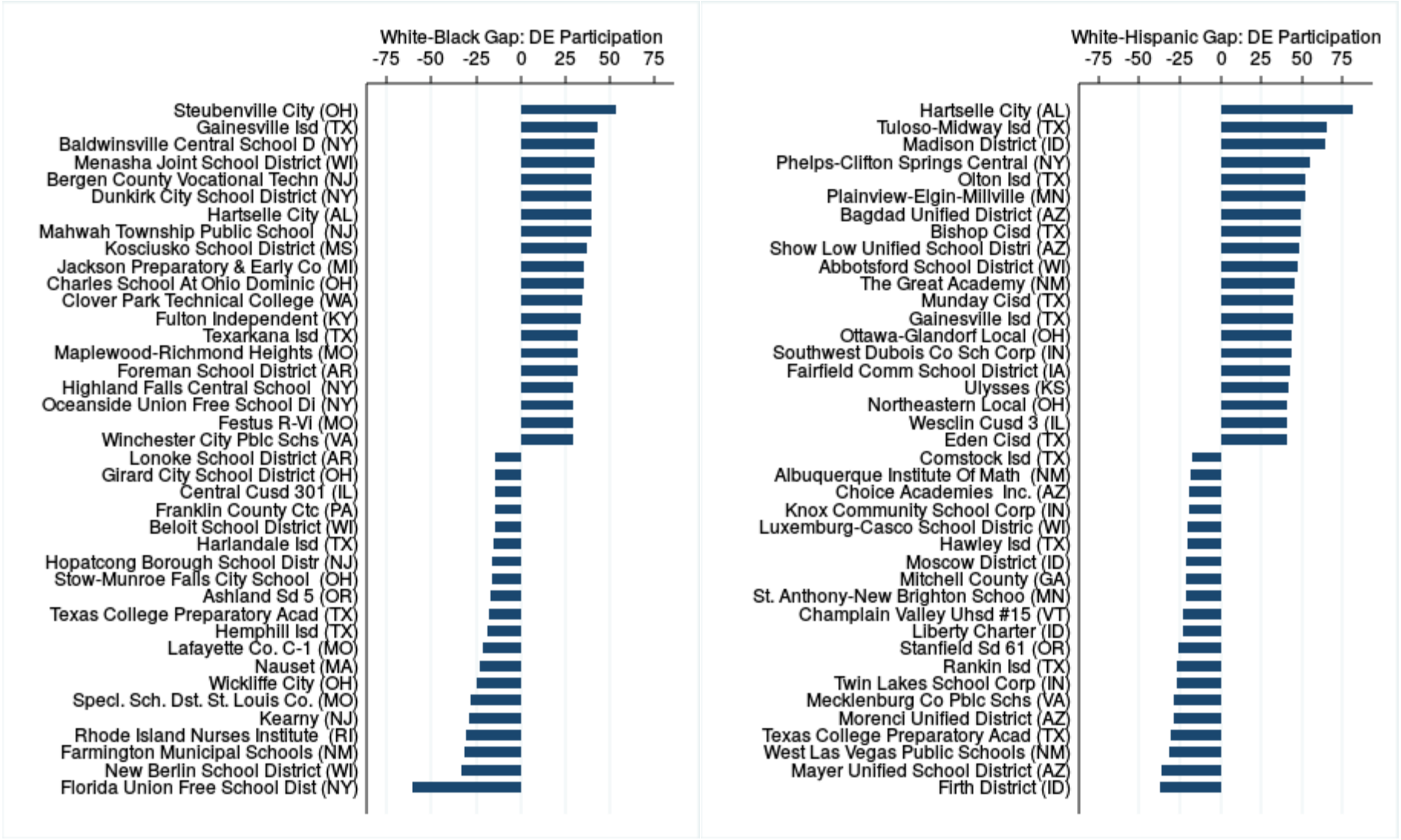
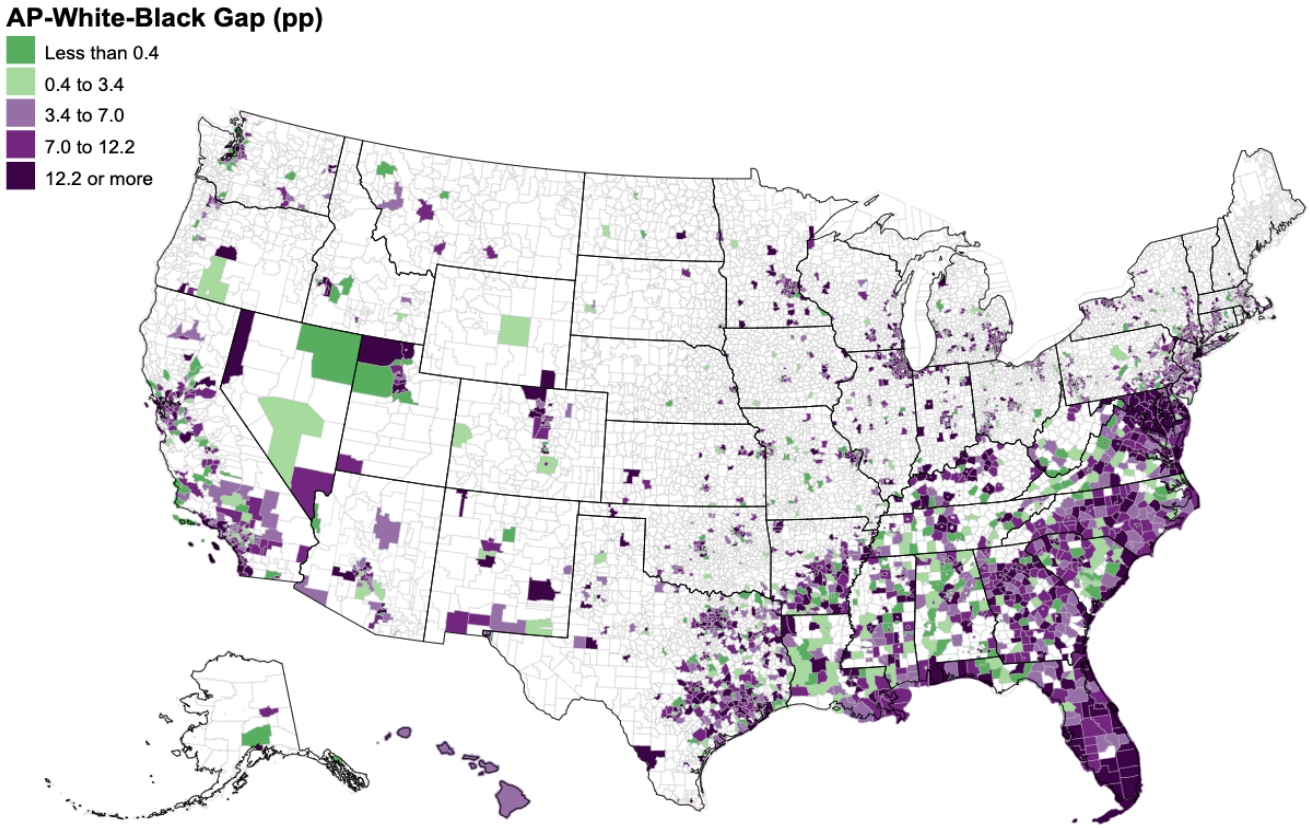


Figure 9
Quintile Maps of District Racial/Ethnic Gaps in AP and DE Participation



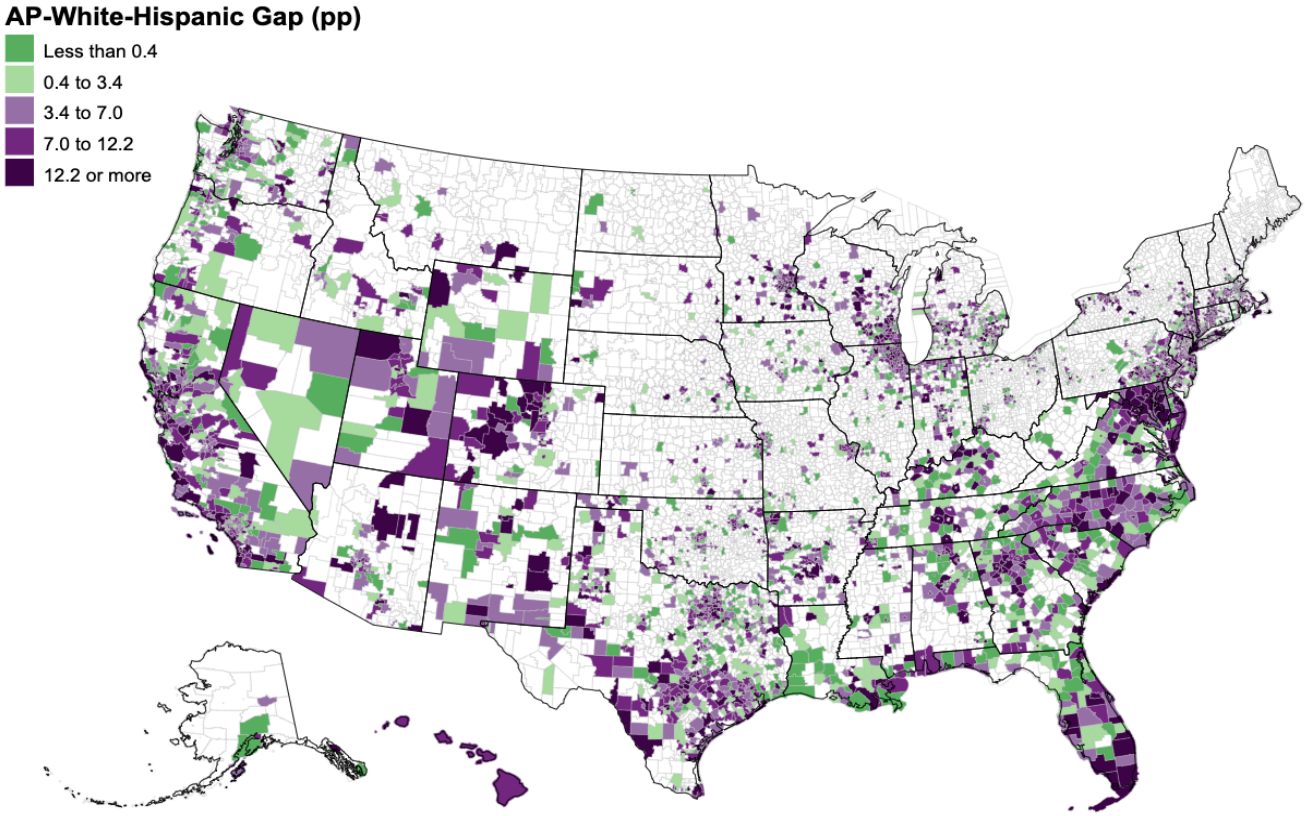
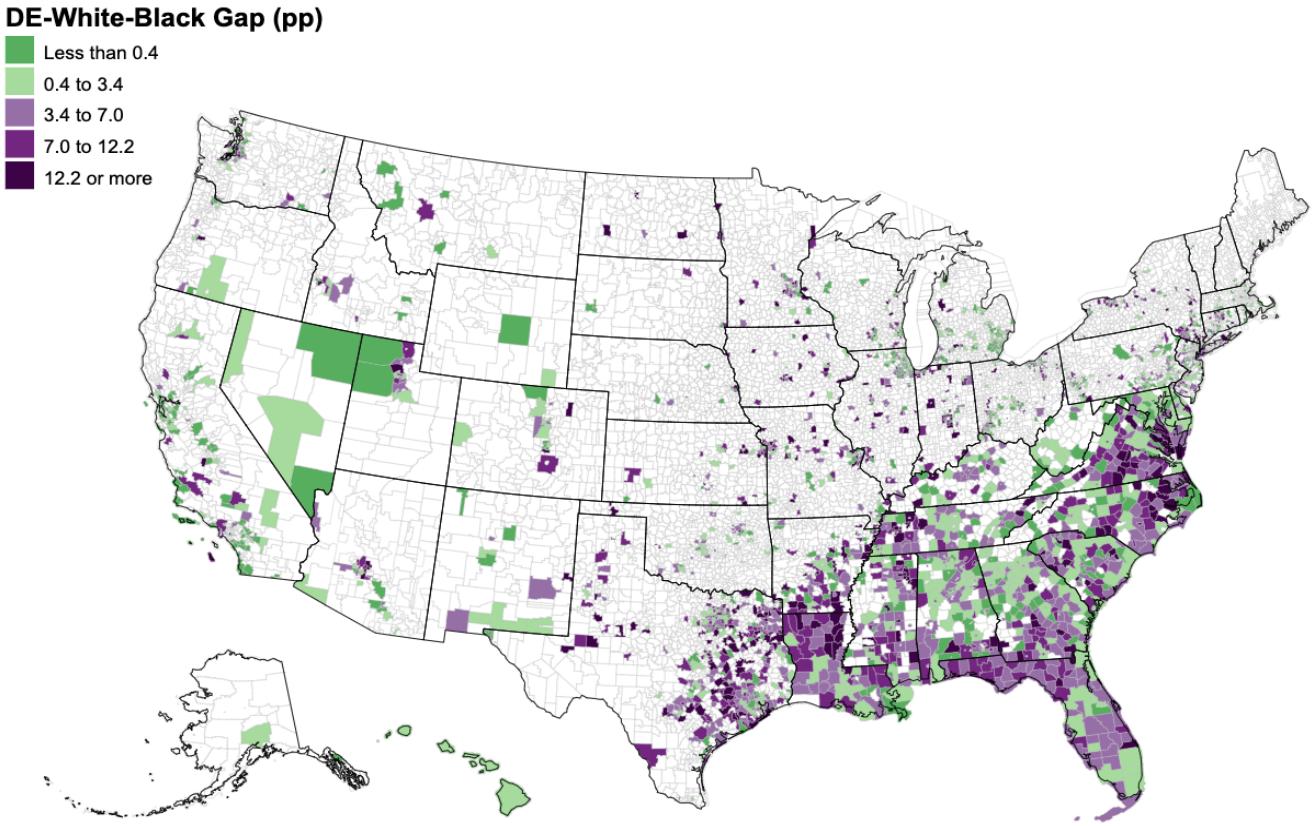
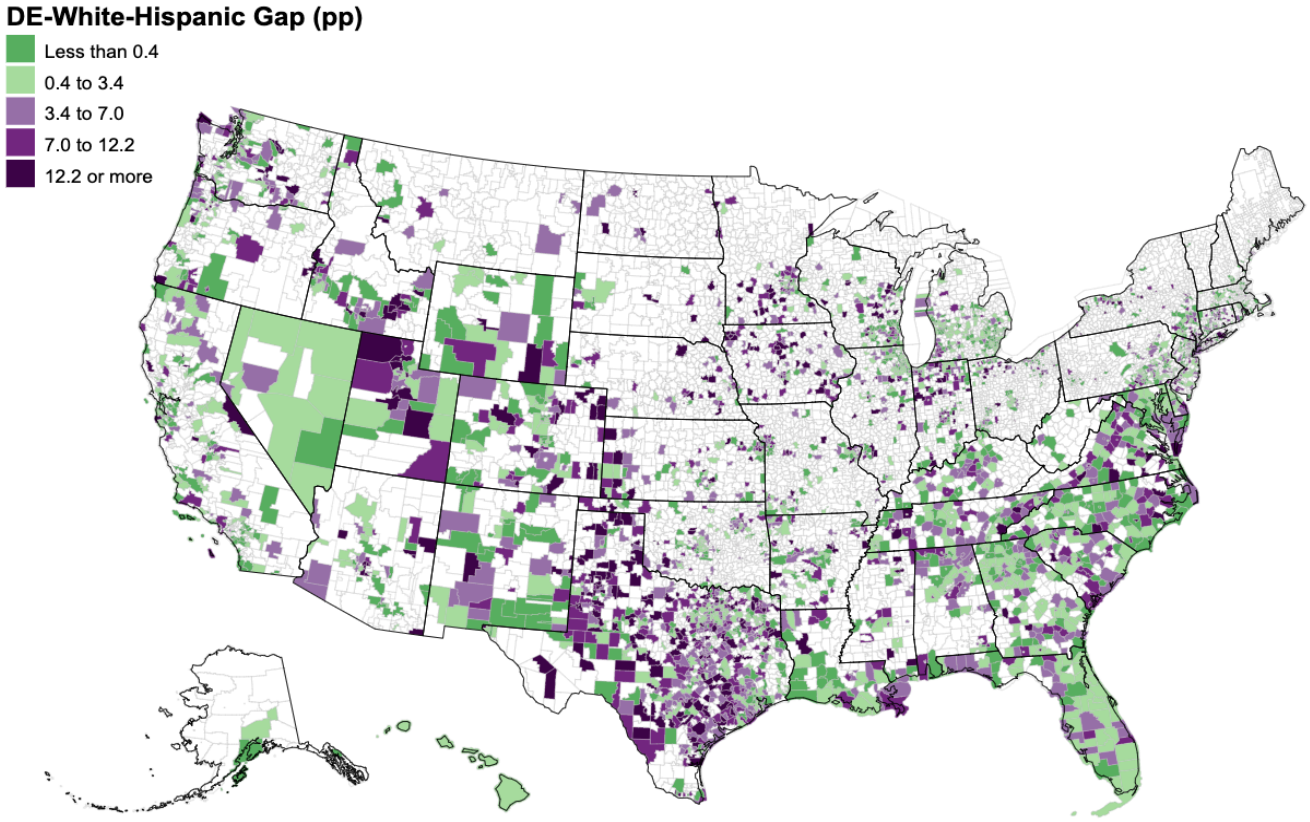


Figure 9 (cont.)
Quintile Maps of District Racial/Ethnic Gaps in AP and DE Participation





4.2.2. Metro Areas

Table 4 shows summary statistics for racial/ethnic equity gaps in AP and DE participation among metro areas. For AP participation, the average metro area gaps were larger at 6.6 and 4.5 percentage points for the White-Black and White-Hispanic gaps, respectively. The average metro area had 4.2 and 3.6 percentage points gaps in DE participation between White students and Black and Hispanic students, respectively. This table shows similar patterns in metro area gaps to that of the district gaps (Table 3) in that there is substantial variation across metros in the size of gaps, though the racial/ethnic gaps in AP participation are consistently larger than those in DE participation. Figure 10 shows the distribution of metro areas in terms of the White-Black and White-Hispanic percentage point gaps in AP and DE participation. Similar to the distribution of district gaps (Figure 6), Figure 10 shows that for the majority of metro areas there are sizable racial/ethnic gaps in both AP and DE participation, though there are more metro areas with non-zero or favorable gaps in DE participation than in AP participation.

Table 4
Summary Statistics for AP and DE Participation Rate Gaps Among Metro Areas

	N Metros	*M*	*SD*	25th Percentile	Median	75th Percentile
Advanced Placement participation gaps						
White-Black gap	757	0.066	0.066	0.027	0.066	0.108
White-Hispanic gap	858	0.045	0.062	0.007	0.045	0.081
Dual enrollment participation gaps						
White-Black gap	763	0.042	0.065	0.009	0.038	0.076
White-Hispanic gap	861	0.036	0.061	0.005	0.030	0.064

Figure 10
Distribution of Racial/Ethnic Gaps in AP and DE Participation Among Metro Areas

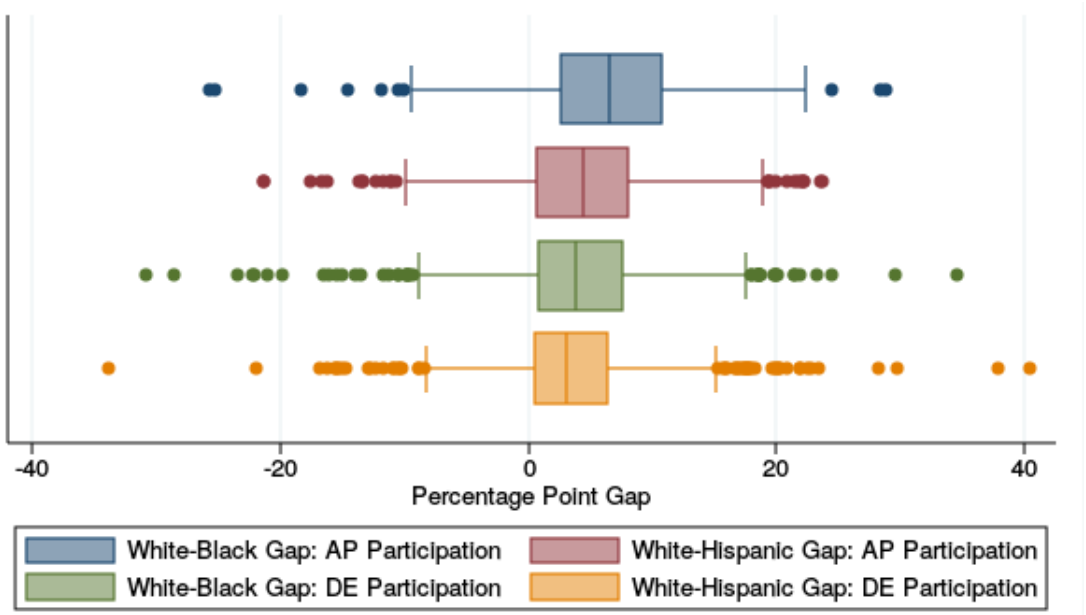


Figure 11 displays the top and bottom 20 metro areas nationally in terms of the size of their White-Black or White-Hispanic gap in AP and DE participation. To geographically represent where in the United States metro areas have larger and smaller racial/ethnic gaps, Figure 12 presents choropleth maps of district White-Black and White-Hispanic gaps in AP and DE participation rates. These maps show metro areas using a similar color scheme as Figure 9, allowing readers to compare participation rate gaps within and across each map to gauge areas of larger and smaller White-Black and White-Hispanic gaps in AP and DE participation.[13] Readers are encouraged to look at both the maps showing participation rates generally (e.g., Appendix Figure A6) and gaps specifically. For example, there are some metro areas in California and Florida that have more favorable racial/ethnic gaps for DE participation compared to AP, but these areas have much higher rates of AP participation overall.

[13] Note that the four maps presented in Figure 9 use a slightly different scale as the four maps presented in Figure 6, as the scale is determined by the quintiles of gaps among metro areas and districts independently.

Figure 11
Percentage Point Racial/Ethnic Gaps in AP and DE Participation: Top and Bottom 20 Metro Areas

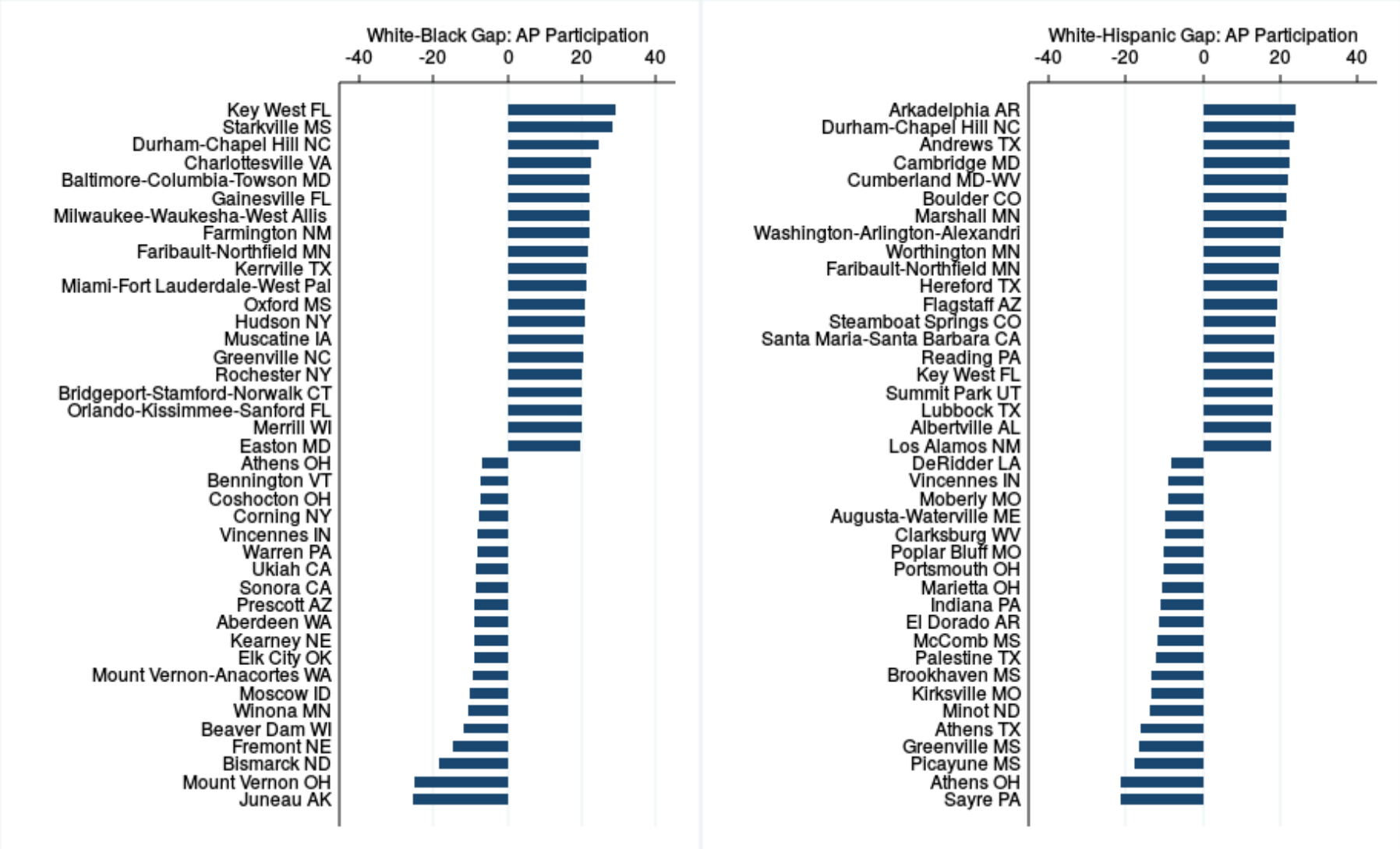


Figure 11 (cont.)
Percentage Point Racial/Ethnic Gaps in AP and DE Participation: Top and Bottom 20 Metro Areas

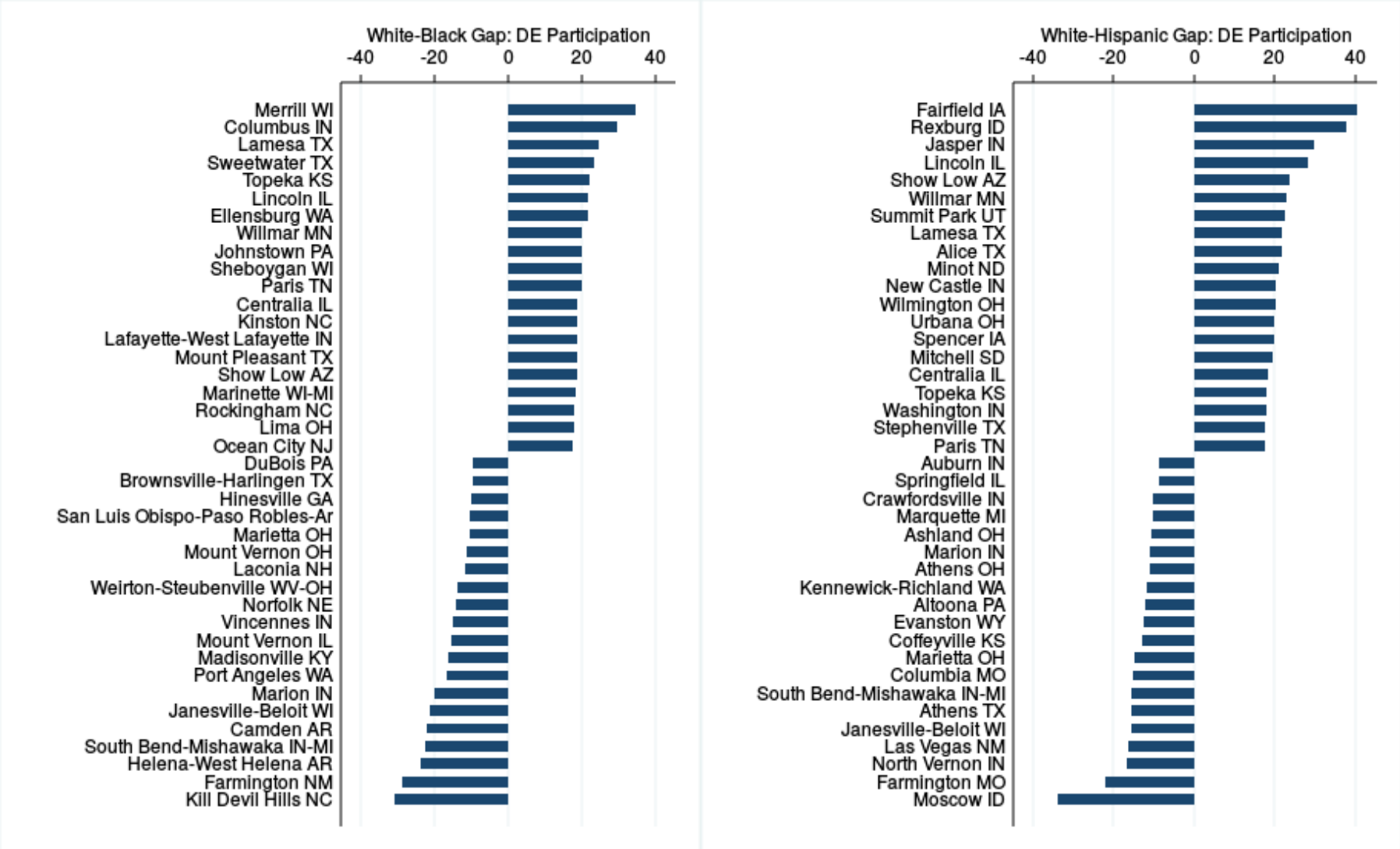
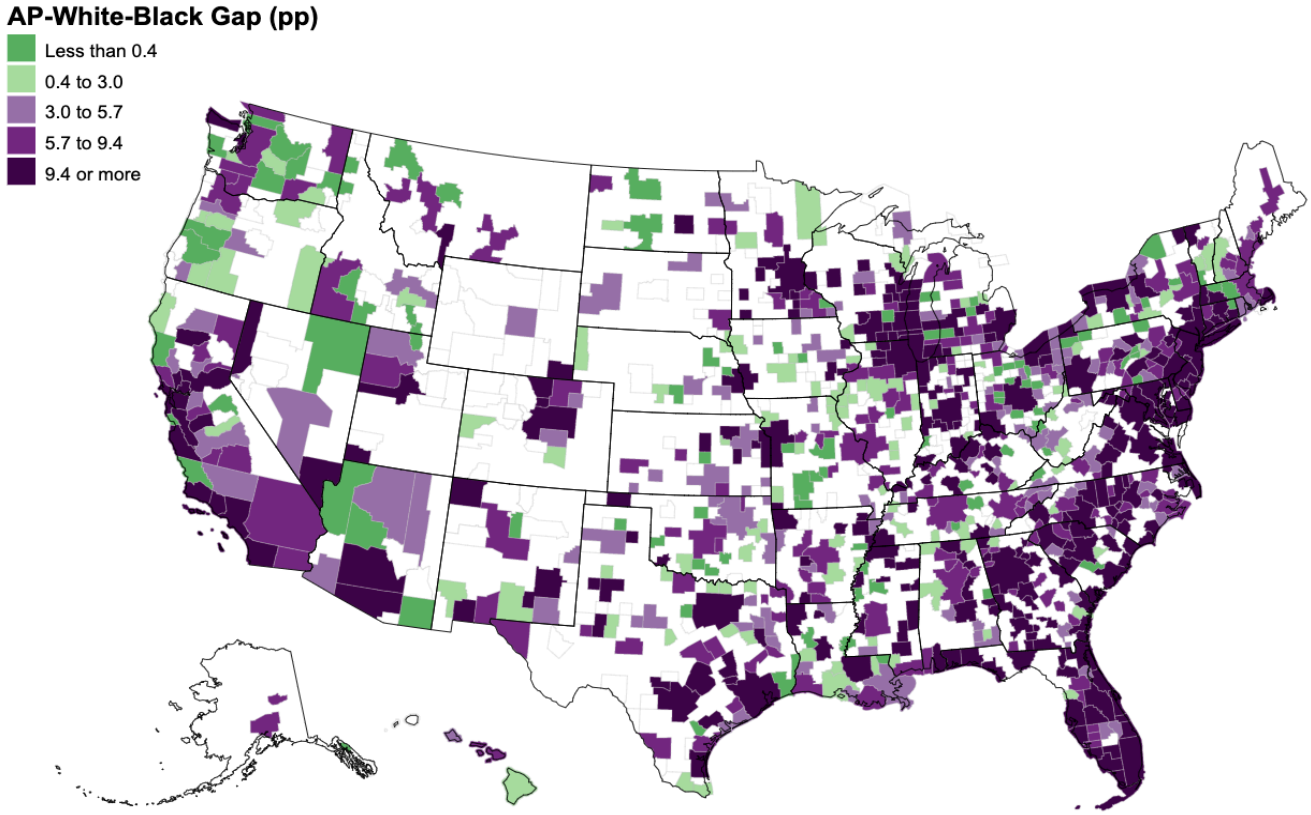


Figure 12
Quintile Maps of Metro Area Racial/Ethnic Gaps in AP and DE Participation



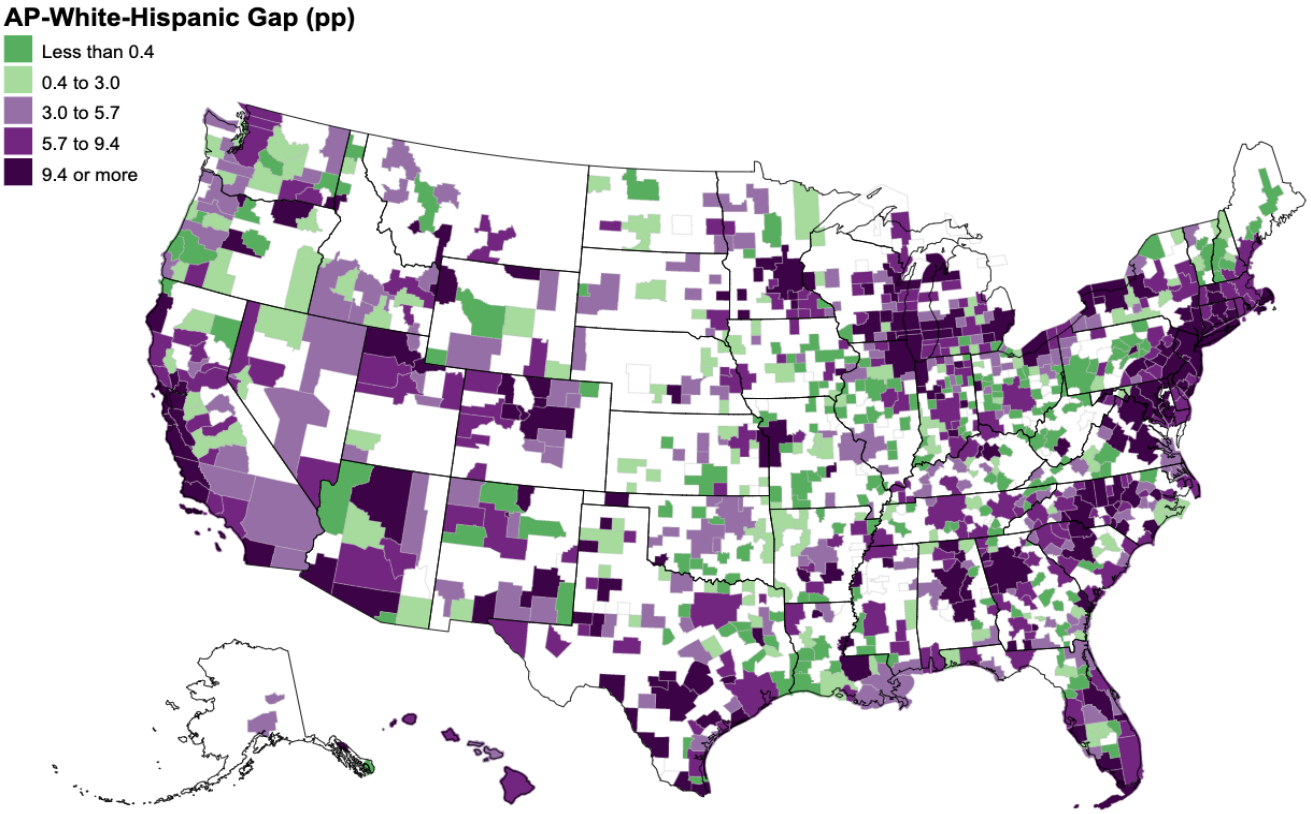
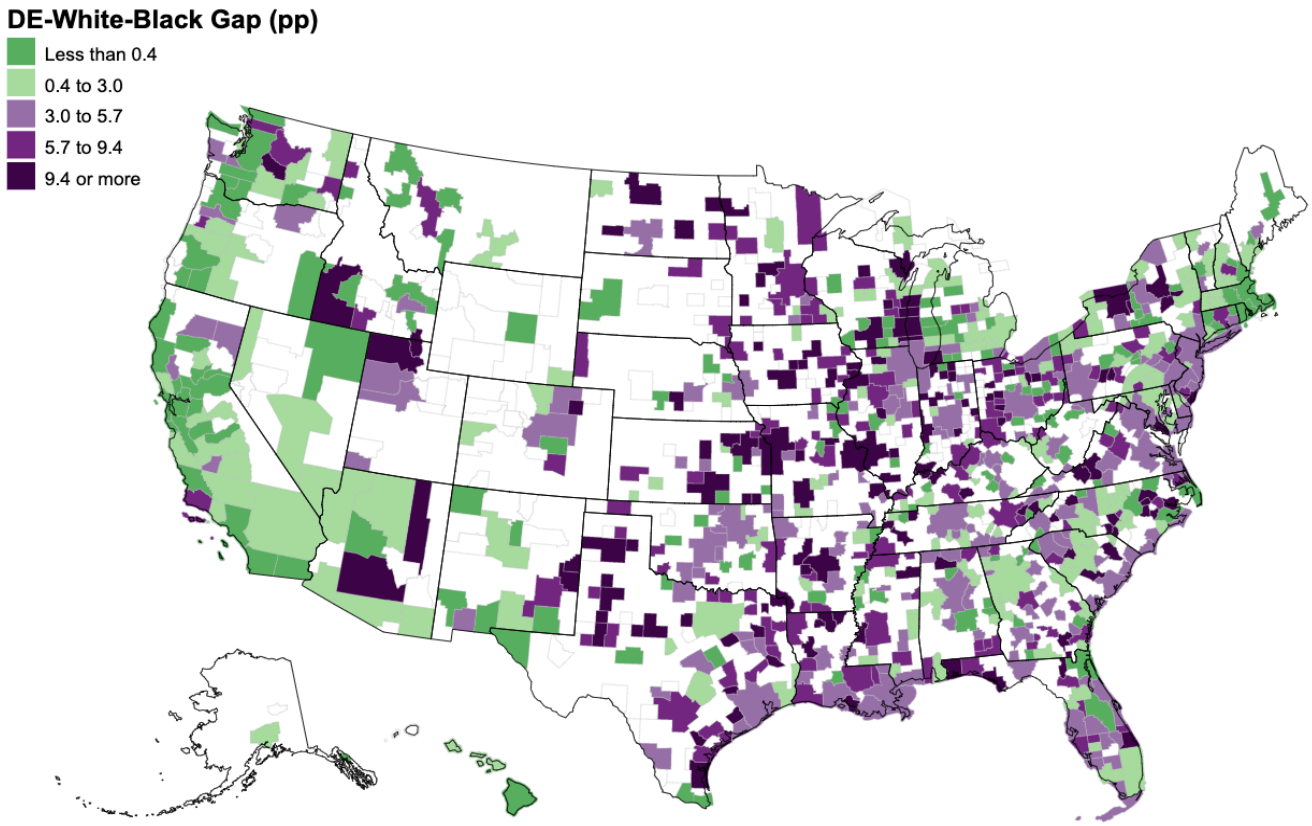
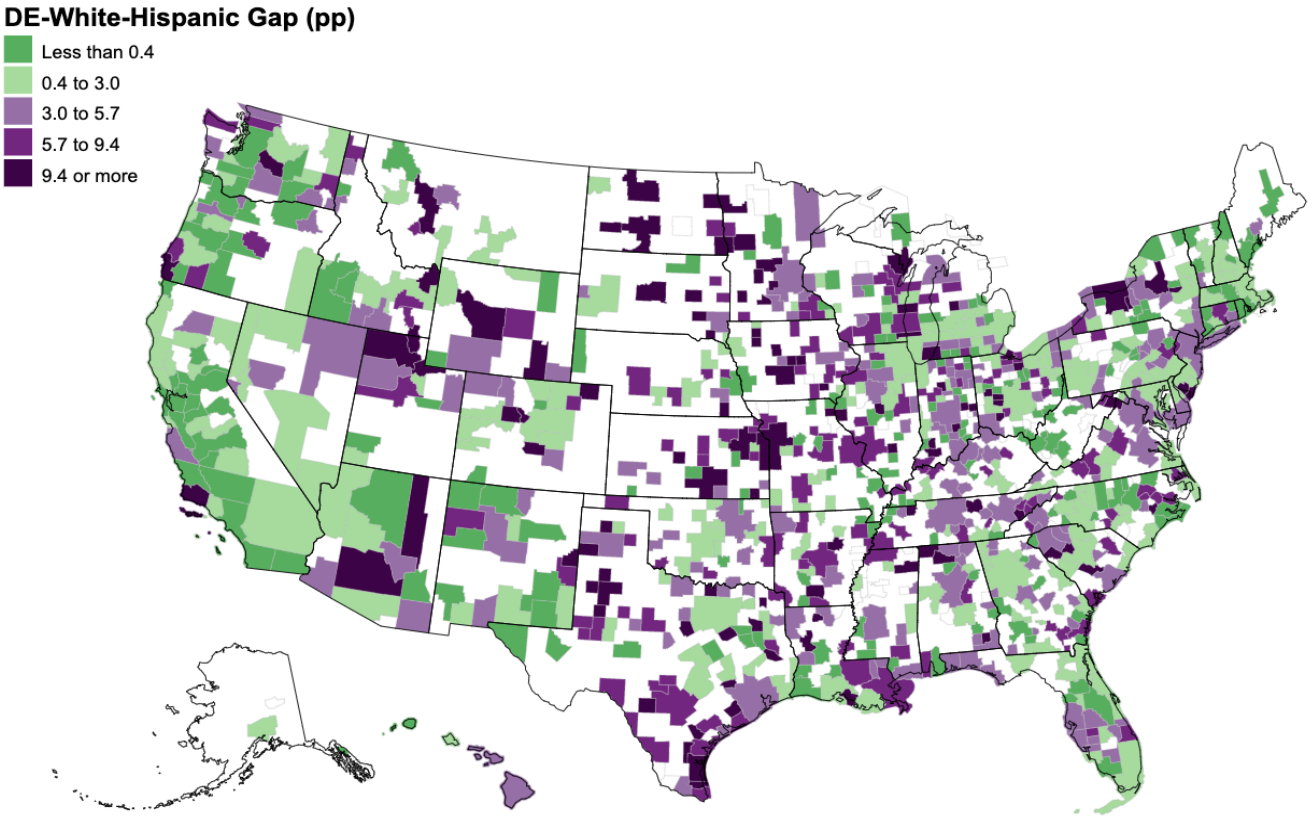


Figure 12 (cont.)
Quintile Maps of Metro Area Racial/Ethnic Gaps in AP and DE Participation





4.3 Correlates of AP and DE Participation

4.3.1. Variance Components

In view of the substantial variation in AP and DE participation, as well as the racial/ethnic gaps shown above, we further use a number of explanatory variables, at both the district level and state level, to predict participation rates and racial/ethnic gaps using multilevel multivariate regressions. As discussed above in section 3.3, these variables are grouped into three broad categories: (1) home resources and neighborhood environments, (2) schooling experiences and AP/DE opportunities, and (3) state-level policies.[14] We first begin with an unconditional means model to understand the variance components—variations in our outcome measures between states and among districts within states. Results presented in column 1 of Table 5 indicate that the variations in AP and DE enrollment, as well as the racial/ethnic gaps in participation in these programs, are concentrated within states rather than between states. Specifically, only 16 percent and 15 percent of the variation in AP and DE enrollment, respectively, is due to differences between states, and even a smaller proportion of the racial/ethnic gaps in AP and DE is due to between-state differences.

Next, we include state-level and district-level variables listed in Appendix Table A3 in the fully conditional multilevel multivariate regression model, and present the proportion of variance explained by state-level and district-level predictors in column 2 and column 3 of Table 5, respectively, for each of our outcome measures. The results reveal two interesting patterns. First, state-level predictors generally explain a large proportion of between-state variation in all outcome measures. This is not surprising,

[14] We also include a pairwise correlation table, Appendix Table A5, which shows the relationship between explanatory variables listed in Appendix Table A3 and AP and DE enrollment. Results from Appendix Table A5 show key differences in the patterns of which covariates are correlated with AP and DE enrollment. AP enrollment is larger in districts with greater proportions of more affluent, educated adults. This is not the case for DE enrollment. In fact, the correlation coefficients are negative and much smaller in magnitude. The White-Black and White-Hispanic free lunch disparity is also correlated with AP enrollment. Again, the relationship is different for DE enrollment; in districts with larger White-Black and White-Hispanic free lunch disparity, AP enrollment is smaller whereas it is larger in terms of DE enrollment. Prior achievement level also seems to matter, particularly for AP enrollment—larger numbers of students enroll in AP in districts with higher levels of prior achievement. Lastly, among all of the variables we included, the average number of AP courses offered in a district is correlated most strongly with AP enrollment.

considering that there are relatively small between-state variations in AP and DE participation to begin with. For AP enrollment, in particular, state-level policies account for 82 percent of the between-state differences. Second, at the district level, where the majority of the variation in the outcome measures comes from, district-level variables are able to account for a noticeably larger variation in AP than DE enrollment. Specifically, district-level predictors explain nearly 50 percent of the variation in AP enrollment, 26 percent of the variation in the White-Black AP enrollment gap, and 18 percent of the variation in the White-Hispanic AP enrollment gap. For DE enrollment and related racial/ethnic gaps, in contrast, the variations that can be explained by district-level predictors range between 2 to 4 percent. Similar patterns are also observed for between-state variations, where state-level predictors account for more variation at the state level for AP enrollment than they do for DE enrollment.

Table 5
Variance Components

	Unconditional Model: Interclass Correlation Coefficient	Fully Conditional Model [Proportion of Variance Explained by Covariates]	
	(1)	(2)	(3)
		State-Level	District-Level
Panel A. District-level analysis			
AP enrollment	0.164	0.823	0.495
DE enrollment	0.150	0.449	0.021
White-Black AP enrollment gap	0.051	0.253	0.263
White-Black DE enrollment gap	0.091	0.404	0.027
White-Hispanic AP enrollment gap	0.056	0.638	0.182
White-Hispanic DE enrollment gap	0.056	0.246	0.037
Panel B. Metro-level analysis			
AP enrollment	0.244	0.595	0.476
DE enrollment	0.291	0.369	0.060
White-Black AP enrollment gap	0.206	0.680	0.285
White-Black DE enrollment gap	0.084	0.652	0.041
White-Hispanic AP enrollment gap	0.189	0.760	0.249
White-Hispanic DE enrollment gap	0.066	0.700	0.035

4.3.2. AP and DE Participation in General

Table 6 presents the results from the multilevel multivariate regressions that use state-level and local-level (either district-level or metro-level) variables to predict AP and DE enrollment. Columns 1 and 2 include district-level enrollment as the outcome variable, while columns 3 and 4 present results on metro-level enrollment. The results reveal three general patterns. First, consistent with the variance decomposition shown in Table 5, explanatory variables generally have stronger predictive power for AP enrollment than for DE enrollment. For example, among the variables categorized as *home resources and neighborhood environments*, the proportion of students receiving free lunches is negatively associated with both district-level and metro-level AP enrollment. Specifically, a 10 percentage point increase in the number of students receiving free lunches in schools is associated with a 0.5 and 1.1 percentage point decrease in AP enrollment at the district and metro level, respectively.[15] In contrast, this variable is not significantly correlated with DE enrollment at either the district level or the metro level.

Second, there are a number of cases where the local-level variables are associated with both AP and DE enrollment, but in opposite directions. For example, both average student-teacher ratio and per-pupil instructional expenditures are positively correlated with AP enrollment but negatively correlated with DE enrollment, although the sizes of the effects are fairly small. In a similar vein, the average number of AP courses offered at a school are associated with a higher participation rate in AP programs but are negatively associated with DE enrollment. These patterns suggest that AP and DE programs may serve as substitutes for each other when schools are allocating resources among different college acceleration programs.

Lastly, among the state-level variables, having strong accountability mandates seems to be the most important predictor for AP and DE participation—districts in states with strong accountability measures and mandates for access to AP or DE programs are associated with higher AP or DE enrollment rates than states without or with weak accountability. Additionally, states that offer strong financial incentives for AP participation have higher AP enrollment rates than states without or with weak financial incentives.

[15] Coefficients have been converted so that one unit is equal to a 10 percentage point change.

Table 6
Regression Estimates Predicting AP and DE Enrollment

	District Level		Metro Level	
	AP Program	DE Program	AP Program	DE Program
	(1)	(2)	(3)	(4)
Mean	0.11	0.113	0.136	0.115
Home resources and neighborhood environments				
SES composite variable	0.004*	-0.005	-0.002	0.020*
	(0.002)	(0.003)	(0.007)	(0.011)
Proportion receiving free lunches in public schools	-0.046***	0.001	-0.113***	0.034
	(0.010)	(0.017)	(0.029)	(0.046)
Schooling experiences and AP/DE opportunities				
Racial/ethnic composition				
Proportion Black in district/metro	0.055***	-0.027**	0.035*	0.031
	(0.007)	(0.011)	(0.020)	(0.032)
Proportion Hispanic in district/metro	0.041***	0.005	0.032*	-0.008
	(0.007)	(0.011)	(0.016)	(0.026)
Proportion of Hispanics who speak English well	---	---	-0.065*	-0.074
	---	---	(0.036)	(0.058)
Racial/ethnic socioeconomic disparities				
White-Black gap in SES composite	---	---	0.001	0.003*
	---	---	(0.001)	(0.002)
White-Hispanic gap in SES composite	---	---	0.003**	-0.003
	---	---	(0.002)	(0.002)
Segregation				
Between-school segregation, White-Black	0.006	0.012	0.048	-0.015
	(0.017)	(0.027)	(0.030)	(0.048)
Between-school segregation, White-Hispanic	0.025	-0.044	-0.055	-0.059
	(0.023)	(0.036)	(0.045)	(0.072)
Between-school free lunch/not free lunch segregation	0.006	0.011	0.088***	-0.124**
	(0.012)	(0.019)	(0.034)	(0.054)
School characteristics				
Average student-guidance counselor ratio	-0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Average student-teacher ratio	0.001***	-0.001**	0.000	-0.001**
	(0.000)	(0.000)	(0.000)	(0.000)
Per-pupil instructional expenditures	0.000***	-0.000***	-0.000	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
White-Black student-teacher ratio difference	-0.000	0.000*	0.000	0.001
	(0.000)	(0.000)	(0.001)	(0.002)
White-Black free lunch difference	0.018*	-0.011	-0.058	-0.024
	(0.010)	(0.017)	(0.047)	(0.074)
White-Hispanic student-teacher ratio difference	-0.000	0.001**	0.000	-0.002
	(0.000)	(0.000)	(0.001)	(0.002)
White-Hispanic free lunch difference	0.031*	-0.029	0.088	0.092
	(0.018)	(0.028)	(0.063)	(0.100)

	District Level		Metro Level	
	AP Program	DE Program	AP Program	DE Program
	(1)	(2)	(3)	(4)
Prior achievement				
Average achievement, all	0.023***	0.016***	0.019***	0.006
	(0.002)	(0.003)	(0.005)	(0.009)
Other factors				
Distance to nearest public institution	-0.000	-0.000	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Average number of AP courses offered	0.009***	-0.002***	0.008***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.001)
State-level policies				
Advanced Placement				
Accountability/mandate: Access–moderate	0.001	---	-0.009	---
	(0.009)	---	(0.009)	---
Accountability/mandate: Access–strong	0.030***	---	0.026**	---
	(0.011)	---	(0.012)	---
Accountability/mandate: Student outcomes–yes	0.003	---	-0.001	---
	(0.010)	---	(0.011)	---
Financial incentives/support–moderate	0.014	---	0.004	---
	(0.013)	---	(0.014)	---
Financial incentives/support–strong	0.024*	---	0.016	---
	(0.014)	---	(0.015)	---
Dual enrollment				
Accountability/mandate: Access–moderate	---	0.030	---	0.029
	---	(0.019)	---	(0.019)
Accountability/mandate: Access–strong	---	0.063***	---	0.056***
	---	(0.019)	---	(0.020)
Accountability/mandate: Student outcomes–moderate	---	0.001	---	0.016
	---	(0.018)	---	(0.016)
Accountability/mandate: Student outcomes–strong	---	-0.028	---	0.001
	---	(0.018)	---	(0.017)
Who pays–local decision	---	-0.021	---	-0.024
	---	(0.019)	---	(0.020)
Who pays–other	---	-0.022	---	-0.033*
	---	(0.020)	---	(0.020)
Average tuition				
Mean tuition in state–4-year colleges	0.000	-0.000**	0.000	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
Mean tuition in state–2-year colleges	-0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
N	8,775	8,775	851	851

Note. Whopays–parent is the reference group. Whopays–other includes school district, state, or a combination of parent and district/state. Policy–weak is the reference group. Proportion of Hispanics who speak English well is based on self-reporting.

*$p < .1$. **$p < .05$. ***$p < .01$.

4.3.3. Racial/Ethnic Gaps in AP and DE Participation

Tables 7 and 8 present results from the regression model that use available state-level and local-level variables to predict racial/ethnic gaps in AP and DE participation. Table 7 presents the results for White-Black enrollment gaps and Table 8 presents the results for White-Hispanic gaps. Although the estimates are not always consistent between Tables 7 and 8, they reveal three general patterns. First, districts with higher poverty levels—measured as proportions of students receiving a free lunch—and greater proportions of minoritized students—measured as proportions of Black and Hispanic students—are generally associated with wider racial/ethnic gaps in AP and DE participation.[16] Using White-Black AP and DE enrollment gaps at the district level as an example, a 10 percentage point increase in the proportion of Black students at the district level is associated with a 1.2 and 0.3 percentage point increase in the White-Black AP and DE gap respectively (Table 7, columns 1 and 2).[17] The point estimates increase in magnitude when we restrict the sample to include only school districts with above-median AP and DE enrollment, that is, districts with the greatest AP and DE opportunities (Appendix Table A6). The same pattern holds for White-Hispanic enrollment gaps in AP and DE participation (Table 8). In a similar vein, greater racial/ethnic disparity in eligibility for free lunch is also associated with wider racial/ethnic gaps in AP and DE enrollment.

Lastly, the patterns we find between state-level policies and racial/ethnic gaps in AP and DE enrollment is less clear than the patterns on overall participation rates discussed in section 4.3.2. For the most part, state-level policies are not consistently associated with White-Black enrollment gaps across the district- and metro-level analysis. For example, states with strong financial incentives and supports have larger White-Black AP participation gaps than states with weak supports, but the point estimates are statistically significant at the metro-level only. For White-Hispanic gaps, states with strong accountability measures for access to AP have smaller gaps by approximately 2 percentage points, compared to states with weak accountability measures. Yet, having a moderate or strong accountability policy for access to DE programs is associated with wider White-Hispanic DE enrollment gaps.

[16] It is important to note that the point estimates are larger for racial/ethnic gaps in AP enrollment than in DE enrollment. This echoes the findings from section 4.3.2.—explanatory variables are more closely related to AP enrollment.

[17] Coefficients have been converted so that one unit is equal to a 10 percentage point change.

Table 7
Regression Estimates Predicting White-Black Participation Gap

	District-Level		Metro-Level	
	AP Program	DE Program	AP Program	DE Program
	(1)	(2)	(3)	(4)
Mean	0.098	0.046	0.066	.041
Home resources and neighborhood environments				
SES composite variable	0.003	-0.002	-0.009	0.036***
	(0.004)	(0.004)	(0.008)	(0.009)
Proportion receiving free lunches in public schools	0.015	0.048***	-0.055*	0.052
	(0.020)	(0.018)	(0.031)	(0.037)
Schooling experiences and AP/DE opportunities				
Racial/ethnic composition				
Proportion Black in district/metro	0.118***	0.026**	0.083***	0.044*
	(0.011)	(0.011)	(0.022)	(0.026)
Proportion Hispanic in district/metro	0.065***	-0.007	0.057***	0.032
	(0.012)	(0.012)	(0.019)	(0.021)
Proportion of Hispanics who speak English well	---	---	-0.053	-0.042
	---	---	(0.041)	(0.050)
Racial/ethnic socioeconomic disparities				
White-Black gap in SES composite	---	---	0.004***	0.002
	---	---	(0.001)	(0.002)
White-Hispanic gap in SES composite	---	---	0.005***	-0.003
	---	---	(0.002)	(0.002)
Segregation				
Between-school segregation, White-Black	-0.082**	-0.097***	0.015	-0.020
	(0.036)	(0.032)	(0.035)	(0.042)
Between-school segregation, White-Hispanic	0.028	-0.012	-0.078	0.008
	(0.056)	(0.046)	(0.049)	(0.060)
Between-school free lunch/not free lunch segregation	-0.010	-0.003	-0.029	-0.038
	(0.031)	(0.028)	(0.037)	(0.044)
School characteristics				
Average student-guidance counselor ratio	-0.000*	0.000***	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Average student-teacher ratio	-0.001***	-0.001*	-0.000	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)
Per-pupil instructional expenditures	0.000***	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
White-Black student-teacher ratio difference	0.000	0.000	-0.001	0.002*
	(0.000)	(0.000)	(0.001)	(0.001)
White-Black free lunch difference	0.316***	0.121**	0.095*	0.083
	(0.061)	(0.051)	(0.054)	(0.065)
White-Hispanic student-teacher ratio difference	0.001	0.001	0.002	-0.003*
	(0.001)	(0.001)	(0.001)	(0.002)
White-Hispanic free lunch difference	0.058	-0.056	0.123*	-0.070
	(0.075)	(0.057)	(0.069)	(0.084)

	District-Level		Metro-Level	
	AP Program	DE Program	AP Program	DE Program
	(1)	(2)	(3)	(4)
Prior achievement				
Average achievement, all	0.025***	0.013***	0.022***	-0.001
	(0.003)	(0.003)	(0.006)	(0.007)
Other factors				
Distance to nearest public institution	-0.000*	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Average number of AP courses offered	0.004***	-0.001***	0.005***	-0.002***
	(0.000)	(0.000)	(0.001)	(0.001)
State-level policies				
Advanced Placement				
Accountability/mandate–medium	0.001	---	-0.003	---
	(0.008)	---	(0.008)	---
Accountability/mandate–strong	0.010	---	0.012	---
	(0.010)	---	(0.010)	---
Financial incentives/support–medium	-0.004	---	-0.015	---
	(0.010)	---	(0.010)	---
Financial incentives/support–strong	0.010	---	0.029**	---
	(0.015)	---	(0.013)	---
Student outcomes	0.011	---	0.023	---
	(0.016)	---	(0.015)	---
Dual enrollment				
Accountability/mandate: Access–moderate	---	0.015	---	0.009
	---	(0.011)	---	(0.011)
Accountability/mandate: Access–strong	---	0.016	---	0.014
	---	(0.011)	---	(0.011)
Accountability/mandate: Student outcomes–moderate	---	0.002	---	0.009
	---	(0.009)	---	(0.009)
Accountability/mandate: Student outcomes–strong	---	-0.006	---	0.007
	---	(0.010)	---	(0.010)
Who pays–local decision	---	-0.014	---	0.003
	---	(0.010)	---	(0.010)
Who pays–other	---	-0.026**	---	0.005
	---	(0.011)	---	(0.010)
Average tuition				
Mean tuition in state–4-year colleges	-0.000	-0.000**	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Mean tuition in state–2-year colleges	0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
N	3,103	2,718	733	738

Note. Whopays–parent is the reference group. Whopays–other includes school district, state, or a combination of parent and district/state. Policy–weak is the reference group. Empty cells indicate large missing values for the covariate. Proportion of Hispanics who speak English well is based on self-reporting.

*p < .1. **p < .05. ***p < .01.

Table 8
Regression Estimates Predicting White-Hispanic Participation Gap

	District-Level		Metropolitan-Level	
	AP Program	DE Program	AP Program	DE Program
	(1)	(2)	(3)	(4)
Mean	0.069	0.041	0.045	0.035
Home resources and neighborhood environments				
SES composite variable	0.002	-0.014***	0.000	0.009
	(0.004)	(0.004)	(0.007)	(0.008)
Proportion receiving free lunches in public schools	-0.041**	-0.052***	-0.117***	-0.028
	(0.017)	(0.018)	(0.030)	(0.034)
Schooling experiences and AP/DE opportunities				
Racial/ethnic composition				
Proportion Black in district/metro	0.096***	0.028**	0.074***	0.066***
	(0.011)	(0.012)	(0.021)	(0.025)
Proportion Hispanic in district/metro	0.088***	0.067***	0.109***	0.061***
	(0.009)	(0.010)	(0.016)	(0.018)
Proportion of Hispanics who report speaking well	---	---	-0.051	-0.047
	---	---	(0.038)	(0.045)
Racial/ethnic socioeconomic disparities				
White-Black gap in SES composite	---	---	-0.000	-0.001
	---	---	(0.001)	(0.001)
White-Hispanic gap in SES composite	---	---	0.006***	0.000
	---	---	(0.002)	(0.002)
Segregation				
Between-school segregation, White-Black	-0.056**	-0.038	-0.037	-0.005
	(0.026)	(0.027)	(0.032)	(0.038)
Between-school segregation, White-Hispanic	0.025	-0.057	-0.008	0.051
	(0.050)	(0.052)	(0.048)	(0.057)
Between-school free lunch/not free lunch segregation	-0.044	0.015	-0.015	-0.048
	(0.030)	(0.031)	(0.035)	(0.039)
School characteristics				
Average student-guidance counselor ratio	-0.000	-0.000	-0.000	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Average student-teacher ratio	-0.000	-0.001***	0.000	-0.001**
	(0.000)	(0.000)	(0.000)	(0.000)
Per-pupil instructional expenditures	0.000***	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
White-Black student-teacher ratio difference	0.000	-0.000	-0.002	-0.001
	(0.000)	(0.000)	(0.001)	(0.001)
White-Black free lunch difference	0.022	-0.056**	0.065	-0.010
	(0.032)	(0.027)	(0.050)	(0.059)
White-Hispanic student-teacher ratio difference	0.000	-0.000	0.002	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
White-Hispanic free lunch difference	0.413***	0.127**	0.147**	-0.002
	(0.059)	(0.060)	(0.066)	(0.077)

	District-Level		Metropolitan-Level	
	AP Program	DE Program	AP Program	DE Program
	(1)	(2)	(3)	(4)
Prior achievement				
Average achievement, all	0.010***	0.010***	0.004	0.004
	(0.003)	(0.003)	(0.005)	(0.006)
Other factors				
Distance to nearest public institution	0.000	0.000***	0.000	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
Average number of AP courses offered	0.002***	-0.001***	0.003***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.001)
State-level policies				
Advanced Placement				
Accountability/mandate–adequate	-0.008	---	-0.019***	---
	(0.006)	---	(0.007)	---
Accountability/mandate–strong	-0.021***	---	-0.018**	---
	(0.008)	---	(0.009)	---
Financial incentives/support–adequate	-0.001	---	0.001	---
	(0.008)	---	(0.009)	---
Financial incentives/support–strong	0.011	---	0.015	---
	(0.011)	---	(0.011)	---
Student outcomes	0.018	---	0.025**	---
	(0.011)	---	(0.012)	---
Dual enrollment				
Accountability/mandate: Access–moderate	---	0.018*	---	0.017*
	---	(0.009)	---	(0.010)
Accountability/mandate: Access–strong	---	0.018*	---	0.016*
	---	(0.010)	---	(0.009)
Accountability/mandate: Student outcomes–moderate	---	-0.003	---	-0.002
	---	(0.008)	---	(0.008)
Accountability/mandate: Student outcomes–strong	---	-0.010	---	-0.006
	---	(0.009)	---	(0.009)
Who pays–local decision	---	-0.004	---	0.001
	---	(0.009)	---	(0.009)
Who pays–other	---	-0.019**	---	-0.004
	---	(0.009)	---	(0.009)
Average tuition				
Mean tuition in state–4-year colleges	0.000	-0.000*	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Mean tuition in state–2-year colleges	-0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
N	4,025	3,605	805	808

Note. Whopays–parent is the reference group. Whopays–other includes school district, state, or a combination of parent and district/state. Policy–weak is the reference group. Empty cells indicate large missing values for the covariate. Proportion of Hispanics who speak English well is based on self-reporting.

*$p < .1$. **$p < .05$. ***$p < .01$.

5. Discussion and Conclusion

This study takes advantage of recently available data from the U.S. Department of Education's Civil Rights Data Collection to provide a national perspective on racial/ethnic gaps in participation in two major programs intended to help high school students get a jump start on college. Our findings reveal substantial variation among school districts and metropolitan areas, within and across states, both in overall participation in AP and DE coursework during high school and in racial/ethnic gaps in participation. Our study also attempts to explain possible sources of variation by using a multilevel multivariate regression model to identify local-level characteristics and state-level policies correlated with both overall participation and racial/ethnic gaps in AP and DE course-taking.

5.1. Key Findings About AP and DE Enrollment Patterns

Several key findings emerge from our descriptive analyses of AP and DE enrollment patterns. First, the racial/ethnic gaps in general are higher in AP than in DE programs. For example, the average district White-Black gap in AP participation (9.8 percentage points) is more than twice as large as the White-Black gap in DE participation (4.7 percentage points). Among the thousands of districts examined, only a small proportion have a close to zero (i.e., less than 1 percentage point) or a negative White-Black AP participation gap. Our descriptive findings identify several dozen districts and metro areas with notably large gaps while others have negative gaps (see Figures 8 and 11), both of which could potentially be explored in more detail in future research as case studies.

Second, we also observe that districts and metro areas with higher rates of participation in AP and DE overall are generally more likely to have larger racial/ethnic gaps in participation. For example, participation in AP coursework in the District of Columbia (DC) metro area (Washington-Arlington-Alexandria), which enrolls more than 250,000 high school students, is 30 percent, which is relatively high compared to metro areas nationwide. Despite the overall high participation, however, there is a noticeable gap between minoritized and White students, where 39 percent of DC-area White students take an AP course compared to 20 percent of Black students and 18 percent of

Hispanic students, leaving White-Black and White-Hispanic gaps of 19 and 21 percentage points, respectively.[18]

Finally, one of the visually striking findings from the maps we constructed that provide a nationwide view on participation in AP and DE courses is the difference in geography between AP and DE participation: AP participation appears to be more prevalent in more coastal and urban areas, whereas DE participation is more prevalent in rural areas in the middle of the country (see Figure 5 and Appendix Figure A6). Figure 5 shows that the between-state differences in overall district participation are also observable in these maps, with states such as Maryland and Florida having consistent strong participation in AP, and others such as Iowa, Utah, Kansas, and New Mexico showing greater participation in DE. The maps showing district and metro racial/ethnic gaps show areas where higher proportions of Black and Hispanic students attend school and participate in AP and DE (Figures 9 and 12). These maps appear to show more of the country geographically covered by districts and metro areas with less favorable AP racial/ethnic gaps compared to DE overall, and less favorable White-Black gaps compared to White-Hispanic gaps (for both AP and DE).

5.2. Key Findings About Correlates of Overall Participation and Racial/Ethnic Gaps

In explaining variation in overall district/metro participation in AP and DE courses as well as racial/ethnic gaps, our results indicate that the majority of the variation appears to be driven by local (either district-level or metro-level) factors rather than state-level factors: Only about 15 percent of the variation in AP and DE enrollment, and less than 10 percent of the variation in racial/ethnic participation gaps, lies between states. In other words, local factors play a dominant role in shaping the district or metro area patterns of participation in college acceleration programs, as well as in gaps in participation between White and minoritized students. One qualification to this finding is that local factors explain about half of the variation in AP enrollment and about a quarter of the variation in AP racial/ethnic gaps, whereas local factors explain only 2 to 4 percent of variation in DE enrollment and gaps (Table 5). This finding warrants further

[18] Readers are directed to https://ccrc.tc.columbia.edu/easyblog/mapping-racial-equity-ap-dual-enrollment.html to look up this study's results for a district or metro area, including other racial/ethnic subgroup participation rates; for instance, 47 percent of Asian students in the DC metro area participate in AP.

investigation. One possible explanation why the variables capturing local factors explain little variation in DE enrollment and gaps is due to the broad definition of participation in DE coursework, which includes a breadth of DE programmatic offerings (e.g., courses taught in high schools, at college campuses, and in career-technical or academic subject areas) relative to the more standardized AP program offerings. For instance, districts with a wider range of course offerings and modalities through DE might also serve a broader swath of students, thereby limiting the ability of our local covariates to capture variation in DE enrollment and gaps.

Further, we identify a handful of local factors that are correlated with AP and DE enrollment in opposite directions, suggesting that schools may view AP and DE as substitutes when allocating resources for college acceleration opportunities. This possibility highlights the importance for future studies to provide rigorous evidence regarding the relative benefits of different college acceleration programs. Additionally, local factors explain a substantially larger portion of variation in AP enrollment and racial/ethnic gaps in AP enrollment as compared to DE enrollment and gaps. Finally, while we do not find strong associations between state-level policy and AP and DE enrollment (or enrollment gaps), there is one notable finding. States with strong policies revolving around accountability have larger AP and DE participation rates than states with weak policies. For AP, these policies include requiring high schools or districts to offer AP courses and including AP course participation and exam success in district reports. Similarly, for DE, these policies also include reporting requirements and policies requiring a high school or district to notify all students and parents of the availability of DE programs (see Appendix Table A4 for a complete list).

When examining the sources of district and metro area racial/ethnic gaps in AP and DE enrollment, results from our multilevel models reveal two interesting patterns. First, local factors that are associated with higher overall program participation, such as larger numbers of AP courses offered, are also associated with larger racial/ethnic gaps in program enrollment. This is consistent with the descriptive results mentioned above in which districts with higher AP and DE participation rates also tend to have larger racial/ethnic gaps in AP and DE enrollment. Indeed, the presence of college acceleration opportunity is required for inequity in such opportunity. In the context of racial/ethnic

discrimination, segregation, and stratification among school districts and metro areas more generally (e.g., Reardon, Kalogrides, & Shores, 2019), it is perhaps unsurprising that places with more college acceleration opportunity also demonstrate greater disparities in participation in such opportunity. More technically, given our definition of gaps in AP and DE participation (participation among White students compared to participation among Black/Hispanic students), higher rates of participation tend to coincide with larger percentage point gaps.[19] This finding adds to existing research showing gaps in access to college acceleration programs based on which types of schools offer such programs (e.g., high-poverty, high-minority; Excel*in*Ed, 2018; GAO, 2018) by further identifying patterns of racial/ethnic inequity within districts that have robust college acceleration offerings. An important implication of such findings is that districts with greater access to college acceleration programs, while achieving strong AP and DE participation overall, may also give rise to greater room for racial/ethnic disparity if inadequate efforts are made to prioritize equitable access to and success in such programs.

Second, another clear predictor of racial/ethnic inequity in AP and DE participation is White-Black and White-Hispanic income disparity, as measured by gaps in free-lunch rates between White and Black/Hispanic students. We find that districts and metro areas with relatively more social stratification along racial/ethnic and economic lines particularly struggle to attain equitable participation in college acceleration programs, and AP course-taking in particular. Though we attempt to explain national variation on these outcomes using a set of state- and local-level factors, we can only offer partial insight into the many mechanisms driving inequitable participation in college acceleration programs. These mechanisms are likely both deeply rooted (e.g., racial/ethnic segregation and discrimination) and specific to school and college practices and policies around access to AP and DE coursework (e.g., eligibility, cost). Further investigation is needed into the mechanisms driving inequitable access to college acceleration programs and how educational leaders and policymakers can counteract these mechanisms.

[19] For example, consider two different districts in which White students participate in AP at twice the rate of Black students. In District A, a higher participation district overall, 30 percent of Black students and 60 percent of White students participate, resulting in a gap of 30 percentage points. In District B, a lower participation district overall, only 5 percent of Black students participate in AP, compared to 10 percent of White students (resulting in a 5 percentage point gap). As this example illustrates, higher participation rates create more risk for inequities.

5.3. Limitations and Caveats

Readers should consider a few limitations of our analyses in interpreting the findings herein. First, although schools and districts have been submitting information about student participation in AP to the CRDC for multiple collection cycles, the addition of DE participation is new for the 2015-16 collection. DE programs and courses are offered in different modalities and taught by both high school and college instructors, compared to AP coursework which is more standardized. Although the CRDC has provided detailed definitions regarding what counts as DE and requires that schools and districts certify the accuracy of their data upon submission, there may still be measurement errors (beyond what may be expected in this type of national administrative data) on the reporting of DE participation, given that 2015-16 was the first year when DE participation became a required element for submission.

Additionally, the broad definition of DE used by the CRDC also prevents us from differentiating between different types of DE programs in this study. Since DE programs vary substantially in multiple dimensions, including course content (e.g., career-technical versus academic content), delivery format (online versus face-to-face), and location (high school versus college), the type of students enrolled in different DE programs may vary considerably. As a result, the ways that various local- and state-level factors predict overall participation and racial/ethnic gaps in DE participation may largely depend on the specific characteristics of particular DE programs. This limitation has important implications for the current analysis. For example, available local- and state-level predictors are only able to explain a fairly small proportion of the variation in DE participation and racial/ethnic gaps, which might be partly due to the heterogeneous nature of DE programs. Therefore, it is critical for future data collection to include detailed information regarding the specific attributes of a DE course or program.

Furthermore, as we describe in section 3.2, we applied a distinct set of restrictions to the CRDC sample to identify the 18,675 eligible schools for this analysis. And, since the primary focus of our paper is on racial/ethnic gaps in AP and DE participation, we had to restrict our sample to districts with at least one racial/ethnic group having a non-zero participation rate. As a result, our findings may not speak to the factors that are

associated with the availability of DE/AP programs in general, especially local factors that lead to complete absence of AP or DE opportunities in a district.

Finally, because the CRDC dataset contains only school-level enrollment counts (rather than grade-level, as is available in CCD), we adjusted the denominator in our AP and DE participation rates for about a quarter of schools that offered 8th grade and below to only include students in grades 9–12, as this was specified in the CRDC instructions for reporting AP and DE participation (further detail is presented in section 3.2). This procedure introduces additional measurement error for a subset of our sample, but without this estimation the AP and DE participation rates in certain high schools offering 8th grade and below would be underestimated.

5.4. Implications for Policy and Practice

Despite the limitations and caveats mentioned above, our analysis provides several important policy implications regarding college acceleration programs. First, given the national scale of our analysis unpacking inequity in participation in the two most prevalent forms of college acceleration in high school, perhaps it is unsurprising that we observe so much variation both in terms of uptake of AP and DE coursework in high school as well as in the extent of racial/ethnic equity gaps. We hope our findings motivate local educational leaders to inquire how their district, college, and/or metro area compares to state and national averages in the percent of high schoolers participating in AP and DE programming as well as the extent of racial/ethnic gaps in participation in these programs. With the addition of DE course-taking information in the 2015-16 CRDC, this public, biennial survey data set is a promising resource for tracking participation in AP and DE with metro-, state-, and national-level benchmarks. And, though we do not report school-level results in this report, we encourage educational leaders to further examine how equitable access to AP and DE is among schools within their districts—which would be particularly useful among larger districts with many high schools. Examining access to AP and DE courses and disaggregating participation rates by student race/ethnicity is critical both in areas with substantial college acceleration programming and in areas with large populations of students of color, as our findings suggest that these areas are more prone to larger racial/ethnic gaps in participation in college acceleration programs.

Second, our findings raise further questions around what school-, district- and state-level policies and practices might support (or inhibit) equitable access to AP and DE courses. Except for state accountability policies that were found to significantly predict overall AP and DE participation rates, our analysis correlating state policies with AP and DE enrollment and racial/ethnic gaps generally yield findings that are both mixed and weak. The lack of strong correlates with state policies we observed might be explained by wide-ranging local practices or policy implementation (i.e., within-state variation) or due to this study's limitation in capturing nuances in state policies. One promising line of future research could work from existing resources documenting state AP and DE policies (ECS, 2016, 2019) and add results from the next CRDC (2017-18 academic year) to further examine the role of state policy in promoting access to AP and DE courses and reducing equity gaps in program participation, including any findings from changes in policy between the 2015-16 and 2017-18 CRDC results.

Finally, though the focus on this study is on participation and access to college acceleration programs, educational leaders and policymakers should also be focused on student success in AP and DE courses, tracking student progression and momentum into and through college. With this study's focus on participation in AP coursework, readers should keep in mind that in order to receive college credit for an AP course, students need to take and receive a qualifying score on an AP test. Previous research, including documentation from the College Board, indicates that there remain racial/ethnic and socioeconomic gaps in AP exam pass rates, even among AP course participants (College Board, 2014). Our study uses a broader definition of participation in AP, counting students as participating if they ever took an AP course. As a result, the racial/ethnic gaps reported in our study are likely to be larger if we were able to also take into account disparities in the number of students who take and pass the AP exam.[20]

Educational leaders should also track and disaggregate the effects of participating in DE on college outcomes, the importance of which was illustrated by a recent study tracking a national cohort of former DE students into and through college after high

[20] The CRDC also includes variables on the number of students who take an AP exam and the number who receive a qualifying score on an AP exam. We focus in this paper on participation in AP coursework, though we encourage further work with this national dataset to explore disparities in reported AP exam uptake and pass rates.

school (Fink, Jenkins, & Yanagiura, 2017). These researchers observed substantial between-state variation not only in rates of college attendance but also in whether former DE students first attended a community college or four-year university after high school and in their likelihood of completing a college credential (Fink, Jenkins, & Yanagiura, 2017). Both in terms of access to and success in these college acceleration programs, the substantial variation in performance observed nationally further underlines the importance of districts and colleges tracking their effectiveness locally.

While we find that the vast majority of districts in this study have racial/ethnic gaps in participation in AP and DE programming, we also find that about one in every five districts have a near-zero or negative equity gap. So what are the districts with relatively high participation in AP and DE and small equity gaps doing to achieve such strong results? A sensible next step would be for researchers, practitioners, and policymakers to collaborate in identifying and documenting the policies and practices among districts (and their partner colleges in the case of DE coursework) that both (1) are highly effective in serving students through these college acceleration programs (controlling for student characteristics and district/college resources) and that (2) achieve strong results without gaps in outcomes between racial/ethnic groups. Although there exists room for improvement in most districts, the variation shown in this study also presents an opportunity to examine and scale innovations to both expand access to college acceleration opportunities and close gaps in participation.

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Appendix

Table A1
Sample Restriction Procedure With Resulting Number of Remaining High Schools

Sample Restriction Step (CRDC/CCD Variable Used)		*N* Remaining Schools
1.	Keep only schools with 11th or 12th Grade (CRDC).	*N* = 25,051
2.	Remove Special Education, Alternative, and Juvenile Justice Schools (CRDC); includes removing schools with the words 'adult' 'behavioral' 'juvenile' 'correction' in the school name (CRDC).	*N* = 20,674
	Merge to CCD directory; remove Non-Matching NCES Schools.	*N* = 20,366
3.	Remove Virtual Schools (CCD); includes removing schools with the words 'virtual', 'cyber', 'electronic', 'internet', 'online', 'distance' in the name.	*N* = 19,983
4.	Remove Elementary, Middle, and Level “Not Applicable” Schools (CCD).	*N* = 19,810
5.	Remove Special Education, Alternative/Other, and "Adult" Schools (CCD).	*N* = 18,675 High Schools *N* = 11,833 Districts *N* = 917 Metro areas

Table A2
Analytic Samples

		Districts		Metros	
Outcome Measure(s)	Description	*N* Districts	*N* Students	*N* Metros	*N* Students
DE & AP participation rate samples	Districts and metros with 20+ enrollment	11,741 (100%)	14,098,228 (100%)	917 (100%)	13,313,214 (100%)
White DE & AP participation rate samples	Districts and metros with 20+ White enrollment	11,017 (94%)	13,862,011 (98%)	914 (99.7%)	13,306,418 (99.9%)
Black DE & AP participation rate samples	Districts and metros with 20+ Black enrollment	4,373 (37%)	11,332,549 (80%)	771 (84%)	13,075,628 (98%)
Hispanic DE & AP participation rate samples	Districts and metros with 20+ Hispanic enrollment	5,834 (50%)	12,312,185 (87%)	877 (96%)	13,254,711 (99.6%)
White-Black DE participation rate gap sample	Districts and metros with: 20+ White enrollment, and 20+ Black enrollment, and either: > 0% White participation in DE, or > 0% Black participation in DE	3,134 (27%)	9,260,290 (66%)	763 (83%)	13,053,199 (98%)
White-Hispanic DE participation rate gap sample	Districts and metros with: 20+ White enrollment, and 20+ Hispanic enrollment, and either: > 0% White participation in DE, or > 0% Hispanic participation in DE	4,211 (36%)	9,966,047 (71%)	861 (94%)	13,214,104 (99%)
White-Black AP participation rate gap sample	Districts and metros with: 20+ White enrollment, and 20+ Black enrollment, and either: > 0% White participation in AP, or > 0% Black participation in AP	3,550 (30%)	10,857,466 (77%)	757 (83%)	13,055,532 (98%)
White-Hispanic AP participation rate gap sample	Districts and metros with: 20+ White enrollment, and 20+ Hispanic enrollment, and either: > 0% White participation in AP, or > 0% Hispanic participation in AP	4,625 (39%)	11,726,685 (83%)	858 (94%)	13,222,443 (99%)

Table A3
Full List of Covariates

Measure	Source
Home resources and neighborhood environments	
Median income	ACS-EDGE, 2012–16
Proportion of adults, aged 25+ with a bachelor's degree or higher	ACS-EDGE, 2012–16
Proportion receiving free lunches in public schools	ACS-EDGE, 2012–16
Single mother-headed household rate	ACS-EDGE, 2012–16
Poverty level	ACS-EDGE, 2012–16
Unemployment rate	ACS-EDGE, 2012–16
Proportion of households receiving SNAP benefits	ACS-EDGE, 2012–16
Schooling experiences and AP/DE opportunities	
Racial/ethnic composition	
Proportion Black in district/metro	CCD
Proportion Hispanic in district/metro	CCD
Proportion of Hispanics who report speaking English well or very well	ACS-EDGE, 2012–16
Racial/ethnic socioeconomic disparities	
White-Black gap in SES composite	SEDA
White-Hispanic gap in SES composite	SEDA
White-Black income gap	SEDA
White-Hispanic income gap	SEDA
White-Black education gap	SEDA
White-Hispanic education gap	SEDA
White-Black single-mother-headed household rate difference	SEDA
White-Hispanic single-mother-headed household rate difference	SEDA
Segregation	
Between-school segregation, White-Black	CCD
Between-school segregation, White-Hispanic	CCD
Between-school free lunch/not free lunch segregation	CCD
School characteristics	
Average student-guidance counselor ratio	CCD
Average student-teacher ratio	CCD
Per-pupil instructional expenditures	CCD
White-Black student-teacher ratio difference	CCD
White-Black free lunch difference	CCD
White-Hispanic student-teacher ratio difference	CCD
White-Hispanic free lunch difference	CCD
Prior achievement	
Average achievement, all	SEDA
Other factors	
Distance to nearest public institution	IPEDS
Average number of AP courses offered	CRDC
State-level policies	
Advanced Placement	ECS
Dual enrollment	ECS

Table A4
AP and DE State Policies: Definition and Category

	Description	Category
Advanced Placement (AP) state policies		
AP participation/success included in high school accountability metrics/reporting	Indicates whether data on AP course and/or exam participation or success is included in district or high school accountability metrics and/or reports.	Accountability/mandate-access
All high schools/districts required to offer AP	Indicates whether states require high schools or districts to offer AP courses.	Accountability/mandate-access
Collaboration on AP between K-12 and higher education systems	Identifies states in which policy mandates or encourages K-12 and higher education entities to collaborate in the development of AP curricula and/or teacher training.	Accountability/mandate-access
State postsecondary institutions must award credit for minimum scores	Indicates whether states must award credit for minimum scores.	Accountability/mandate-access
State financial support for AP course offerings/AP success	Indicates whether states provide funds for (1) start-up costs associated with offering new or expanded AP course offerings, and/or (2) teacher bonuses for students' AP success, and/or (3) student financial rewards for their AP success.	Financial incentives & program support
State programs and funding for teacher training	Indicates whether states require AP teachers to attend College Board-sponsored training, receive special licensure to teach AP courses, or provide funds for AP or pre-AP teachers to receive AP training or professional development.	Financial incentives & program support
State subsidies for testing fees	Indicates whether state (not exclusively school or district) funds are provided to supplement federal and College Board exam fee reductions for low-income students. It also identifies states that are reducing or waiving exam fees for non-low-income students, either generally or for AP exams in certain subject areas such as in science, technology, engineering and math (STEM) disciplines. In spring 2016, the fee for subject-specific AP exams is $92. The College Board provides a $30 fee reduction for low-income students, and high schools typically waive the $9 processing fee for low-income students.	Financial incentives & program support
State support for encouraging access to AP	Identifies state approaches to enhance student access and success in AP coursework, including supports for pre-AP instruction and online course providers affiliated with a state agency that offer AP coursework to students statewide.	Financial incentives & program support
State scholarship criteria include AP scores	Indicates states that require students to achieve minimum scores on one or more AP exams or another college-ready measure to be eligible for merit-based state scholarships.	Accountability/mandate-student outcomes

	Description	Category
Dual enrollment state policies		
Offering is mandatory	This variable indicates whether all high schools and all eligible public postsecondary institutions (two-year and/or four-year, as defined in state policy) in a state are required to provide dual enrollment opportunities.	Accountability/mandate-access
Program reporting requirement	Indicates whether postsecondary institutions (or high school partners) are required to report (to a state agency and/or to the public) on the number, course-taking, demographics, and/or success of students participating in dual enrollment programs.	Accountability/mandate-access
Student eligibility requirements	Indicates that a state does not have student eligibility requirements such as grade-level, academic, or other criteria.	Accountability/mandate-access
Courses offered virtually	Indicates whether state policy specifies where dual enrollment courses may be offered and whether they are offered virtually.	Accountability/mandate-access
Students/parents must be notified of dual enrollment opportunities	Indicates state policy requires a high school or district to notify all students and/or their parents of the availability of dual enrollment programs.	Accountability/mandate-access
Counseling/advising is made available to students	Indicates state policy requires prospective or current dually-enrolled students to receive counseling about participation in dual enrollment programs.	Accountability/mandate-access
Postsecondary and/or secondary credit earned	Indicates whether students in dual enrollment programs earn high school and postsecondary credit.	Accountability/mandate-student outcomes
Students may take developmental/ remedial coursework for dual credit	Indicates whether state policy explicitly allows high school students to access postsecondary developmental/remedial coursework for dual credit.	Accountability/mandate-student outcomes
CTE component	Indicates whether state policy explicitly allows high school students to enroll in career/technical education courses for high school and postsecondary credit.	Accountability/mandate-student outcomes
Cap on number of credits students may earn	Indicates that there is no cap on the number of dual enrollment credits a student may earn: per semester, per school year, or during a student's high school career.	Accountability/mandate-student outcomes
Public postsecondary institutions required to accept credits	Indicates whether public two- and four-year institutions other than the institution at which the student earned postsecondary credit are required to accept postsecondary credits earned through dual enrollment programs.	Accountability/mandate-student outcomes
Who is primarily responsible for paying tuition	Indicates who is primarily responsible for paying students' tuition—the student's family, the district, etc.—or if postsecondary institutions are required to waive tuition for dual enrollment students.	Financial incentives & program support

Source: Education Commission of the States (2016, 2019).

Table A5
Pairwise Correlations Between Enrollment, Enrollment Gaps, and Predictor Variables

	Enrollment		White-Black Gaps		White-Hispanic Gaps	
	AP Program	DE Program	AP Program	DE Program	AP Program	DE Program
	(1)	(2)	(3)	(4)	(5)	(6)
Home resources and neighborhood environments						
Socioeconomic composition						
SES composition	0.301***	0.057***	0.193***	-0.066***	0.162***	-0.026
Median income	0.431***	-0.041***	0.212***	-0.086***	0.168***	-0.063***
Proportion of adults, aged 25+ with a bachelor's degree or higher	0.524***	-0.061***	0.351***	-0.066***	0.284***	-0.070***
Proportion receiving free lunches in public schools	-0.259***	-0.067***	-0.119***	0.084***	-0.107***	0.045**
Single mother-headed household rate	-0.066***	-0.103***	-0.049**	0.054**	-0.012	-0.019
Poverty level	-0.207***	-0.072***	-0.124***	0.074***	-0.118***	0.027
Unemployment rate	-0.079***	-0.107***	-0.107***	-0.02	-0.069***	-0.043**
Proportion of households receiving SNAP benefits	-0.235***	-0.055***	-0.160***	0.072***	-0.141***	0.021
Schooling experiences and AP/DE opportunities						
Racial/ethnic composition						
Proportion Black in district	0.006	-0.125***	0.064***	0.060***	0.087***	-0.049**
Proportion Hispanic in district	0.073***	-0.059***	0.026	-0.032	0.059***	0.129***
Proportion of Hispanics who report speaking English well or very well	0.002	0.004	-0.027	-0.021	-0.039*	-0.039*
Racial/ethnic socioeconomic disparities						
White-Black gap in SES composite	-0.046***	-0.008	0.128***	0.086***	0.071***	0.004
White-Hispanic gap in SES composite	-0.014	0.006	0.118***	0.040*	0.110***	0.076***
White-Black income gap	0.018	0.016	0.205***	0.096***	0.164***	0.073**
White-Hispanic income gap	0.049**	0.032*	0.214***	0.054*	0.204***	0.106***
White-Black education gap	0.052***	0.010	0.236***	0.128***	0.190***	0.112***
White-Hispanic education gap	-0.035**	0.019	0.138***	0.071***	0.134***	0.172***
White-Black single-mother-headed household rate difference	0.026	0.032*	-0.096***	-0.060**	-0.018	0.028
White-Hispanic single-mother-headed household rate difference	-0.005	-0.005	-0.060***	-0.029	-0.063***	-0.023
Segregation						
Between-school segregation, White-Black	0.015	-0.015	0.133***	-0.044*	0.090***	-0.029
Between-school segregation, White-Hispanic	0.048***	-0.073***	0.154***	-0.041*	0.201***	-0.034*
Between-school free lunch/not free lunch segregation	0.043***	-0.027**	0.107***	-0.037*	0.118***	-0.038*

	Enrollment		White-Black Gaps		White-Hispanic Gaps	
	AP Program	DE Program	AP Program	DE Program	AP Program	DE Program
	(1)	(2)	(3)	(4)	(5)	(6)
School characteristics						
Average student-guidance counselor ratio	-0.011	0.003	-0.046**	0.033	-0.035*	-0.012
Average student-teacher ratio	0.076***	-0.016	-0.054**	-0.056**	-0.014	-0.075***
Per-pupil instructional expenditures	0.080***	-0.01	0.150***	-0.048**	0.186***	-0.010
Proportion attending charter schools	-0.027**	-0.089***	-0.019	-0.076***	0.011	-0.053***
White-Black charter enrollment rate difference	0.003	-0.024*	-0.014	-0.003	0.004	-0.030
White-Black student-teacher ratio difference	-0.038***	0.003	-0.026	0.003	-0.023	0.003
White-Black free lunch difference	-0.214***	0.065***	-0.218***	0.019	-0.169***	0.075***
White-Hispanic charter enrollment rate difference	0.000	-0.021*	-0.033	-0.011	-0.002	-0.039*
White-Hispanic student-teacher ratio difference	-0.003	-0.01	0.032	-0.002	0.030*	-0.005
White-Hispanic free lunch difference	-0.184***	0.031***	-0.197***	0.032	-0.233***	0.015
Prior achievement						
Average achievement, all	0.363***	0.087***	0.216***	-0.026	0.148***	-0.025
Other factors						
Distance to nearest public institution	-0.186***	0.038***	-0.157***	0.083***	-0.122***	0.135***
Average number of AP courses offered	0.711***	-0.122***	0.382***	-0.077***	0.303***	-0.111***

Table A6
Regression Estimates Predicting White-Black Participation Gap: Subsamples

	District-Level		Metro-Level	
	AP Program	DE Program	AP Program	DE Program
Mean	.112	.072	.096	.059
Home resources & neighborhood environments				
SES composite variable	0.002	0.003	-0.002	0.061***
	(0.005)	(0.006)	(0.010)	(0.017)
Proportion receiving free lunches in public schools	0.042*	0.039	0.012	0.133*
	(0.023)	(0.028)	(0.046)	(0.068)
Schooling experiences and AP/DE opportunities				
Racial/ethnic composition				
Proportion Black in district/metro	0.132***	0.054***	0.131***	0.132***
	(0.014)	(0.019)	(0.033)	(0.050)
Proportion Hispanic in district/metro	0.060***	-0.004	0.062**	0.051
	(0.013)	(0.018)	(0.026)	(0.036)
Proportion of Hispanics who speak English well	---	---	0.078	-0.051
	---	---	(0.063)	(0.088)
Racial/ethnic socioeconomic disparities				
White-Black gap in SES composite	---	---	0.004**	0.001
	---	---	(0.002)	(0.003)
White-Hispanic gap in SES composite	---	---	0.011***	-0.006
	---	---	(0.003)	(0.004)
Segregation				
Between-school segregation, White-Black	-0.115**	-0.177***	0.002	0.029
	(0.045)	(0.057)	(0.049)	(0.090)
Between-school segregation, White-Hispanic	0.070	-0.033	-0.112	0.064
	(0.069)	(0.082)	(0.076)	(0.124)
Between-school free lunch/not free lunch segregation	0.003	-0.027	-0.050	0.080
	(0.040)	(0.050)	(0.062)	(0.084)
School characteristics				
Average student-guidance counselor ratio	-0.000	0.000***	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Average student-teacher ratio	-0.001**	-0.001	-0.001	-0.002
	(0.000)	(0.001)	(0.000)	(0.001)
Per-pupil instructional expenditures	0.000***	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
White-Black student-teacher ratio difference	0.000	0.000	-0.001	0.010***
	(0.000)	(0.000)	(0.002)	(0.003)
White-Black free lunch difference	0.381***	0.304***	0.111	-0.057
	(0.074)	(0.091)	(0.076)	(0.139)
White-Hispanic student-teacher ratio difference	0.001	0.001	0.002	-0.001
	(0.001)	(0.001)	(0.002)	(0.004)
White-Hispanic free lunch difference	-0.025	-0.046	0.103	-0.097
	(0.093)	(0.091)	(0.099)	(0.178)

	District-Level		Metro-Level	
	AP Program	DE Program	AP Program	DE Program
Prior achievement				
Average achievement, all	0.027***	0.011**	0.030***	0.030**
	(0.004)	(0.005)	(0.008)	(0.014)
Other factors				
Distance to nearest public institution	-0.000	0.000	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.000)
Average number of AP courses offered	0.003***	-0.001	0.004***	-0.003***
	(0.000)	(0.000)	(0.001)	(0.001)
State-level policies				
Advanced Placement				
Accountability/mandate–adequate	0.001	---	0.000	---
	(0.009)	---	(0.010)	---
Accountability/mandate–strong	0.006	---	0.006	---
	(0.011)	---	(0.011)	---
Financial incentives/support–adequate	-0.004	---	0.007	---
	(0.011)	---	(0.011)	---
Financial incentives/support–strong	0.015	---	0.035**	---
	(0.016)	---	(0.016)	---
Student outcomes	0.014	---	0.014	---
	(0.017)	---	(0.018)	---
Dual enrollment				
Accountability/mandate: Access–moderate	---	0.014	---	0.008
	---	(0.013)	---	(0.022)
Accountability/mandate: Access–strong	---	0.010	---	0.010
	---	(0.013)	---	(0.021)
Accountability/mandate: Student outcomes–moderate	---	-0.006	---	0.010
	---	(0.009)	---	(0.013)
Accountability/mandate: Student outcomes–strong	---	-0.008	---	0.020
	---	(0.010)	---	(0.016)
Who pays–local decision	---	-0.012	---	-0.004
	---	(0.011)	---	(0.018)
Who pays–other	---	-0.028***	---	0.008
	---	(0.010)	---	(0.017)
Average tuition				
Mean tuition in state–4-year colleges	-0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Mean tuition in state–2-year colleges	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
N	2,599	1,454	399	347

Note. Sample includes school districts/metro areas with above-median AP and DE enrollment. Whopays–parent is the reference group. Whopays–other includes school district, state, or a combination of parent and district/state. Policy-weak is the reference group. Empty cells indicate large missing values for the covariate. Proportion of Hispanics who speak English well is based on self-reporting.

*p < .1. **p < .05. ***p < .01.

Table A7
Regression Estimates Predicting White-Hispanic Participation Gap: Subsamples

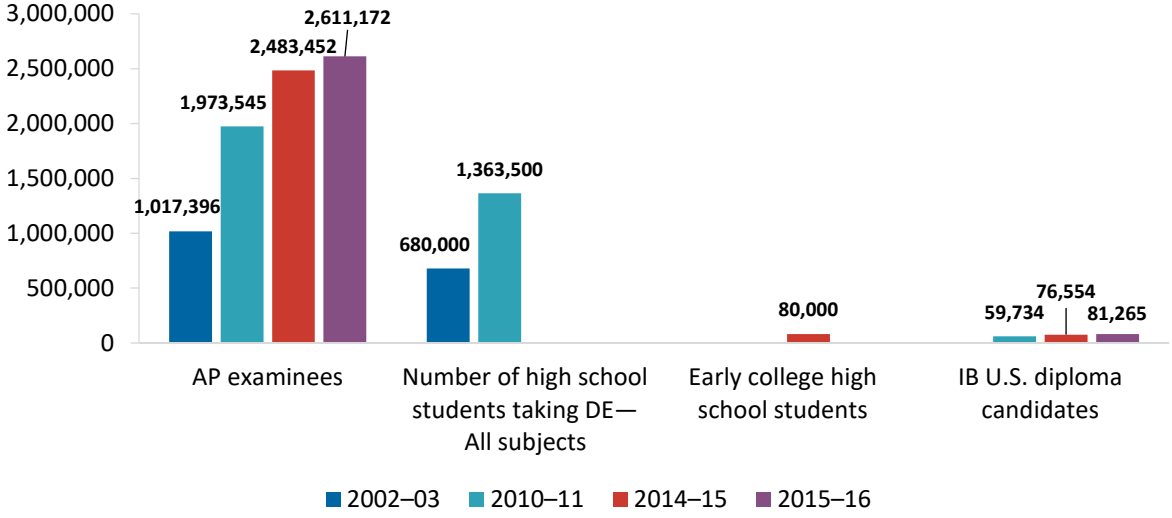
	District-Level		Metro-Level	
	AP Program	DE Program	AP Program	DE Program
Mean	0.080	0.060	0.069	0.050
Home resources and neighborhood environments				
SES composite variable	0.001	-0.015***	0.014	0.002
	(0.004)	(0.006)	(0.010)	(0.015)
Proportion receiving free lunches in public schools	-0.033	-0.087***	-0.070	-0.092
	(0.020)	(0.026)	(0.045)	(0.058)
Schooling experiences and AP/DE opportunities				
Racial/ethnic composition				
Proportion Black in district/metro	0.112***	0.074***	0.120***	0.121***
	(0.013)	(0.020)	(0.033)	(0.044)
Proportion Hispanic in district/metro	0.085***	0.088***	0.094***	0.078***
	(0.011)	(0.014)	(0.023)	(0.029)
Proportion of Hispanics who report speaking well	---	---	-0.010	-0.033
	---	---	(0.061)	(0.075)
Racial/ethnic socioeconomic disparities				
White-Black gap in SES composite	---	---	-0.003*	-0.003
	---	---	(0.002)	(0.002)
White-Hispanic gap in SES composite	---	---	0.008***	0.003
	---	---	(0.003)	(0.003)
Segregation				
Between-school segregation, White-Black	-0.088***	-0.080*	-0.022	0.034
	(0.032)	(0.042)	(0.049)	(0.072)
Between-school segregation, White-Hispanic	0.053	-0.114	-0.090	0.103
	(0.060)	(0.093)	(0.075)	(0.106)
Between-school free lunch/not free lunch segregation	-0.075**	0.036	-0.004	-0.013
	(0.034)	(0.053)	(0.060)	(0.067)
School characteristics				
Average student-guidance counselor ratio	-0.000	-0.000	-0.000	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Average student-teacher ratio	-0.000	-0.001**	0.001	-0.001
	(0.000)	(0.001)	(0.000)	(0.001)
Per-pupil instructional expenditures	0.000***	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
White-Black student-teacher ratio difference	0.000	-0.000	-0.003**	-0.001
	(0.000)	(0.000)	(0.002)	(0.003)
White-Black free lunch difference	0.036	-0.049	-0.008	-0.075
	(0.041)	(0.036)	(0.075)	(0.109)
White-Hispanic student-teacher ratio difference	0.000	-0.001	0.004**	0.008**
	(0.001)	(0.001)	(0.002)	(0.004)
White-Hispanic free lunch difference	0.417***	0.300***	0.245**	0.002
	(0.071)	(0.102)	(0.098)	(0.147)

	District-Level		Metro-Level	
	AP Program	DE Program	AP Program	DE Program
Prior achievement				
Average achievement, all	0.012***	0.011**	-0.001	0.014
	(0.003)	(0.004)	(0.008)	(0.011)
Other factors				
Distance to nearest public institution	0.000**	0.000***	0.000	0.001*
	(0.000)	(0.000)	(0.000)	(0.000)
Average number of AP courses offered	0.001***	-0.002***	0.001	-0.003***
	(0.000)	(0.000)	(0.001)	(0.001)
State-level policies				
Advanced Placement				
Accountability/mandate–adequate	-0.006	---	-0.014	---
	(0.006)	---	(0.009)	---
Accountability/mandate–strong	-0.022***	---	-0.017*	---
	(0.008)	---	(0.010)	---
Financial incentives/support–adequate	-0.002	---	0.017	---
	(0.008)	---	(0.010)	---
Financial incentives/support–strong	0.014	---	0.022	---
	(0.012)	---	(0.015)	---
Student outcomes	0.019	---	0.021	---
	(0.012)	---	(0.017)	---
Dual enrollment				
Accountability/mandate: Access–moderate	---	0.010	---	0.010
	---	(0.012)	---	(0.019)
Accountability/mandate: Access–strong	---	0.010	---	0.007
	---	(0.012)	---	(0.017)
Accountability/mandate: Student outcomes–moderate	---	-0.007	---	-0.007
	---	(0.008)	---	(0.011)
Accountability/mandate: Student outcomes–strong	---	-0.014	---	-0.006
	---	(0.009)	---	(0.013)
Who pays–local decision	---	0.001	---	0.003
	---	(0.010)	---	(0.015)
Who pays–other	---	-0.016	---	-0.005
	---	(0.010)	---	(0.015)
Average tuition				
Mean tuition in state—4-year colleges	0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Mean tuition in state—2-year colleges	-0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
N	3,349	2,172	419	409

Note. Sample includes school districts/metro areas with above-median AP and DE enrollment. Whopays–parent is the reference group. Whopays–other includes school district, state, or a combination of parent and district/state. Policy-weak is the reference group. Empty cells indicate large missing values for the covariate. Proportion of Hispanics who speak English well is based on self-reporting.

*p < .1. **p < .05. ***p < .01.

Figure A1
National Participation in Different College Acceleration Strategies



Note (from original figure): National enrollment data do not exist for DE and CTE beyond 2010–11.

Source: College Board, 2017, p. 9, Figure 1. (Figure A1 reproduces all data from the original figure.)

Figure A2
Distribution of Metro Area AP and DE Participation Rates

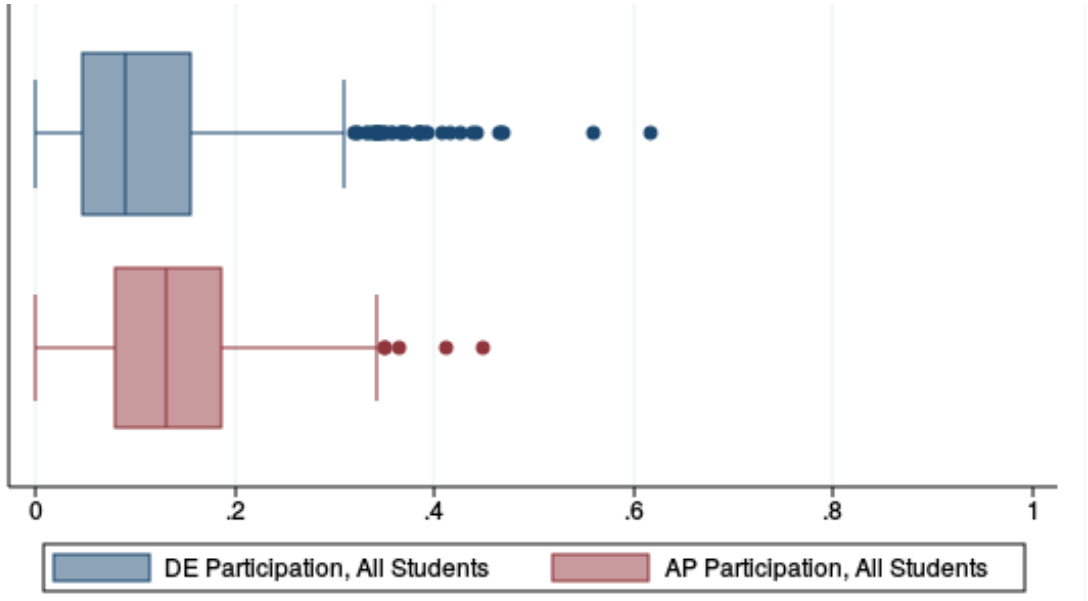


Figure A3
Distribution of Metro Area AP Participation Rates, by Student Race/Ethnicity

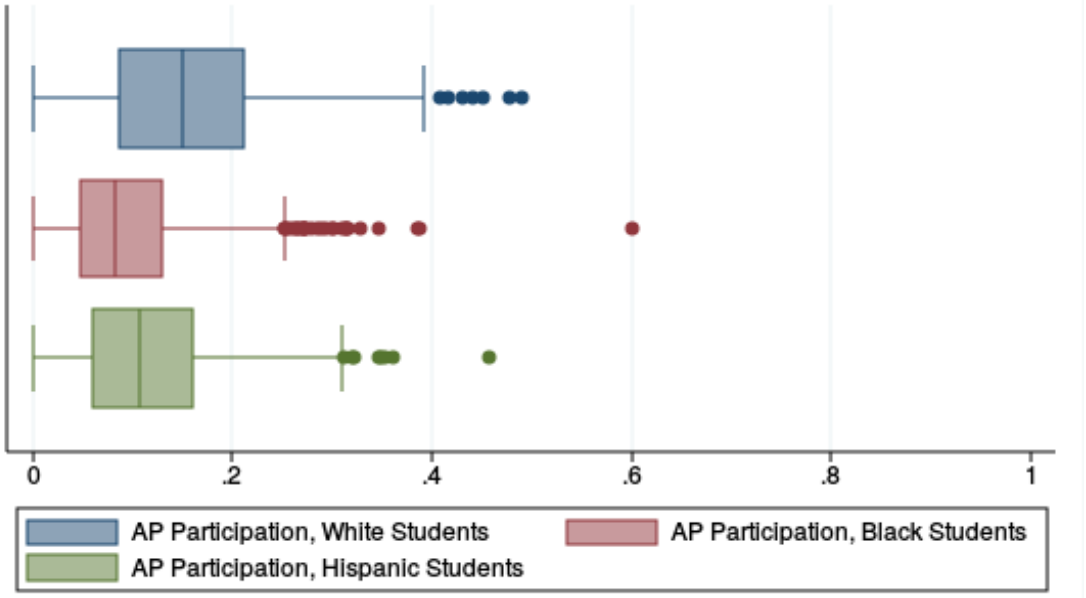


Figure A4
Distribution of Metro Area DE Participation Rates, by Student Race/Ethnicity

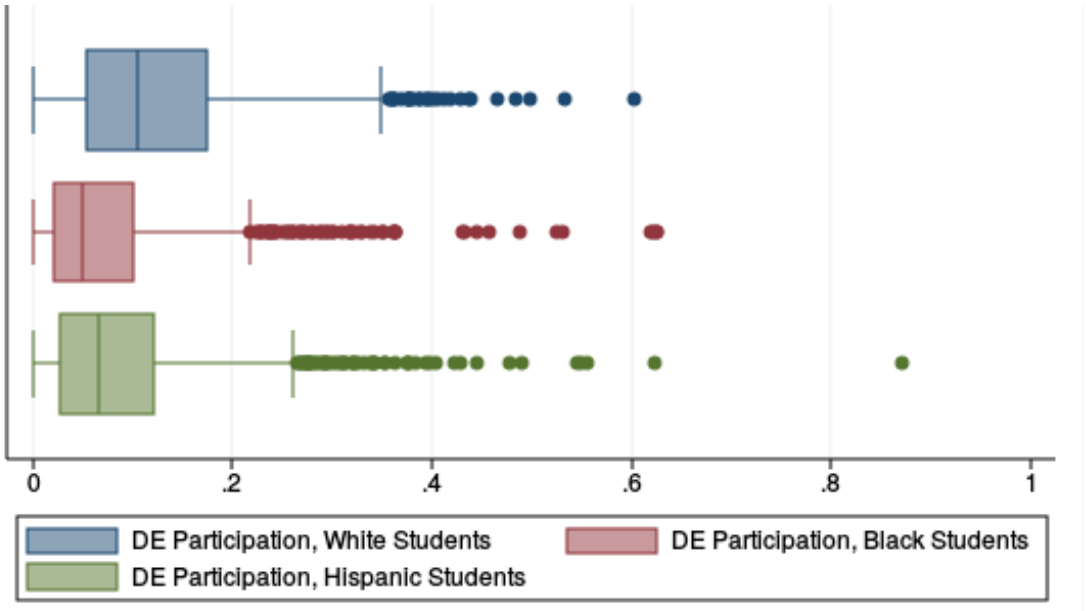


Figure A5
Top 40 Metro Areas for AP and DE Participation

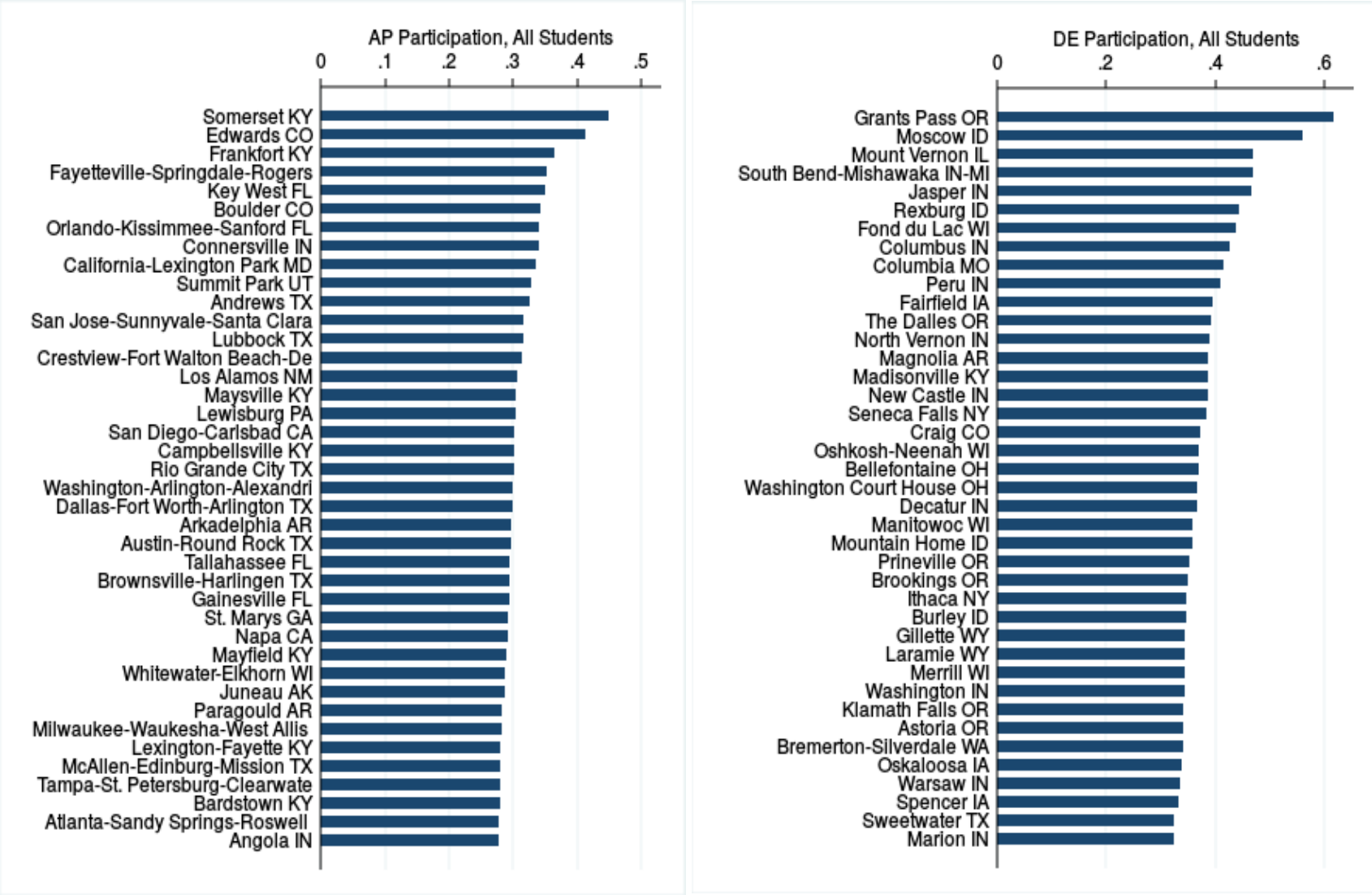


Figure A6
Map of Metro Area AP and DE Participation Rates