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The Nation's Achievement Inequality Report Card: An Assessment of Test Score and Equality Trends in Traditional Public, Charter, Catholic, and Department of Defense Schools

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We present a descriptive comparison of trends in achievement and inequality in traditional public, public charter, Catholic, and Department of Defense schools in the U.S. Our sample includes 6,155,570 observations for 4th and 8th graders in math and reading between 2005 and 2024. We focus on changes in the 90th and 10th percentile scores of the students in those school sectors on the National Assessment of Education Progress, adjusted for key student demographics. Analysis of exactly 1000 overall and subgroup achievement trends reveals that the 90–10 performance gaps are largest and widening at the fastest rate in the traditional public school sector, chiefly due to the declining annual trend for its low achievers at the 10th percentile. Most of this increase in inequality occurred prior to the COVID-19 pandemic, which merely accelerated the pre-existing trend. In contrast, increased inequality in the public charter sector is solely due to performance improvements at the 90th percentile and is limited to 4th grade. Charter achievement trends are generally positive, with 10th percentile scores increasing along with, and sometimes exceeding, 90th percentile score gains, thereby reducing the 90–10 achievement gap. The 90–10 student performance gap in the Catholic sector increased over the 20 years of our study period, driven by both increases at the 90th percentile and declines at the 10th percentile, much like the traditional public school sector. The Department of Defense (DoD) schools are positive outliers in our study. Student achievement in DoD schools was higher in 2024 than in 2005, at both the 90th and 10th percentiles, with little change in the performance gap. We discuss subgroup heterogeneities, outliers, and policy implications.

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Author Contributions

M. Danish Shakeel conceived of the study. M. Danish Shakeel and Patrick J. Wolf designed it. Material preparation and data collection were performed by Misty Gallo. Data analysis was conducted by M. Danish Shakeel. The first draft of the manuscript was written by M. Danish Shakeel and Patrick J. Wolf. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Declarations

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Abstract

We present a descriptive comparison of trends in achievement and inequality in traditional public, public charter, Catholic, and Department of Defense schools in the U.S. Our sample includes 6,155,570 observations for 4th and 8th graders in math and reading between 2005 and 2024. We focus on changes in the 90th and 10th percentile scores of the students in those school sectors on the National Assessment of Education Progress, adjusted for key student demographics. Analysis of exactly 1000 overall and subgroup achievement trends reveals that the 90–10 performance gaps are largest and widening at the fastest rate in the traditional public school sector, chiefly due to the declining annual trend for its low achievers at the 10th percentile. Most of this increase in inequality occurred prior to the COVID-19 pandemic, which merely accelerated the pre-existing trend. In contrast, increased inequality in the public charter sector is solely due to performance improvements at the 90th percentile and is limited to 4th grade. Charter achievement trends are generally positive, with 10th percentile scores increasing along with, and sometimes exceeding, 90th percentile score gains, thereby reducing the 90–10 achievement gap. The 90–10 student performance gap in the Catholic sector increased over the 20 years of our study period, driven by both increases at the 90th percentile and declines at the 10th percentile, much like the traditional public school sector. The Department of Defense (DoD) schools are positive outliers in our study. Student achievement in DoD schools was higher in 2024 than in 2005, at both the 90th and 10th percentiles, with little change in the performance gap. We discuss subgroup heterogeneities, outliers, and policy implications.

Keywords: achievement gap, inequality, COVID learning loss, traditional public school, charter school, Catholic school, Department of Defense school

The United States' K-12 school landscape is vast. It comprises formal brick-and-mortar schools, homeschooling, full-time virtual schools, and microschools as part of the broader educational ecosystem. Schooling options beyond the traditional public schools have been growing, with varying levels of academic success. For example, virtual schools now enroll more than 500,000 students (Hamlin et al., 2023), homeschoolers comprise more than 3 million students (NCES, 2023; Ray, 2022), and microschools serve 750,000-2.1 million students (Ohls et al., 2025). The research literature offers mixed evidence of academic success in these sectors, however (Hamlin et al., 2023; Paul & Wolf, 2020; Ray, 2017). The growth of these non-traditional sectors could shift the comparative performance trends between school types.

Our study focuses primarily on four school sectors that educate most American students, chiefly in non-virtual settings. These brick-and-mortar school sectors are district-operated traditional public schools (TPS), publicly funded and privately managed charter schools,[1] private religious schools affiliated with the Catholic Church, and federally operated Department of Defense (DoD) schools. District-operated TPS are governed by state laws, school board rules, collective bargaining contracts, and political demands for uniformity, improvement, and equality. Charter schools are authorized by government agencies, but their overseers range from school districts and mayors' offices to state departments of education, universities, and special boards. The Catholic Church hierarchy oversees most Catholic schools, though local school boards independently operate some of them. The DoD Education Agency manages the DoD schools within the administrative hierarchy of the cabinet agency recently renamed the Department of War.

[1] A minority of the charter schools operate fully online.

What are the trends in student performance on the National Assessment of Educational Progress (NAEP), a.k.a. “The Nation’s Report Card,” in each of these four major school sectors, controlling for key student demographics? How does the dispersion in student achievement compare across these four school sectors, overall and for various student subgroups? Specifically, how do the low and high achievers fare? To what extent are negative trends in educational improvement and equality associated with the COVID-19 pandemic? Is the news all bad regarding student achievement trends, or do some types of schools show promise in demonstrating both improvement and gains in equality? We explore these questions using the 90th and 10th percentile scores in math and reading for 4th and 8th grades on the NAEP from 2005 to 2024.

We chose the analysis period between 2005 and 2024, since charter schools were tested in NAEP for the first time at both the 4th and 8th grades starting in 2005. The latest results in NAEP Explorer are available for 2024. We identify 1000 trends in student performance at the 90th and 10th percentiles and the 90–10 achievement gap across school sectors, grades, subjects, and subgroups, with special attention to changes before COVID-19 and across the entire time series, including the pandemic. Our study represents the most comprehensive analysis of student performance on the NAEP since COVID-19 disrupted student learning.

First, we discuss the literature on the four major school sectors, their association with student achievement improvement and equality, and prior comparisons of school sectors using NAEP data. Second, we present a theoretical standard of improvement and equality for evaluating performance trends across the various school sectors. Third, we describe the data that informs our study. Fourth, we discuss our empirical strategy. Fifth, we examine the results, and, finally, we discuss the takeaways and policy implications of our findings.

Literature Review

Here we describe prior research on the distinctive features of our four schooling sectors, studies of their relative effectiveness in promoting improvement and equality in student academic outcomes, and why NAEP data are helpful in doing so.

Sector Distinctions, Test Score Improvements, and Equality

The TPS sector educates most of the nation's children and is required to find a spot in its district's school system for every local student who wishes to attend. Under such circumstances, we might expect TPS students' achievement outcomes to vary substantially. In theory, charter schools may be less diverse than TPS, as students opt into them based on parental preferences. Charters tend to locate in low-income urban areas near low-performing TPS and disproportionately enroll African American and Hispanic students (Valant, 2019). Catholic schools may also be less diverse in achievement than TPS, as they cater to a subsection of the student population, though the concentration of Catholic schools in cities and the disproportionate representation of people of Hispanic background among American Catholics means that their student population tends to be diverse in income, race, and ethnicity (Greene & O'Keefe, 2001). The students in DoD schools reflect the racial and ethnic diversity of the U.S. Armed Forces, but disproportionately come from families with modest incomes.

Some charter school networks, such as the Knowledge is Power Program (KIPP), Harlem Children's Zone, and Boston's charter schools, have delivered strong results for students (Cohodes, Setren & Walters, 2021; Dobbie & Fryer, 2011; Nichols-Barrer & Gleason, 2020). Research from CREDO (2015) found that students in urban charter schools who were assessed on NAEP scores showed gains for both upper- and lower-scoring students compared to similar TPS students. National studies indicate that, on average, charter success is mixed. In studies

drawing from state accountability test scores, charters only outperform TPS by a few weeks of learning per year (Raymond et al., 2023), and one-fourth of charters are closed prior to or at their initial five-year reauthorization review (Burris, 2024). Alternatively, charter school test scores are higher than those of TPS when NAEP scores are used as the measure (Tribble, 2020; Petrilli and Griffith, 2024). Researchers often hesitate to claim causality in cross-sectional evaluations of charter and TPS, although many recent studies rely on either matching or virtual control record (VCR) quasi-experimental methods (Griffith & Petrilli, 2020).

Research on Catholic schools suggests that they tend to have a positive effect on student achievement, especially for students from disadvantaged backgrounds. Coleman and Hoffer (1982) reported that students in Catholic schools exhibited higher growth in verbal and math achievement than similar students in public schools. The Catholic schooling advantage was larger for students from disadvantaged backgrounds. Willms (1985) confirmed those findings, giving rise to what became known as the "Catholic schooling effect." Bryk and colleagues (1993) extended the research on the Catholic schooling effect, arguing that it stemmed from Catholic institutional and theological commitments to the common good. More recently, scholars have reported that the Catholic schooling effect is waning, possibly due to changes in the focus of Catholic education and the demographics of its schools (Freeman & Berends, 2016).

Department of Defense schools provide an intriguing contrast to the other school sectors in our study. We discuss them at length here, since they rarely are part of discussions about K-12 education in the U.S. DoD schools serve over 60,000 children of active-duty military personnel across the country and around the world. They have been lauded for producing strong achievement despite serving a predominantly low-income and minority student population (Mervosh, 2023). Department of Defense schools are part of the public-school sector, but they

are unique in several ways. Established after World War II to educate the children of service members, these schools are equipped to serve the highly mobile children in both domestic and international settings. Organizationally, the schools are distinct from their TPS counterparts. They are overseen and funded by the federal government with multi-year budgets, and their mission and culture are rooted in military tradition, with behavior policies overseen by military officials rather than educators (*Student Disciplinary Rules and Procedures, Change 1*, 2025; Wong, 2024).

Recognizing lagging academic indicators, the DoDEA (the administering agency overseeing the schools) enacted College and Career-Ready standards in 2015, followed by a Restructuring for Student Achievement, centered on the establishment of the Centers for Instructional Leadership, in 2016 (Wong, 2024). DoD schools released a Blueprint for Continuous Improvement in 2025 (DODEA, 2025). The plan emphasizes both classroom design and instructional practices. The most recent accreditation review from May 2025 shows that DoDEA schools evidence higher results across multiple measures than other sectors (DODEA, 2025). Teachers are federal employees, and their hiring and professional development practices are uniform (*Employee benefits,* n.d.; Wong, 2024). Students tend to be more mobile due to reassignment of their parents, which may contribute to increased risk of anxiety and depression with limited knowledge of supports (Frederick & Siebler, 2022). The DoD model focuses on integrating and supporting parents through nutrition, counseling resources, and career services (Pope & Pope, 2023). DoDEA employees are more likely to be racial and ethnic minorities than their TPS counterparts (*DoDEA*, 2023).

Researchers have investigated the contextual differences between DoD and other types of schools (De Pedro et al., 2011). Not only do DoDEA student NAEP scores tend to be higher than

those of students in other school sectors, but scores for subgroups also tend to be more equal (Heller, 2024; Hauser, 2020). This marker of success is not a new development; DoD schools have consistently produced comparatively high student test scores since they began administering the NAEP tests in the late 1990s. Researchers hypothesize that the success of DoD schools is due to whole family support, policy and mission coherence, and localized control (Smrekar, 2007; Hauser, 2020).

Comparing School Sector Outcomes Using NAEP Data

The NAEP – a congressionally mandated program overseen by the National Assessment Governing Board – is the official national measure of student achievement and a benchmark for state assessments, guiding educational decisions in the U.S. (National Assessment Governing Board, 2025). Also known as the Nation's Report Card, the NAEP is administered by the National Center for Education Statistics biannually in even years and reported in odd years. The test covers math and reading at the 4th- and 8th-grade levels[2] to representative samples of students in all fifty states, Puerto Rico, the District of Columbia, and the DoD schools. School closures due to the COVID-19 pandemic delayed the 2020 NAEP administration until 2021 and its reporting until 2022, placing NAEP on a post-COVID schedule of odd-year administration and even-year reporting. The total number of observations per test ranges from approximately 150,000 to 200,000.

Student performance on the NAEP allows policymakers to assess progress in achievement over time and across demographic and geographic subgroups, at the national, state, and selected urban districts levels. The NAEP reports average scores for 4th- and 8th-grade students in math and reading on a 0-500-point scale. Scores are also available by school sectors.

[2] NAEP is infrequently administered at grade 12, and in other subjects.

The NAEP scores can be divided into higher, middle, and lower ranges of student performance, which change with each administration of the test. For example, the 25th percentile score in a particular administration of the test means that a quarter of the students scored at or below that scale score. NAEP Explorer[3] provides score performance data at the 10th, 25th, 50th, 75th, and 90th percentiles. Estimates of the 90th and 10th percentiles and the standard deviation of student performance are subject to sampling error. Still, this error tends to be small because of the large number of students participating in each NAEP administration.

Researchers have studied cross-sector differences in NAEP achievement for the past two decades (Herbst, 2025). Those studies focus on public-private differences in average scores, not on trends in the distributional gaps by sector, as we do here. Braun and his colleagues (2006) used Hierarchical Linear Modeling (HLM), controlling for student body characteristics, to examine 2003 NAEP achievement differences between public and private schools. The researchers included charter schools along with TPS in the "public" category. They found that students at private schools scored higher, on average, than students in public schools in both reading and math in 4th and 8th grade. After controlling for student demographics at the school level, however, average reading scores remained significantly higher for 8th-grade private school students, but were statistically similar between 4th-grade private and public school students. Controlling for student characteristics at the school level, the average math score for students in private schools was significantly lower than the average public school score in 4th grade but statistically similar to the average public school score in 8th grade.

Lubienski and Lubienski (2006) analyzed the same 2003 NAEP data, again using HLM to control for school-level differences in student body composition, but treated charter schools as

[3] https://nces.ed.gov/nationsreportcard/data/

a separate category of public schools and reported results only in math, not in reading. They found that, controlling for school-level characteristics, the 8th-grade students in public charter schools and various specific types of private schools had average math scores that were statistically similar to those in TPS, except for students in "Conservative Christian" schools, whose average math scores were significantly below the TPS average. For 4th graders, the researchers reported that the regression-adjusted average math scores of TPS students were significantly higher than those of all other school types, including public charter, Catholic, Lutheran, Conservative Christian, and "Other Private" schools.

Shakeel and Peterson (2020) analyzed individual-level NAEP data from 2005 to 2017 for the charter and TPS sectors, concluding that test score gains in the charter sector outpaced those in the TPS sector for African Americans, students from low socioeconomic backgrounds, and students in the Northeast. While those results might suggest increases in equality in the charter sector, the researchers did not examine the 90–10 achievement gap or its trend to confirm such a development. Similarly, Matheny et al. (2021) used the longitudinal Stanford Education Data Archive to investigate differences in district-level achievement trends. While the local lens enabled the researchers to track the movement of the achievement gap across student subpopulations, the study included only public school students.

To our knowledge, there is only one comparative study of the achievement effects of DoDEA versus TPS schools (Hinkson, 2007). Hinkson analyzed the Black-White differences in achievement on the 1998 NAEP reading exam. This study differs from ours because the author did not control for background differences, including parents' education levels.

Scholars have used NAEP score percentiles to compare overall trends in student performance for the high- and low-achieving students. Walton and LoGerfo (2022) reported that

NAEP scores at the 25th percentile declined across the spectrum after the COVID-19 pandemic. West (2025) writes, “The gap between the lowest-performing and highest-performing students is now widening across all subjects and grades, highlighting the stark reality that schools today are equipping only some students for postsecondary success.”

Aldeman (2024) reports that the NAEP gap between the highest 10 percent and the lowest 10 percent of students by performance—the 90–10 gap—was stable overall from 2003 through 2013. After 2013 and especially in the wake of the COVID-19 pandemic, NAEP scores overall dropped, but the decline was largest for the lowest 10 percent of performers. While much has been made of COVID-19’s disruption of student achievement, the declines in student performance started before the pandemic affected schools. Wyckoff (2025) agrees that many of the COVID-era learning losses had their genesis much earlier. These learning losses affected students at different rates and in different directions. Students in the lower-performing subgroup had steeper declines than those in the middle- or upper-scoring subgroups (Malkus, 2025). Discussing grade 12 NAEP results in 2024, Aldeman (2025) stated, “Student achievement is down overall — but kids at the bottom are sinking faster.” Identifying how widespread this decline in achievement and equality is across time, school sectors, grades, subjects, and subgroups motivates our study.

In summary, researchers who have examined cross-sector differences in NAEP performance have not focused on the 90–10 achievement gap. Researchers who have focused on the 90–10 achievement gap in the NAEP have not examined cross-sector differences in that key measure of inequality. None of the prior analyses have adjusted for individual student background characteristics. We do so here, examining the NAEP 90–10 achievement gaps across students in different types of schools, across grades, and over time, overall and within key

student subgroups. Which sector, if any, is most trending towards equality in NAEP scores over time while boosting the scores of both low and high performers? That is the key question that motivates this study.

A Conceptual Standard for Improvement and Equality

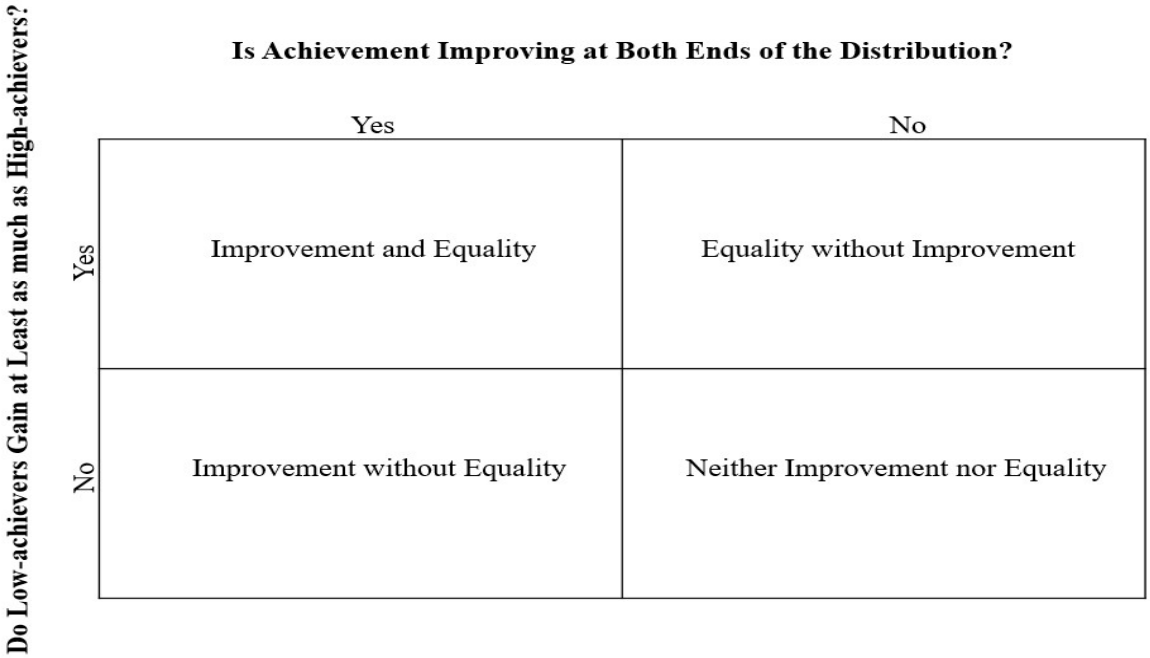
Most advocates for educational improvement in K-12 education seek both greater educational improvement, as evidenced by higher scores across the performance distribution, and greater educational equality, as demonstrated by smaller gaps between high and low performers (Ornstein, 2015). E. D. Hirsch (2009) emphasized the importance of narrowing achievement gaps while improving achievement levels for all students. He cautioned that achievement gaps, which he saw as disproportionately affecting lower-achieving students, were driven by content gaps. At a minimum, we do not want to see gains exclusively for high performers, while low performers trend down, thereby increasing the performance gap between them. A desire for both improvement and equality seeks trends whereby student achievement is improving across the performance distribution, and the improvements are equal, if not larger, for the lower-achieving subgroup. Since gaps decrease when top performers do less well, low performers do better, or both, it is essential to evaluate performance gap changes in terms of the trends driving them.

That ideal of gap-reduction by pushing the lower performers up as opposed to pulling the upper performers down is displayed in the upper left quadrant of Figure 1. A social justice perspective prioritizes closing outcome gaps more than improving performance (Beasley & Haulmark, 2021). Thus, many advocates for social justice in education would accept trends in which higher achievers are not improving their performance so long as the performance gap is closing, either because lower achievers are improving (preferred) or because they are declining at a slower rate than higher achievers. This social justice perspective is displayed in the top right

quadrant of Figure 1. Trends in educational outcomes might be demonstrating improvement, but the performance gains might be greater for higher-achieving students than for lower-achieving ones. Such a "Pareto improving" situation, where everyone is made better in absolute terms, even as outcome gaps are widening (Arrow, 1951), is displayed in the lower left quadrant of Figure 1. Finally, if student outcomes are not improving across the performance distribution, and lower-achieving students are losing more ground than higher-achieving students, we are left with the highly undesirable situation of increasing futility and inequality, as shown in the lower-right quadrant of Figure 1.

Figure 1

Conceptual framework for judging 90–10 NAEP trends



In what follows, we assess 1000 trends in NAEP scores for the 90th and 10th achievement percentiles over time and across schooling sectors, based on the extent to which they deviate from the ideal of increasing improvement and equality. We examine average student scores at the 90th and 10th percentiles, and the gap between them, for three reasons. First, those

cut points in the performance distribution have face validity. Performing better than 90 percent of one's peers is a clear mark of excellence. Performing worse than 90 percent of one's peers is a clear mark of struggling. Second, NAEP scores are reported at five cut points, with the 90th and 10th percentiles among them, along with the 75th, 50th, and 25th percentiles.[4] Third, as discussed in the literature review section, previous researchers have examined NAEP scores at the 90th and 10th percentiles, as well as the gap between them, in studies of educational equality. Those prior studies lack the expansive scope of our project, but they give us confidence that the 90-10 performance gap is a well-established metric of relative equality in test score outcomes.

Data

We analyze nationally representative NAEP scores comprising 6,155,570 student-by-year observations. The database is pooled cross-sectional, not panel data, as different students are sampled to represent the 4th- and 8th-grade student populations each time the NAEP is administered. Restricted-use microdata include 5,690,470 observations on 4th- and 8th-grade math and reading for 2005-2022, along with aggregated data from the NAEP explorer for 2005-2024[5] (see Appendix table S5 for detailed sample sizes). These data contain information on student demographic and geographic categories. We report overall outcome trends over that 20-year time period as well as results by the following subgroups: ethnicity (white, black, Hispanic, and Asian), gender (male and female), economically disadvantaged and advantaged (until 2022 referred to as free and reduced lunch [FRL] eligible and ineligible), parental education levels (did not finish high school (HS), graduated HS, some education after HS, graduated college; only

[4] While the 50th percentile tells us nothing about equality, the 75th and 25th percentile lack the face validity of the 90th and 10th percentiles regarding "top" and "bottom" performers.
[5] The 2024 NAEP comprises 465,100 observations.
https://www.nationsreportcard.gov/reports/mathematics/2024/g4_8/
https://www.nationsreportcard.gov/reports/reading/2024/g4_8/

asked of students in grade 8), classified and not classified as an English Language Learner (ELL), classified and not classified with a disability, and locale (city, suburb, town, and rural) for TPS, charter, Catholic, and DoD schools.

Background data also comprise age,[6] number of books in the home (0-10, 11-25, 26-100, >100) and a computer at home.[7] Data for all categories covers odd years between 2005 and 2019, plus 2022 and 2024. Census locale regions are consistently coded in NAEP starting in 2007, leaving locale with nine longitudinal data points, while all other subgroup categories have ten. Some outcome data for NAEP scale scores at percentiles are not reported in the NAEP Explorer. Missingness is related to data not meeting NCES' reporting standards, either because there are too few cases for a reliable estimate or the coefficient of variation for the estimate is 50 percent or greater, as is the case for the overall private school sector. Any series missing outcome data for a given year between the initial and final years for any category within a grade, subject, and school sector is excluded from our study. Appendix tables S1-S4 compare the enrollment share for elementary and secondary levels between NAEP and NCES surveys overall and for the ethnic and FRL subcategories. This comparison suggests that the NAEP data closely match the NCES survey data for overall and subgroup categories.

Empirical Strategy

Cross-sectional comparisons, such as those we present here, are potentially biased due to composition dynamics (Council, 2004; Hedges et al., 2013). We work to mitigate those limitations through statistical adjustments, as specified by Braun and colleagues (2006) and McLaughlin (2005). Our analytic approach controls for cross-sector selection on observables by

[6] Age is estimated as of the 15th day of the birth month. Ages more than two years from the mean weighted national age are recoded to the mean.
[7] 2019 and 2022 responses on "a desktop/laptop computer you can use" and "a tablet that you can use" are combined as a proxy for a computer in the home.

first adjusting the 90–10 anchor points in each year, subject, grade, and sector for key measurable student characteristics. We then regress the adjusted scores on time. We do not, and cannot, control for unobservable factors that might jointly influence selection into a specific schooling sector and student test scores. The changes in trends across school sectors that are the focus of our study could be affected by unobserved selection patterns. Thus, we characterize our findings as merely descriptive and associational, not necessarily causal.

All results reported in this paper are on the NAEP Explorer's composite scale. NAEP scale scores at various percentiles are constructed from its microdata, using survey weights for each year, grade, subject, and school sector. Individual students take only part of the NAEP test, as the test is lengthy, and each portion is assigned a plausible value (PV) based on student performance. Statistical techniques are employed to construct the composite NAEP score from five PV between 2005 and 2013, and 20 PV in the subsequent waves.

We constructed unadjusted NAEP scores by first calculating the weighted percentiles for each PV and then averaging them. These unadjusted scores match the scale scores for percentiles reported in the NAEP Explorer. To estimate background-adjusted scores at percentiles, we first regressed each PV on the list of background items, with the subgroup indicator variable excluded from the standard list of controls when conducting the subgroup analysis for that subgroup. Dummy-variable adjustment for the few missing values among the control variables was employed to use all observations with outcome data. We then obtained weighted percentile scores from the regression-adjusted numbers for each PV and averaged them. Thus, our analytic procedure produces accurate aggregate and subgroup NAEP scale scores, adjusted for student demographics and aligned with key points in the student performance distribution. The 90th and

10th percentile points on the student performance distribution for each sector and year are demographically adjusted 90–10 anchor points.

Microdata for NAEP 2024 has not yet been released. To obtain adjusted scores at the 90th and 10th percentiles in 2024, we used deductive imputation, assuming that the gap between adjusted and unadjusted scores at the 90th and 10th percentiles in 2024 is the same as in 2022 (Chingos & Blagg, 2025). To assess linear annual trends, the 90th and 10th percentile scores, and the 90–10 gap scores, were regressed on year for each category within a grade, subject, and school sector. Equation (1) displays the regression of achievement scale-score type *t* (90th, 10th, or 90–10 gap) in year *y*, grade *g*, subject *s*, and school sector *k* for a category *c* on year *y*, where ε denotes the standard error. β_0 displays the intercept and β_y is the coefficient of interest. Figures plot the per-decade change based on yearly coefficients from regressions covering 2005-2024 (Shakeel & Peterson, 2022). The plots display results for pre-COVID (PC) 2005-2019 and full term (FT) 2005-2024, thereby revealing how COVID affected the change-per-decade.

$$achievement_{tygskc} = \beta_0 + \beta_y year_y + \varepsilon_{tygskc} \quad (1)$$

NAEP tests are vertically scaled, allowing comparisons of student achievement across grade levels. The average difference in 4th- and 8th-grade performance in math and reading on NAEP tests between 2005 and 2024 is 41 points in math and 43 points in reading. That implies that average annual performance on these tests improves by about 10.25 points in math and 10.75 points in reading for students from 4th through 8th grade. We use these numbers to interpret the per-decade changes in 90th and 10th percentile scores and 90–10 gap scores in terms of years of learning (Shakeel & Dills, 2024, p. 267; Shakeel & Peterson, 2020, pp. 612-613). Due to our sample of over 6 million observations, all but the most trivial changes and

differences in our analysis are statistically significant at a high confidence level.[8] We use a rule-of-thumb that only changes and differences of 2 scale score points or more per decade, amounting to slightly less than one-fifth of a year's learning, are substantively meaningful.

Results

All our results are adjusted for student demographics. We present our findings in sets clustered by grade, subject, and school sector. Each cluster presents, from left to right, the change (per-decade) in performance for the 10th percentile student pre-COVID, the change for the 10th percentile student for the full 20-year term of the study, the change for the 90th percentile student pre-COVID, the change for the 90th percentile student for the full 20-year term of the study, the change in the 90–10 achievement gap pre-COVID, and the change in the 90–10 achievement gap for the full 20-year term of the study. With the horizontal line as the origin, the most positive profile of the trend results, left to right, would be a large positive first bar (10th percentile pre-COVID in blue) that at least partially persists for the second bar (10th percentile full term in red), followed by a positive third bar (90th percentile pre-COVID in green) that at least partially persists for the fourth bar (90th percentile full term in yellow), concluded by a negative fifth bar (gap change pre-COVID in purple) that at least partially persists for the sixth and final bar (gap change full term in orange). The most negative profile of the trend results would be the exact opposite of that pattern: negative first four bars, signaling lower scores over time, and positive last two bars, indicating higher inequality.

Overall Main Findings

For 4th graders in TPS, the 90–10 achievement gap grew by 7 or more points in both math and reading per decade 2005-2024 (Figure 2, first and second row far-left clusters, orange

[8] Standard errors can be obtained from the authors upon request.

bars). Students in TPS performing at the 10th percentile were further behind their 90th percentile peers by over one-and-one-third years of learning in both key subjects from the start to the end of these 20 years. Most of the increase in the TPS 90–10 gap in 4th-grade math occurred before the onset of the COVID pandemic. The reading gap for TPS 4th graders, which had expanded at an alarming rate of nearly 9 points per decade before COVID, declined slightly after the onset of the pandemic (Figure 2, first and second far-left clusters, comparing purple to orange bars). Gains in the 90th percentile average scores (yellow bars) and declines in the 10th percentile average scores (red bars) contributed about equally to the large increase in the 90–10 achievement gap for 4th graders, 2005-2024. Pre-COVID, gains by students at the 90th percentile (comparing green bars to blue bars) largely drove the increase in the reading gap and exclusively drove it in math.

The story for 4th graders in public charter schools is different (Figure 2, top two rows, middle-left column). Unlike the other school sectors, where results tend to vary in important ways across the math and reading domains, charter results are nearly identical across the two subject areas. The 90–10 achievement gap grew by a little less than 3 points in math and a little more than 3 points in reading per decade in the charter sector, or about a third of a year of learning over a ten-year period. Nearly all the growth in the gap happened pre-COVID, when 4-5-point achievement gains per decade for the 10th percentile students almost kept pace with achievement gains at the 90th percentile of about 4-5 points. The gap grew in charters after the onset of COVID because students at the 90th percentile tested only somewhat below their pre-COVID achievement high, while students in the 10th percentile lost all or nearly all their pre-COVID learning boost. Unlike in the TPS sector, 10th percentile students in the charter sector

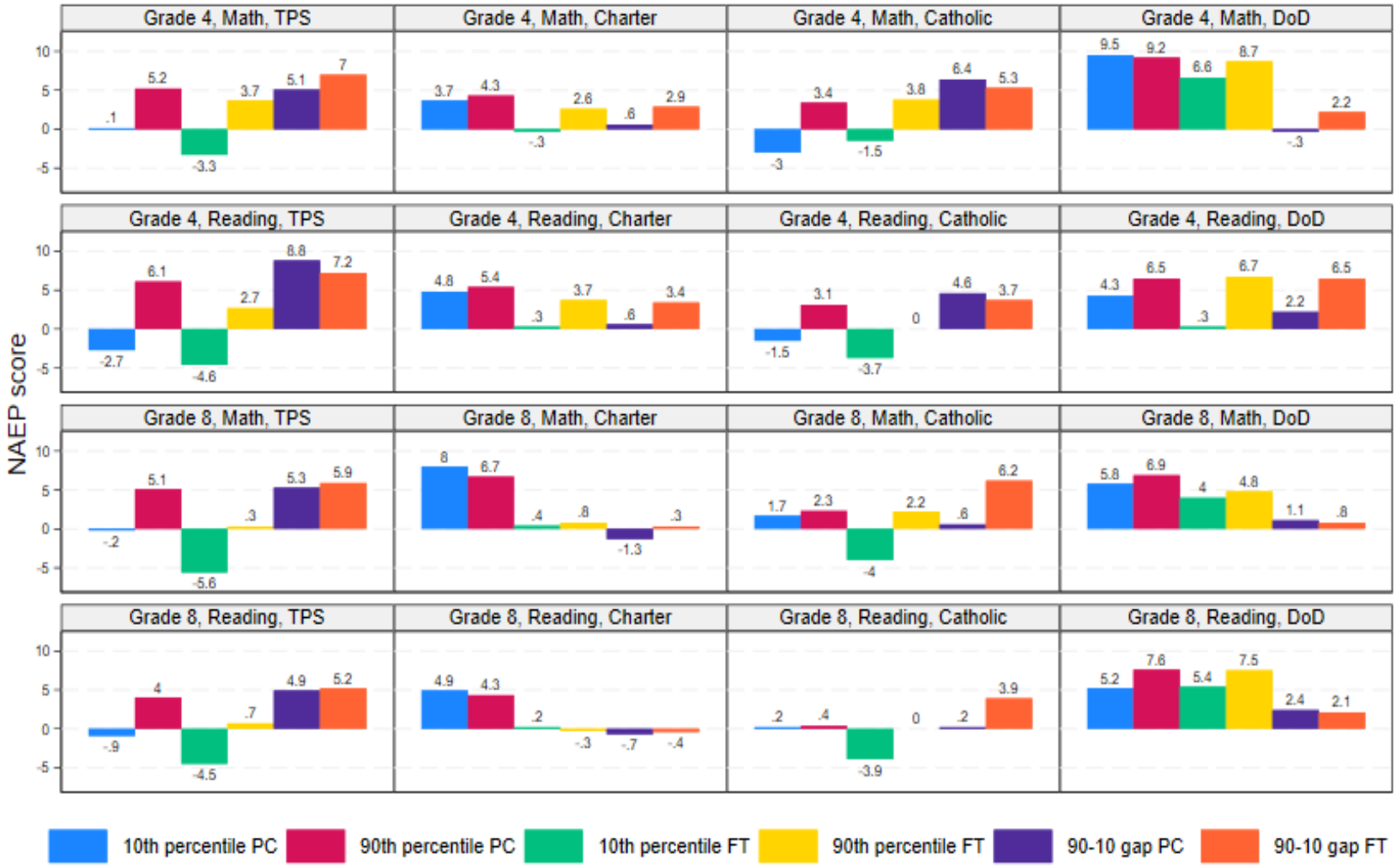
were not performing at a meaningfully lower level in 2024 than they were in 2005, in either math or reading. COVID wiped out the positive trend in their learning gains but did not reverse it.

The pattern in Catholic schools follows more closely that of TPS, but most changes are smaller in magnitude (Figure 2, top two rows, middle-right column). For Catholic school 4th graders, the 90–10 gap in math grew by over 5 points per decade, amounting to half a year of learning, while the gap in reading increased by a little less than 4 points per 10-year period, or about a third of a year of learning. The 90–10 gaps for 4th graders in Catholic schools expanded more during the pre-COVID than the post-COVID period. In reading, the average score of Catholic 4th graders at the 90th percentile in 2024 was identical to the 90th percentile average score in 2005, while the average for 10th percentile students was lower by almost 4 points.

Finally, the pattern of results for 4th graders in DoD schools most resembles that of charters, but with even higher performance (Figure 2, top two rows, far-right column). The 90–10 gap grew by a little over 2 points per decade in math and 6.5 points per decade in reading, but that was because average performance at the 90th percentile increased by nearly 9 points in math and almost 7 points in reading. For DoD 4th-grade students performing at the 10th percentile, average math scores were 6.6 points higher per decade over the time series, nearly keeping pace with the increase in average math scores for their 90th percentile peers. In reading, scores for the 10th percentile DoD students did not increase meaningfully during the period, but they also did not decline. The pre-COVID years produced no meaningful change in the 90–10 gap for DoD 4th graders in math, although the reading gap grew by about 2 points per decade pre-pandemic. Most of the increase in the 90–10 gap for 4th graders in DoD schools was due to 10th percentile student scores dropping more than the scores of 90th percentile students post-COVID.

Figure 2

Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap by grade, subject, and school sector



Notes: PC=Pre-Covid (2005-2019), FT=Full Term (2005-2024), TPS=Traditional Public School and DoD=Department of Defense.

Most 4th graders have only been in school for 5 years. Whether they are high- or low-achieving students, their performance on the NAEP is likely less a reflection of their schooling experience than it is for 8th graders, who have at least 9 years of formal schooling under their belts. Now we turn our attention to those 8th graders.

The results for TPS 8th graders are like the 4th grade results, except the increase in the 90–10 gap is slightly smaller, and the decline for 10th percentile students in math is larger (Figure 2, third and fourth rows, far-left clusters, orange and red bars). The 90–10 gap grew by nearly 6 points in math and a little over 5 points in reading per decade, representing a little more than half a year of learning in the former case and a little less than half a year in the latter. Nearly all the growth in the gap occurred pre-pandemic, mainly due to higher scores for students at the 90th percentile. The gap grew after the pandemic because scores for students at the 90th percentile stopped increasing while scores for students at the 10th percentile dropped by over half a year of learning per decade in math and over a third of a year in reading.

The results for public charter school students in 8th grade are dramatically different from the TPS pattern (Figure 2, third and fourth rows, middle-left clusters). Pre-COVID, average scores for 10th percentile 8th graders in math surged by 8 points per decade, a gain of three-fourths of a year of learning. For 10th percentile charter students, the reading gain pre-COVID was 5 points per decade, amounting to slightly less than half a year of learning. Charter 8th graders at the 90th achievement percentile experienced slightly lower gains than their 10th percentile peers in both math and reading pre-pandemic, closing the 90–10 achievement gap in the charter sector by a trivial amount pre-COVID. For charters, all the trends plateaued for 8th graders over the full term, as 10th percentile and 90th percentile achievement changes flat-lined, causing the change in the 90–10 gap to do likewise.

For 8th graders in Catholic schools, there was no meaningful change in the 90–10 achievement gap in either math or reading pre-COVID (Figure 2, third and fourth rows, middle-right column, purple bars). Average scores for students at the 10th and 90th percentiles increased trivially and comparably in both math and reading pre-COVID, leaving the gap between them unchanged. During and after COVID, average scores for students at the 10th percentile dropped dramatically, resulting in a decline for the entire study period of around 4 points, or over one-third of a year of learning, which drove the overall increase in the gap in Catholic schools of over 6 points in math and nearly 4 points in reading.

In several respects, the results for 8th graders in DoD schools are closest to our conceptual ideal. The 90–10 gaps in DoD schools did not increase for 8th-grade students either pre-COVID or over the entire period, indicating that both high- and low-performing students in DoD schools showed increasing or stable test scores before, during, and since the pandemic. In reading, the gains of students at the 10th percentile of over 5 points per decade and of students at the 90th percentile of 7.6 points per decade, before COVID, were at least the same, if not higher, during the full period, *indicating no drop in reading scores for 8th graders in DoD schools since the onset of the pandemic*. In math, the full-term test score increase was slightly larger than the pre-COVID increase, but comparable in size for both the 10th and 90th percentile students, resulting in no meaningful change in the 90–10 gap since the pandemic.

In sum, our overall results indicate that none of the four school sectors fully meet our conceptual standard for improvement and equality, as evidenced by NAEP scale score changes 2005-2024. The DoD sector performed best on improvement metrics, as students at the 10th percentile increased their test scores over the full term in all cases except 4th-grade reading, which remained flat. Scale-scores increased in all four grade/subject categories for students at the

90th performance percentile in DoD schools, representing gains from about 40 percent to about 85 percent of a full year of learning, across the full term of our longitudinal data. While the gains for 90th percentile students in DoD schools were consistently higher than those for 10th percentile students, the difference was only large for 4th graders in reading. For the other three grade/subject categories, the 90–10 achievement gap increased only slightly in DoD schools over our 20-year period. Thus, DoD schools overall fall in the bottom left quadrant of our diagram: Improvement without Equality, though they also do not show a meaningful increase in inequality, except in the case of 4th-grade reading.

Public charters similarly meet the criteria for Improvement without Equality, but without the consistently strong gains in scores evidenced by DoD schools across the full term. All the meaningful gains in scores for 10th percentile students pre-COVID dissipated post-pandemic. The same pattern is evident for 90th percentile students in 8th grade (but not in 4th grade). The 90–10 achievement gap did not decline over the full term for 8th graders in public charter schools, but it also did not grow. For 4th-grade charter students, the gap grew moderately over the full term, as pre-COVID score increases for 10th percentile students decreased more post-pandemic than those for 90th percentile students.

Both TPS and Catholic schools fall into the category of lower scores without gap reduction, based on their overall full-term results. The TPS sector only demonstrated meaningful achievement gains for its higher performers, and only in 4th-grade subjects. For lower performers in TPS, scores declined meaningfully across the board, in math and reading, in 4th and 8th grade. As a result, the 90–10 performance gap in TPS is much larger at the end of our 20-year period, leaving TPS squarely in the lower scores without gap reduction category. The

results for Catholic schools were broadly like those of TPS, though smaller in magnitude, leaving Catholic schools also in the lower scores without gap reduction classification.

Main Findings Robustness Check

Our main findings draw on performance changes for student populations at both tails of the achievement distribution —the 90th and 10th percentiles. Accidents, cheating, and unique circumstances tend to affect extremes much more than they influence the central tendency of a distribution (Hanushek et al., 2022). To assess the robustness of our findings, we replicated the analysis using the 75th and 25th percentiles instead of the 90th and 10th. For most school sectors, grades, subjects, and time periods, the results for the 75th and 25th percentiles, and the gap between them, are merely moderations of the 90–10 results, as we would expect (Figure 3; see Appendix Figures S14-S33 for subgroup results).

In the TPS sector, the 75–25 achievement gap widened meaningfully across all grade/subject categories except 8th-grade reading, where it widened trivially (Figure 3, far-left column). Pre-COVID, average scale scores for TPS students at the 25th percentile increased meaningfully in 8th-grade reading and trivially in the other grade/subject categories, compared to a meaningful drop in 4th-grade reading and trivial declines in both 8th-grade subjects for students at the 10th percentile. This pattern underscores that the TPS sector was not improving outcomes for its lowest performers —those at the 10th percentile —before COVID, even as average scores were rising at least trivially for its 25th percentile students.

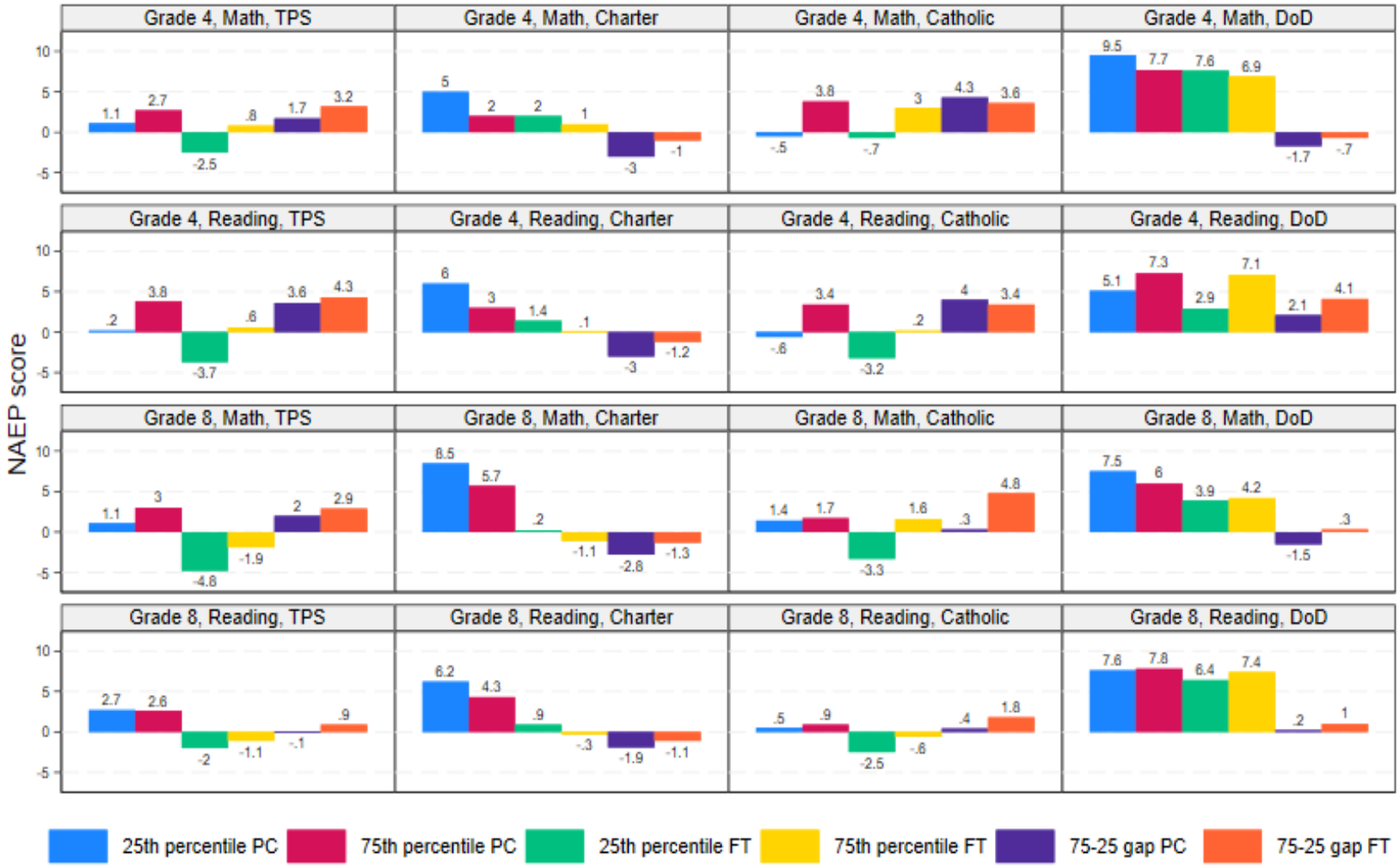
For public charter schools, the 75–25 performance gap declined by a trivial amount for all grade/subject categories over the full term (Figure 3, middle-left column, orange bars). These results contrast somewhat with the 90–10 gap for charters, which increased meaningfully for 4th graders and remained essentially unchanged for 8th graders. The charter sector produced strong

test score gains for its students at the 25th percentile pre-COVID, some of which survived the pandemic. In contrast, its students at the 75th percentile gained less than their 25th percentile peers pre-COVID and, for 8th graders, lost a trivial amount of ground across the full term.

In the Catholic school sector, almost every result for the 75–25 groups and gaps is about 20% smaller than for the 90–10 groups and gaps (Figure 3, middle-right column). The DoD sector 75–25 results also closely approximate its 90–10 results (Figure 3, far-right column), except that the full-term gap in 4th-grade math flips to a trivially lower 0.2 points for the 75–25 comparison, as opposed to 2.2 points higher for the 90–10 comparison. Similarly, the pre-COVID 75–25 gap in math for 8th graders in DoD schools dropped trivially, whereas it grew by 2.2 points in the 90–10 analysis. Thus, there is some evidence of equality gains in DoD schools when comparing their 75th percentile scores to their 25th percentile scores. Still, we generally do not observe such gains when comparing their 90th percentile scores to their 10th percentile scores.

Figure 3

Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap by grade, subject, and school sector



Notes: See Fig. 2.

Highlights of Subgroup Findings

The results of our analysis within key subgroups are too extensive to discuss in their entirety (see Appendix Figures S1-S13). Here we summarize the results, highlighting outlier findings that contrast with the overall classification of public charter schools and DoD as posting score changes that signal increasing improvement with a simultaneous increase in inequality, and TPS and Catholic schools posting score changes that suggest increasing achievement drops and inequality.

Ethnicity

Figures 4, 5, 6, and 7 present ethnic results for white, black, Hispanic, and Asian students. Public charter and DoD schools stand out for their increasing scores for black students, especially pre-COVID. Pre-pandemic, the scores of black 4th-grade students at the 90th percentile in charters increased by over 8 points per decade in both math and reading, while scores of black charter peers at the 10th percentile remained stagnant. In 8th grade, scores of black students at the 90th percentile in charters surged by 12 points per decade in math and nearly 5 points per decade in reading, though the score increases for their 10th percentile peers were smaller at 7 and 3 points, respectively. Thus, the 90–10 gap grew substantially for black students in charters both before the pandemic and for the full term of the study, in all grades, subjects, and periods except pre-COVID 8th-grade reading.

Scores for black students at the 90th percentile in DoD schools increased more than those of high performers in any of the other sectors, including charters. For 4th graders, pre-COVID, those gains were 14 points per decade in math and 10.5 in reading, only slightly diminished by the pandemic. Scores of 8th-grade black students at the 90th percentile in DoD schools increased almost 8 points per decade in math and over 9 in reading pre-COVID, with the reading gains

expanding to nearly 11 points for the full term of our study. Both pre-COVID and full-term gains in scores for 10th percentile black students in DoD schools were smaller, and close to 0 full term across all grades and subjects except 4th-grade math, producing large increases in the 90–10 performance gap for black DoD students. For white 8th-grade students in both charter and DoD schools, achievement gains both pre-COVID and full term were similar for students at the 90th and 10th percentiles, leading to little change in the 90–10 achievement gap for 8th-grade white students in those schools.

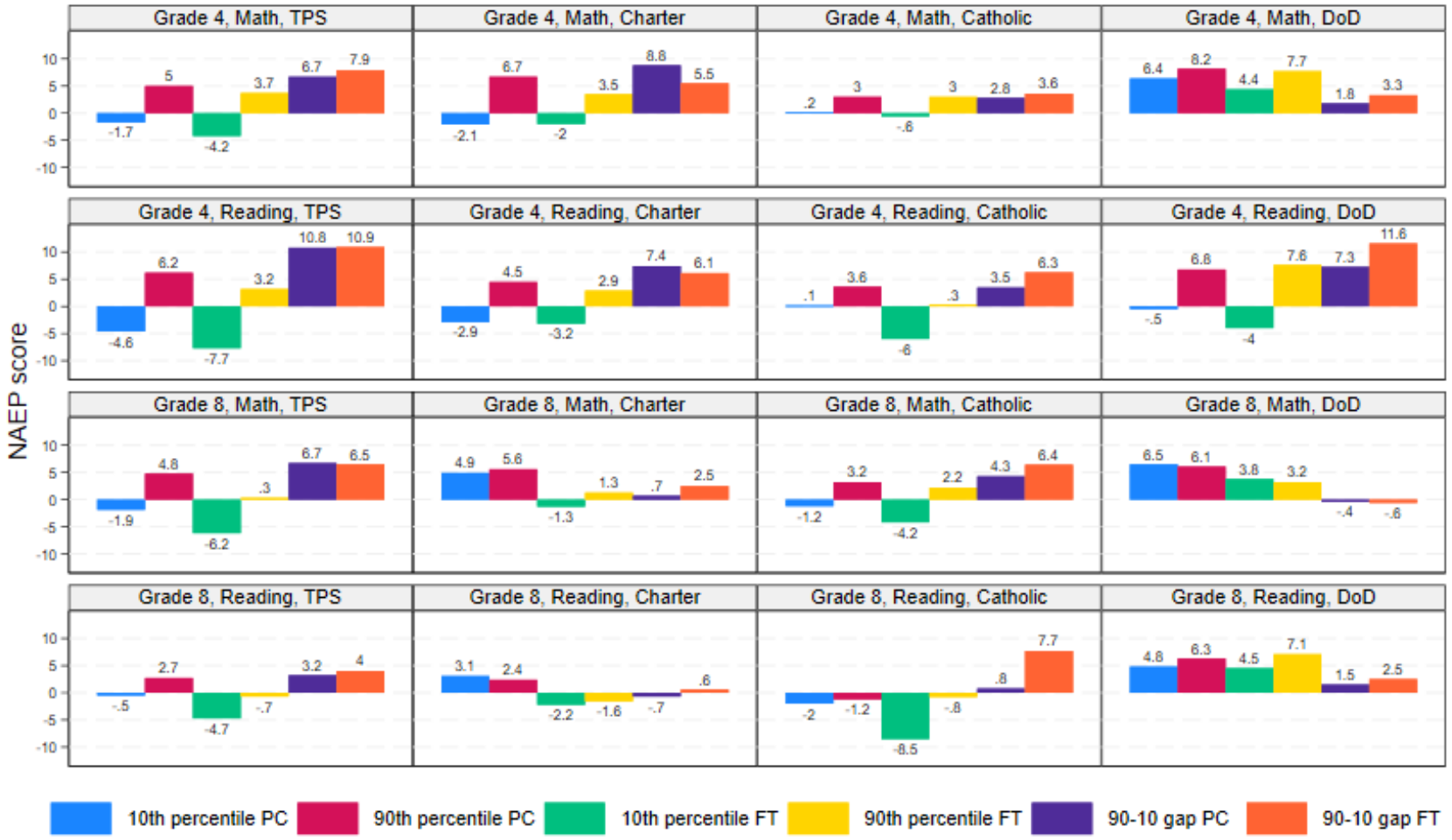
Charter schools also generated similar gains for Hispanic students at the 90th and 10th percentiles in 8th-grade math and reading and 4th-grade reading pre-COVID and full term, producing no meaningful change in the 90–10 gap in those grades and subjects, especially full term. Catholic schools experienced little change in the 90–10 performance gap for Hispanic students in grade 8 math, as neither high nor low performers gained or lost substantial ground pre-COVID or full term, but the 90–10 gap grew by almost 11 points per decade in 4th-grade reading for Hispanic students in Catholic schools full term, as the achievement level of the 10th percentile students dropped almost 5 points per decade while the performance of the 90th percentile students surged by over 6 points per decade.

The scores of Asian students increased in both levels and equality over the 20 years in public charter schools, except in 8th-grade reading (Figure 7). The patterns for 4th graders are especially striking. Asian students in 4th grade at the 10th percentile in charters gained almost 8 points per decade in math and nearly 17 points per decade in reading pre-pandemic. Amazingly, their gains over the full term of the study are even larger, almost 12 points and over 18 points respectively, indicating that the average score for 10th percentile Asian 4th graders in charters increased both during *and after* the pandemic, even after adjusting for student demographic

changes. The gains for 90th percentile Asian students in 4th grade in charters were more modest than those of their 10th percentile peers, producing significant reductions in the 90–10 achievement gap of 4.6 points in math and 13.4 points in reading for that subgroup. Asian charter students at the 10th percentile also experienced sizable increases in math and reading scores in 8th grade pre-pandemic, but only the math gains survived COVID and reduced the 90–10 gap by 3 points. The reading gains for 10th percentile Asian 8th-grade charter students did not survive the pandemic, and the 90–10 gap in that subject grew by 5 points over the full term.

Figure 4

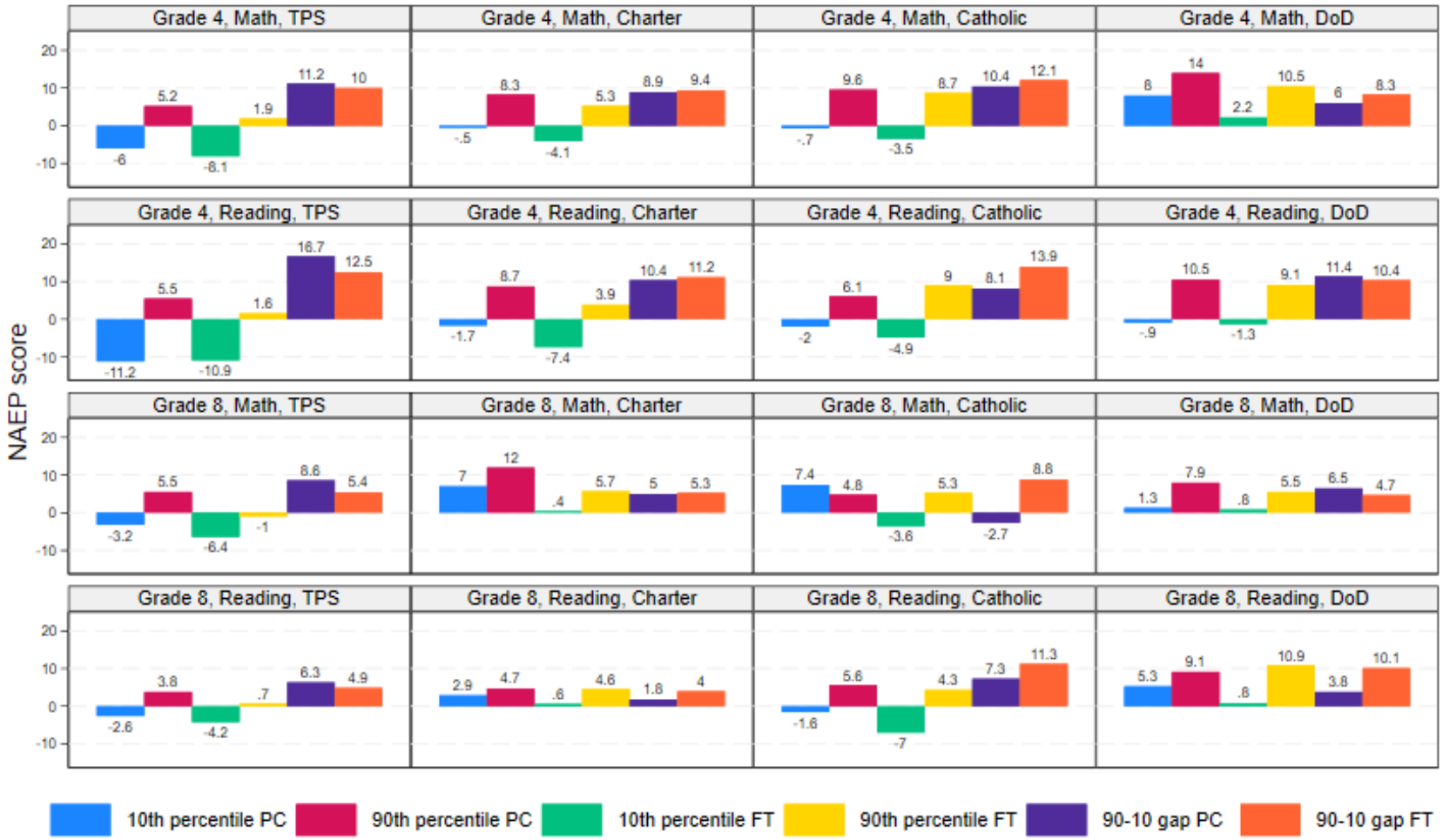
Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for white students by grade, subject, and school sector



Notes: See Fig. 2.

Figure 5

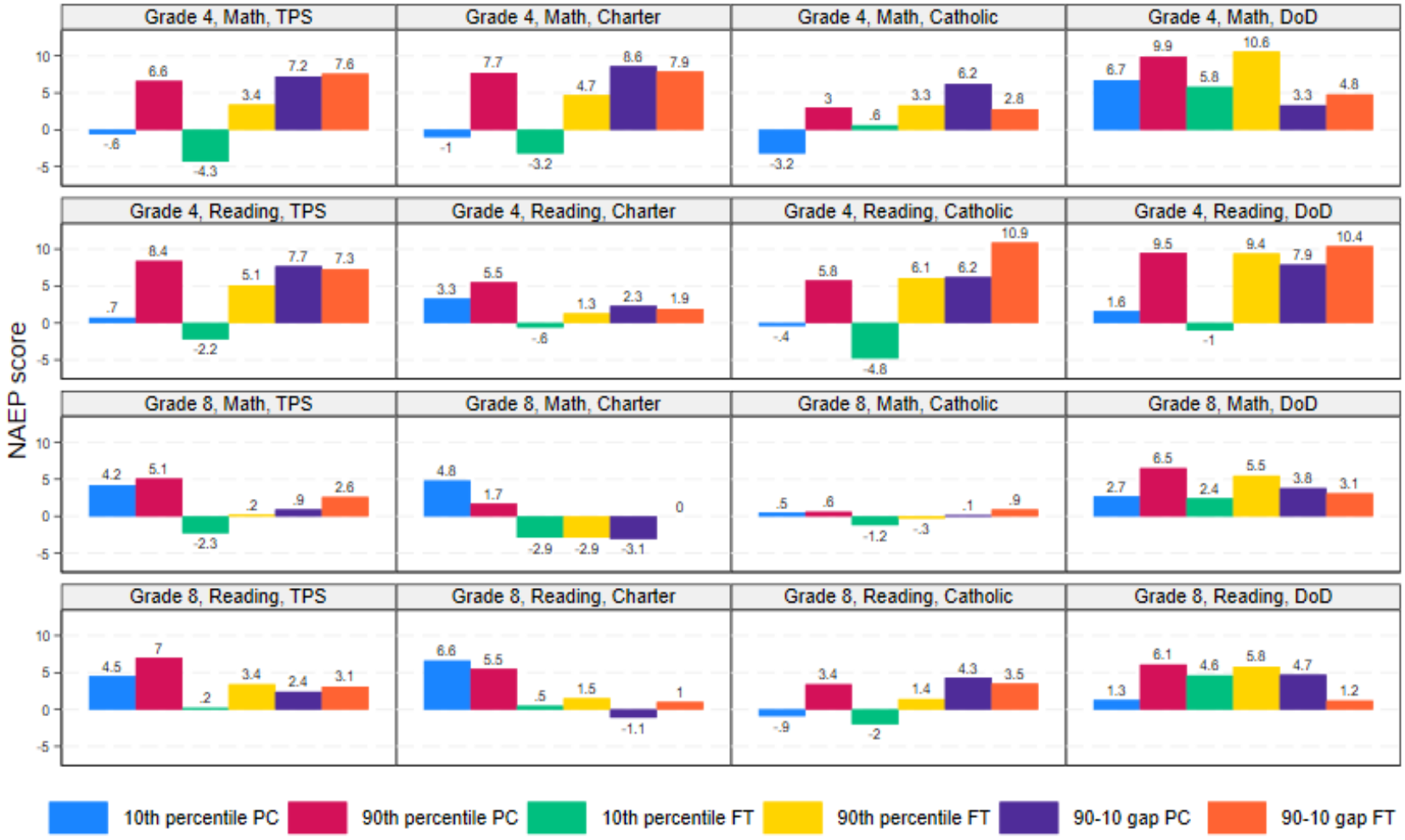
Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for black students by grade, subject, and school sector



Notes: See Fig. 2.

Figure 6

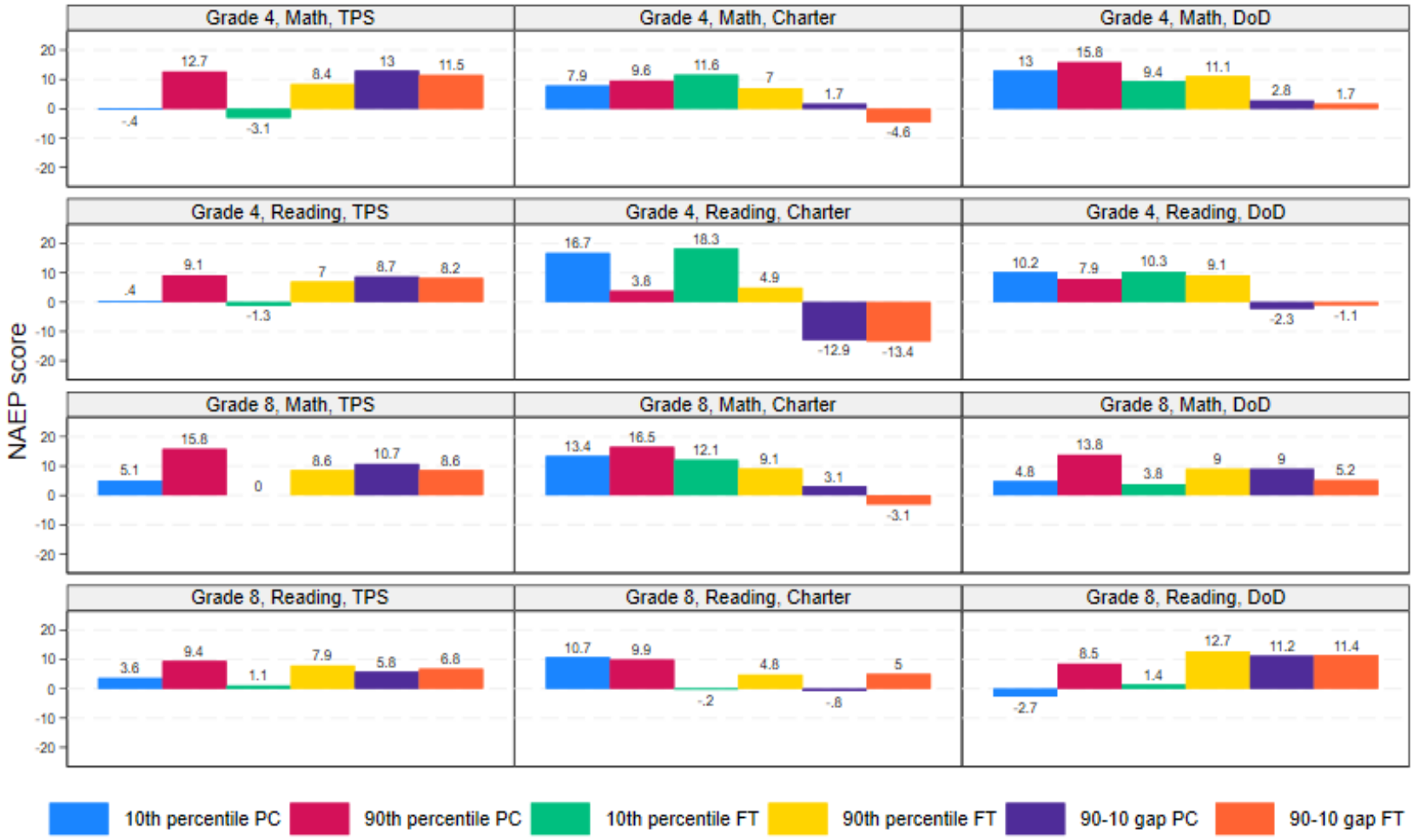
Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for Hispanic students by grade, subject, and school sector



Notes: See Fig. 2.

Figure 7

Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for Asian students by grade, subject, and school sector



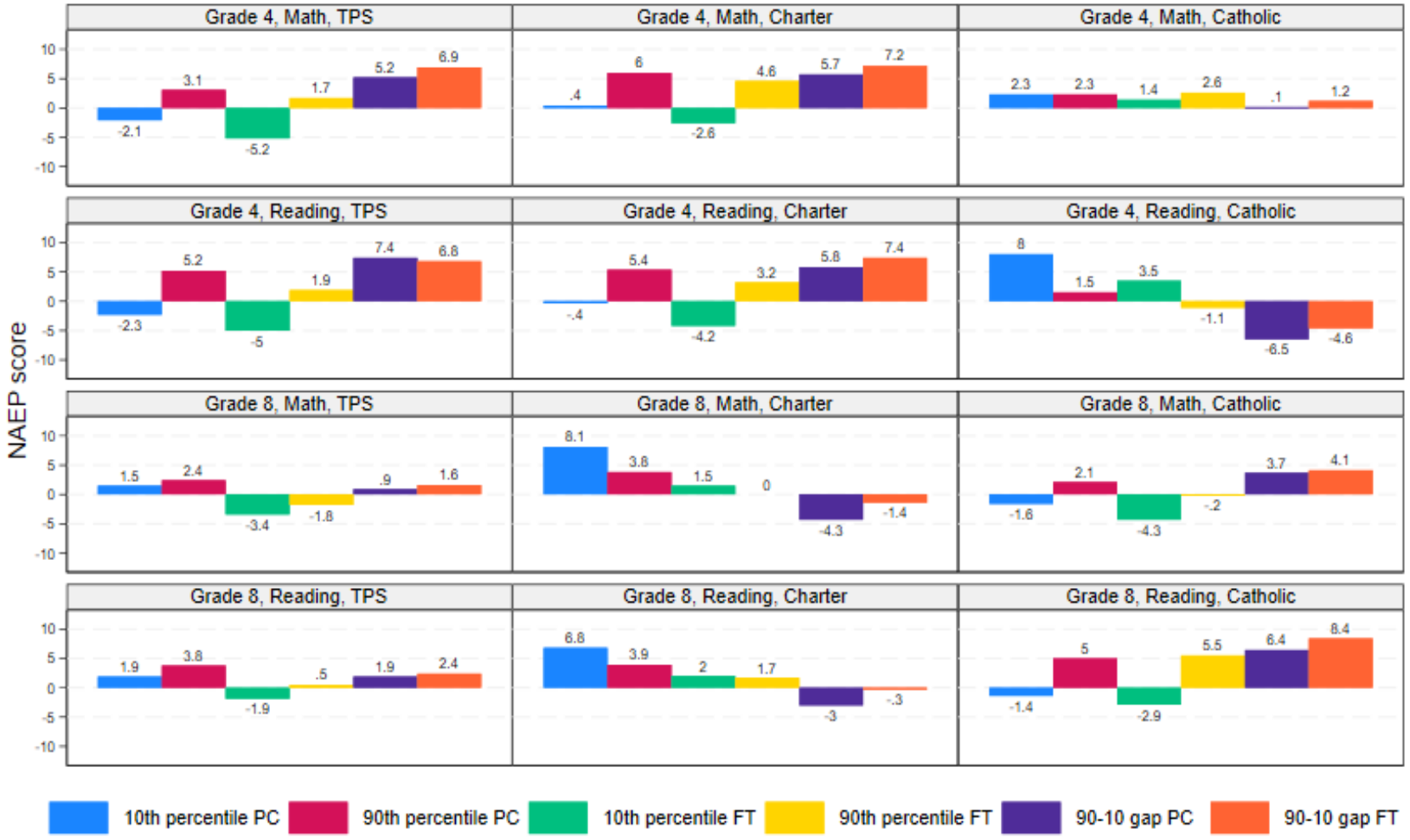
Notes: See Fig. 2.

Economically Disadvantaged

The TPS, public charter, and Catholic school sectors primarily evidenced growth in the 90–10 performance gap for their economically disadvantaged students at one but not the other grade level (Figure 8). In the TPS and charter sectors, the gap grew substantially in 4th grade, by around 7 points per decade in both school sectors and subjects for 4th graders, but either restrained or reversed growth in the 90–10 gap in the 8th grade subjects. The charter sector stands out for a drop in its 90–10 achievement gap among economically disadvantaged 8th graders pre-COVID by over 4 points per decade in math and 3 in reading. The reductions shrunk to nearly 0 over the full term, however. The gap in charters declined pre-COVID because the scores of 10th percentile students who were economically disadvantaged increased by a greater amount than the increase for 90th percentile low-income students, but hardly any of those gains survived the pandemic. For Catholic schools, the 90–10 gap in 4th grade math for economically disadvantaged students barely changed both pre-COVID and full term. In 4th grade reading, the 90–10 achievement gap among the low-income subgroup of Catholic students decreased by 6.5 points per decade pre-COVID and 4.6 points per decade for the full term, demonstrating one of the few full-term 90–10 performance gap closings. The DoD schools did not have sufficient counts in their income disadvantaged subgroup to be included here.

Figure 8

Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for economically disadvantaged students by grade, subject, and school sector



Notes: See Fig. 2.

English Language Learners (ELL)

The 90–10 performance gap for ELL students in TPS grew by 9-10 points per decade in 4th-grade math and reading, both pre-COVID and full term, due to large drops in the average achievement of 10th percentile students of 7-11 points per decade (Figure 9). The pattern is dramatically different in 8th grade, as there was no change in the 90–10 gap in reading either pre-COVID or full term. The TPS sector showed a decrease in the gap for ELL students in 8th-grade math, by nearly 5 points per decade pre-COVID and over 2 points per decade full term, mainly due to declines in the scores of 90th percentile students. In the charter sector, the 90–10 achievement gap for ELL students grew by 10-12 points in 4th-grade math pre-COVID and full term, barely increased in 4th-grade reading, and declined massively in 8th-grade math and reading.

The 8th-grade results for ELL students in public charter schools are stunning. In math, average performance at the 10th percentile rocketed up 16.5 points per decade pre-COVID, even while average performance at the 90th percentile declined by 11.6 points per decade, producing a reduction in the 90–10 achievement gap for 8th-grade ELL students in charters of over 28 points per decade, *by far the largest gap reduction in our study*. The 10th percentile scores of ELL students in charters post-pandemic were much lower but still above their 2005 scores, while scores at the 90th percentile actually improved during and after the pandemic for ELL students, generating a reduction in the 90–10 gap in 8th grade math for ELL charter students of 14 points per decade for the full term, a substantial equalization of achievement. The pattern was broadly similar for ELL students in 8th-grade reading, as the 90–10 gap declined by over 17 points per decade pre-COVID and nearly 15 points full term, with 10th percentile ELL students retaining almost all of their 10 points-per-decade pre-COVID gains through the full term of the study. In

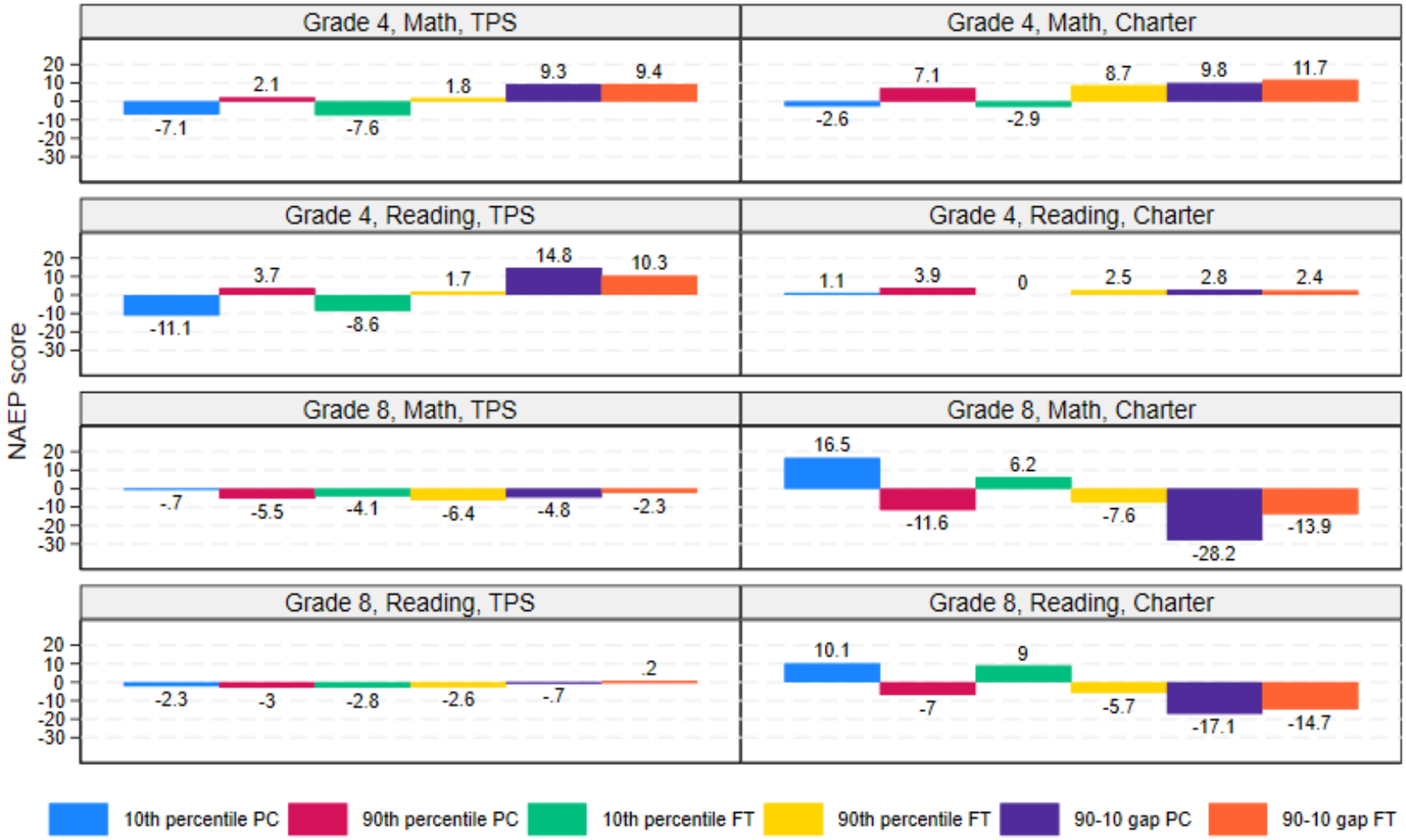
contrast, 90th percentile ELL students declined moderately in performance. The Catholic and DoD sectors had too small a subsample of ELL students to be included in this subgroup analysis.

Students with Disabilities (SWDs)

The 90–10 achievement gap for SWDs in the TPS, charter, and DoD sectors followed interesting patterns that, in some cases, deviated from the overall sector pattern (Figure 10). The gap grew substantially for 4th-grade SWDs in TPS, as the average achievement of 10th percentile SWDs declined while that of 90th percentile SWDs remained flat. For 8th-grade SWDs in TPS, the gap did not change meaningfully because scores rose and fell modestly and similarly for those at both the 90th and 10th percentiles. For charters, SWDs experienced a slight increase in the gap in 4th-grade math, due to declines in performance at the 10th percentile, but no meaningful change in the gap in 4th-grade reading due to slight declines for both high and low performers, both pre-COVID and full term. The big story for charters again occurs in 8th grade. The 8th-grade SWDs in the charter sector experienced a substantial reduction in the 90–10 gap of 13-14 points per decade pre-COVID and about 7-9 points per decade full term. Importantly, the gap closed because the average scores of charter SWDs in 8th grade at the 10th percentile increased by nearly 15 points in math and 12.5 points in reading pre-COVID. In contrast, the average scores of their 90th percentile peers barely changed, and at least some of those gains held up during the pandemic. The pattern of the 90–10 gap in DoD schools for SWDs closely follows the overall pattern of substantial increases in both the 90th and 10th percentile student scores, which largely survive the pandemic but are slightly higher at the 90th percentile, thereby modestly widening the gap.

Figure 9

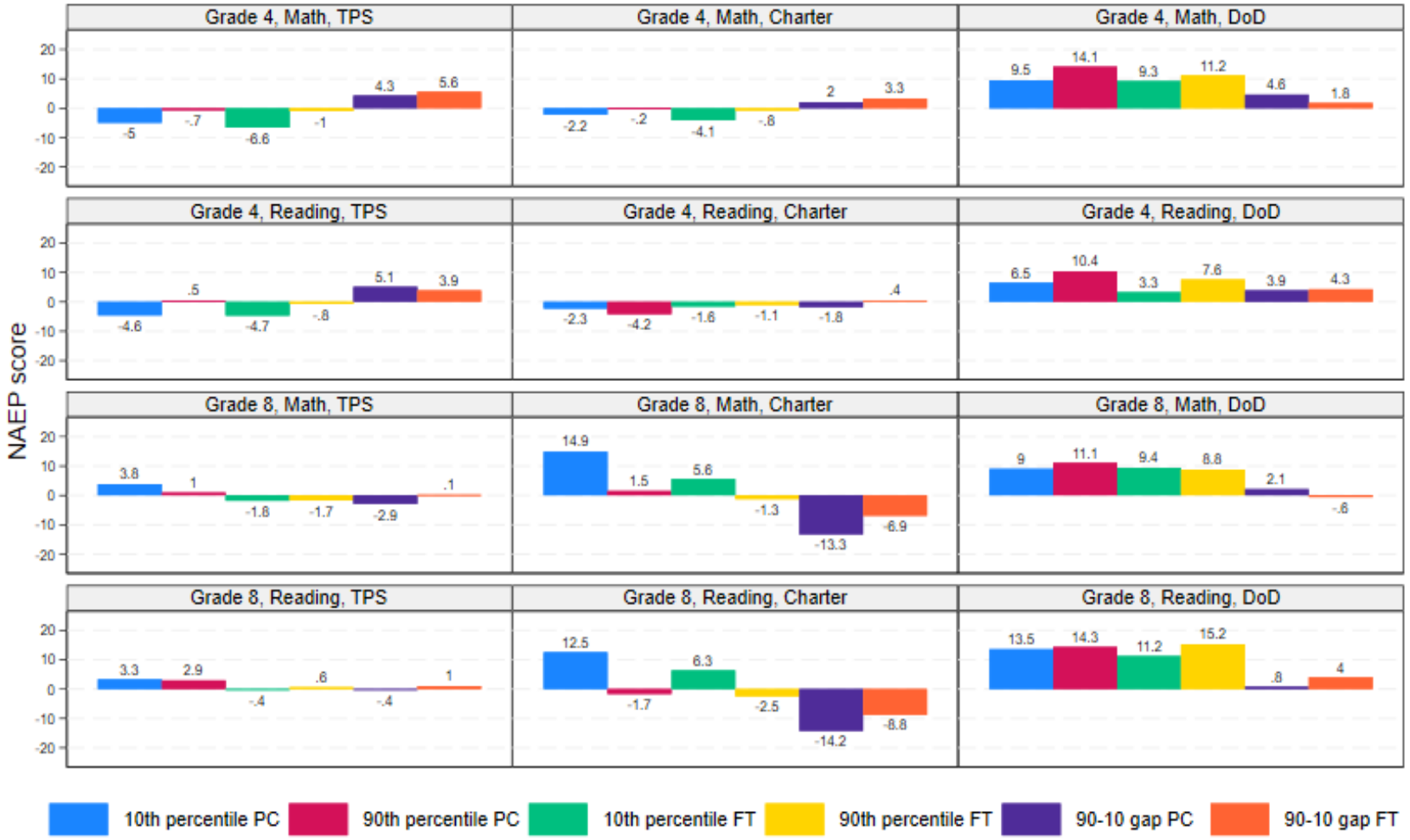
Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for English language learner students by grade, subject, and school sector



Notes: See Fig. 2.

Figure 10

Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for students with disabilities by grade, subject, and school sector



Notes: See Fig. 2.

Other Subgroup Highlights

The subsamples of students by parental education level were small, available only for some school sectors and in 8th grade, but some of the results are striking (Appendix Figures S1–S4). The 90–10 gap in math declined by 4.5 points full term for students of parents with less than a high school diploma who were in public charter schools, as 10th percentile students held onto a sliver of gains through the pandemic, while 90th percentile students switched from modest gains to modest losses. The scores of students of parents with only a high school diploma at the 10th percentile in TPS were dramatically lower post-pandemic. Still, their 90–10 gap only increased by 2-3 points because 90th percentile scores dropped substantially as well. Some of the largest increases in the 90–10 gap we observe are among children of parents with some college enrolled in Catholic schools, where the gap over the full term spiked by nearly 16 points in math and 14 points in reading because the average performance of 10th percentile students cratered. The pattern of results across sectors and time for children of college-educated parents was similar to the overall results.

The patterns for male and female students closely reflect the overall patterns, except that the scores of 10th percentile male 8th graders in Catholic schools dropped dramatically over the full term, especially after COVID (Appendix Figures S5 and S6). For students who are not economically disadvantaged, the pattern is distinctive only for Catholic schools, as scores for students with higher incomes at both the 10th and 90th percentiles changed little before COVID or over the full term, across grades and subjects (Appendix Figure S7). The pattern of results for students in urban areas does not differ substantially from the overall pattern. The 90–10 achievement gap changed by about the same amount, or did not change, across sectors, grades, subjects, and time periods, for non-ELL students, students without disabilities, and students in

cities, suburbs, towns, and rural areas as it did for the overall sample, with one big exception (Appendix Figures S8–S13). In towns, 4th-grade students in charter schools saw a massive increase in the 90–10 gap in reading —equivalent to around 2 years of learning per decade — entirely before the pandemic, due to a huge plunge in the average scores of 10th percentile students (Appendix Figure S12).

Limitations

This paper presents a descriptive analysis of changes in achievement levels and inequalities in TPS, charter, Catholic, and DoD schools in the U.S. between 2005 and 2024. We adjust all our results based on key student demographic characteristics—race, gender, income, ELL status, disability status, and locale. We also present achievement trends, and not levels, as levels are more affected by measured and unmeasured student characteristics than are trends. Unmeasured student characteristics that vary across both school sectors and time still might be influencing achievement levels and trends at the 90th and 10th percentiles, and therefore our estimation of the 90–10 gap. We cannot rule out temporal changes in unmeasured student selection factors as a primary explanation for the magnitudes and trends in the 90–10 gaps we present here. Thus, our findings are descriptive and associational, not necessarily causal.

Our data are pooled cross-sectional. Thus, they do not track changes in achievement for specific students over time. Instead, they demonstrate changes in the performance of student categories over time across school sectors.

Our analysis is limited by the data made available by the NCES. Although non-Catholic private schools participate in the NAEP, they do so in insufficient numbers or with insufficient consistency to be included in our longitudinal analysis. Some student subgroups in the DoD and

Catholic school sectors are too small to report results. We can only speak about the available data.

Discussion

In accordance with the conceptual framework in Figure 1, we can generate a summary report card on improvement and equality across all results. A sector exhibits improvement if student achievement increases by at least 2 points per decade. A sector displays equality if the meaningful score increases for the lower-achievers are at least as large as the increases for the higher-achievers. In Table 1, we count the total occurrence of improvement and equality across the 1000 overall and subgroup trend results in our analysis. We display the count as a percentage for a sector by grade, subject, and duration (PC=Pre-COVID (2005-2019) or FT=Full Term (2005-2024)). The top section of Table 1 shows percentages for improvement, and the bottom section displays percentages for equality. The averages are also displayed on the bottom row and right column for the two analyses.

One takeaway from Table 1 is that improving scores is hard, but closing gaps is harder. Nearly 29 percent of our comparisons across time demonstrate improvement, meaning that over 71 percent do not. The DoD schools pull up the improvement average dramatically, with 71 percent of their comparisons showing test-score improvement over time, compared to almost 36 percent for charters, a little over 7 percent for TPS, and just 2 percent for Catholic schools. Still, this underperformance on the improvement metric pales in comparison to the results on the equality metric. A mere 10% of our comparisons demonstrate any closing of the gap between 90th percentile and 10th percentile performers. Charters show the highest proportion of gap-reducing comparisons —23 percent —while DoD schools show 14 percent, Catholic schools a mere 2 percent, and TPS a minuscule 1 percent.

Table 1. Sector summary – Improvement and Equality

Grade	4	4	4	4	8	8	8	8	
Subject	Math	Math	Reading	Reading	Math	Math	Reading	Reading	
Duration	PC	FT	PC	FT	PC	FT	PC	FT	
Improvement									Average
TPS	5.9	0	5.9	0	19	0	28.6	0	7.4
Charter	41.2	11.8	52.9	11.8	81	9.5	76.2	0	35.5
Catholic	9.1	0	0	0	7.7	0	0	0	2.1
DoD	100	90.9	54.5	27.3	78.6	64.3	78.6	71.4	70.7
Average	39	25.7	28.3	9.8	46.6	18.5	45.8	17.9	28.9
Equality									Average
TPS	0	0	0	0	0	0	9.5	0	1.2
Charter	17.6	11.8	23.5	5.9	52.4	9.5	61.9	0	22.8
Catholic	9.1	0	0	0	7.7	0	0	0	2.1
DoD	27.3	0	18.2	9.1	21.4	21.4	14.3	0	14
Average	13.5	2.9	10.4	3.7	20.4	7.7	21.4	0	10

Note: Table displays percentages based on counts of improvement and equality out of the total results for a sector by grade, subject, and duration (PC=Pre-COVID (2005-2019), FT=Full Term (2005-2024)).

Other overall patterns are interesting. Results are worse over the full term than pre-COVID, as expected. Trends are worse for 4th graders than for 8th graders, with a few exceptions. No sample-wide average for improvement or equality, by grade and subject, indicates a majority of comparisons meet our benchmarks. Eighth-grade math and reading trends pre-COVID come closest, with 46-47% of comparisons showing test-score improvements over time. The worst overall results are regarding the equality metric. Of the 69 comparisons across the full term of our analysis for 8th-grade students in reading, *none showed gains in equality*. No sector reduced the 90–10 achievement gap in reading from 2005 to 2024, overall or for any subgroup of 8th graders. Less than 3 percent of the trends in 4th-grade math scores indicated gap-closing over the full term, solely because the charter sector showed equality gains in nearly 12 percent of its trends. Less than 4 percent of the reading trends examined full term for 4th graders resulted in gap reduction.

In our overall findings, we observe meaningful test-score improvements without substantial increases in inequality —our ideal outcome —in one result for the Department of Defense schools run by the U.S. Federal Government. In 8th-grade math, from 2005 to 2024, the average score of DoD students at the 10th percentile increased by about four-tenths of a year of learning per decade, allowing them to nearly keep pace with their 90th percentile peers, who gained slightly less than half a year of learning per decade during that period. The result was no significant increase in the 90–10 achievement gap in 8th-grade math in DoD schools, as both groups advanced together. The pattern of results in DoD schools persisted through the COVID pandemic, except that pre-COVID decadal gains of about four-tenths of a year of learning for the 10th percentile students in 4th-grade reading were no longer present post-pandemic, leading to

an increase of six tenths of a year of learning in the 90–10 gap per decade due to DoD students at the 90th percentile holding onto all their pre-COVID gains in that grade and subject.

The improvement trends for public charter schools were not as strong as the trend for DoD schools, but they did improve the equality of student outcomes. From 2005 to 2024, the average achievement of charter students at both the 90th and the 10th percentiles did not change meaningfully. Moderate gains for both groups across the board during the pre-COVID era were not evident post-pandemic for students at the 10th percentile in both grades and subjects, as well as the students at the 90th percentile in 8th grade. Thus, the charter sector experienced no change in the 90–10 gap in 8th-grade math or reading, as scores for both high and low performers dropped commensurately during and after the pandemic.

The TPS sector reflected the least desirable NAEP outcomes in our analysis. Overall, by 2024, TPS demonstrated the largest increase in the 90–10 achievement gaps across all grade/subject categories, except 8th-grade math. This growth in the 90–10 achievement gap from 2005 to 2024 in TPS left the school sector that educates the most students with the largest sector-based gap between its high- and low-performing students, passing the public charter school sector, which had the largest 90–10 achievement gap in our anchor year of 2005.

The most concerning finding in our study is the explanation for why the gap has grown so much in the TPS sector since 2005. The primary reason for TPS gap expansion is that the average scores of students in the 10th percentile have declined since 2005 by about one-third of a year of learning per decade in 4th-grade math, over four-tenths of a year of learning per decade in 4th-grade and 8th-grade reading, and over half a year of learning per decade in 8th-grade math. A meaningful decline in the 10th percentile scores in TPS only preceded the pandemic for 4th-grade reading. For the other three grade/subject categories, 10th percentile scores were flat

before tanking during COVID and not recovering. The extensive school closings in TPS during the COVID pandemic, demanded by teacher union officials and supported by many public health officials (DeAngelis & Makridis, 2021; Patrinos, Jakubowski & Gajderowicz, 2025), appear to have had a disproportionate negative effect on 10th percentile students, almost exclusively explaining their average achievement drop from 2005 to 2024.

Catholic schools also experienced drops in the performance of their 10th percentile students and increases in the scores of their 90th percentile students, but those changes since 2005 mostly were not as pronounced as the TPS changes, leading to smaller increases in the 90–10 gap for Catholic schools than for TPS, except in 8th-grade math, where the gap increased slightly more in the Catholic sector than in the TPS sector.

Outliers

The 90–10 achievement gap has grown meaningfully across all school sectors and subjects since 2005, except for the one DoD outcome and two charter outcomes mentioned above. In certain types of schools, however, some student subgroups have demonstrated sizable reductions in the gap, either by the preferred mechanism of higher 10th percentile score increases than 90th percentile score increases, or by the non-preferred mechanism of reduced achievement outcomes at the 90th percentile. The score trends of Asian students in public charter schools in 4th grade resulted in a decline of over a year of learning in the achievement gap over the full term because large gains at the 10th percentile pre-pandemic were slightly higher post-pandemic. The 90–10 achievement gap for economically disadvantaged 4th-grade students in DoD schools in reading shrank by almost half a year of learning per decade, driven by modest increases in 10th percentile achievement scores and small declines in 90th percentile scores. For economically disadvantaged 8th graders in charter schools, the pattern is similar in both math

and reading. The 90–10 gap decreased by a trivial amount because 10th percentile performance increased slightly while 90th percentile performance grew less (reading) or not at all (math).

We observed a dramatic 90–10 gap closing for ELL students and students with disabilities in the public charter school sector. The gap for 8th-grade ELL students in charters dropped by over a year of learning per decade in math and over one and a third years of learning per decade in reading, but the gap reduction was due to a combination of large increases in achievement at the 10th percentile, accompanied by substantial declines in achievement at the 90th percentile. Similarly, 8th-grade students with disabilities in the charter sector experienced a decadal decrease in the 90–10 gap of nearly two-thirds of a year of learning in math and over three-quarters of a year of learning in reading because 10th percentile scores surged dramatically while 90th percentile scores declined slightly.

In analyzing these data, we hoped to identify many clear cases of schooling improvement accompanied by large gains in equality. We were disappointed only to find a single case that fully met our admittedly optimistic criteria: Reading scores of Asian 4th-grade students in public charter schools.

Policy implications

The TPS sector in the U.S. has both improvement and equality challenges. The gaps in achievement levels between the highest- and lowest-performing student subgroups are largest and are growing the most in the TPS sector, which educates 77% of the school-age population. The 90–10 achievement gap has grown in the TPS sector primarily because the achievement of the 10th percentile of test-takers has declined by as much as half a year of learning per decade over the past 20 years. Clearly, policymakers and TPS practitioners need to focus on reducing the yawning gap in achievement between high- and low-performing students by improving

outcomes for students at the lower end of the distribution. There are several policy interventions proven to be effective in boosting achievement in schools, including high-dosage tutoring, instruction consistent with the science of reading, and extended learning time (Fryer Jr & Howard-Noveck, 2020; Grissmer et al., 2023; Jez & Wassmer, 2015; Robinson, Kraft, Loeb, & Schueler, 2021). These interventions need to be made available to more low-achieving students in TPS.

More research is needed on this topic. Scholars need to study Department of Defense schools to learn what they do differently that might explain their positive trend in achievement gains for students at both the 10th and 90th percentiles, and their mostly small increases in the 90–10 gap. Researchers should examine charter schools to determine why their 90–10 achievement gaps are shrinking so dramatically for 8th-grade ELL students and students with disabilities, primarily due to higher achievement levels at the 10th percentile. Catholic schools should be studied for approaches that might explain the dramatic reduction in the 4th-grade 90–10 reading gap for economically disadvantaged students. Most importantly, scholars and policy analysts should seriously question the widespread assumption that TPS best promotes educational equality (e.g. Stitzlein, 2023[2017]). Based on our analysis of the 90–10 achievement gaps with nationally representative NAEP data from 2005 to 2024, the grade for traditional public schools on the nation's achievement inequality report card is "needs improvement."

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Online Appendix

This appendix contains the following supplementary tables and figures:

Table S1. Share of enrollment in traditional public schools in NAEP and NCES

Category	Survey	2005	2007	2009	2011	2013	2015	2017	2019	2022
Overall	NAEP	89.07	88.70	88.58	88.77	88.13	87.34	87.53	86.70	85.50
	NCES	88.50	88.90	89.57	90.30	90.88	90.60	90.60	89.60	89.30
White	NAEP	58.74	57.20	55.90	53.58	52.63	50.99	49.55	48.27	46.74
	NCES	57.00	55.70	54.10	51.70	50.30	48.90	47.60	46.40	44.50
Black	NAEP	16.72	16.29	15.61	15.25	14.59	14.55	14.21	14.26	13.83
	NCES	19.90	17.00	16.70	15.80	15.60	15.40	15.20	15.00	14.90
Hispanic	NAEP	18.13	19.51	20.96	22.74	24.00	25.21	26.22	26.74	27.72
	NCES	19.90	21.20	22.30	23.70	24.90	25.90	26.80	27.70	28.90
Asian	NAEP	4.44	4.78	5.10	5.44	5.37	5.55	5.76	5.86	6.25
	NCES	4.60	4.90	4.90	4.70	4.80	5.00	5.20	5.30	5.50
FRL Eligible	NAEP	41.94	42.66	44.96	49.67	51.26	53.42	51.44	51.50	49.84
	NCES	42.01	42.26	44.64	48.10	51.99	51.79	52.63	52.08	48.60

Note. NAEP enrollment share combines grades 4 and 8 in math and reading, whereas NCES enrollment share combines elementary and secondary grades.

Source: National Center for Education Statistics. (2023). *Table 204.10. Number and percentage of public school students eligible for free or reduced-price lunch, by state: Selected years, 2000–01 through 2021–22*. U.S. Department of Education. Retrieved December 1, 2024, from https://nces.ed.gov/programs/digest/d23/tables/dt23_204.10.asp

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U.S. Department of Education, National Center for Education Statistics. (2018). *Digest of Education Statistics 2018, table 216.20: Public elementary/secondary school universe survey, 2000–01 and 2017–18*. U.S. Department of Education, Institute of Education Sciences. https://nces.ed.gov/programs/digest/d18/tables/dt18_216.20.asp

U.S. Department of Education, National Center for Education Statistics. (2017). *Digest of Education Statistics 2017, table 216.20: Public elementary/secondary school universe survey, 2000–01 and 2017–18*. U.S. Department of Education, Institute of Education Sciences. https://nces.ed.gov/programs/digest/d17/tables/dt17_216.20.asp

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National Center for Education Statistics. (2023). Table 203.10. Enrollment in elementary and secondary schools, by grade level: Fall 2000 through fall 2023. U.S. Department of Education, Institute of Education Sciences. https://nces.ed.gov/programs/digest/d23/tables/dt23_203.10.asp
National Center for Education Statistics. (2023). Table 205.20. Enrollment in elementary and secondary schools, by race/ethnicity and type of school: Fall 2000 through fall 2023. U.S. Department of Education, Institute of Education Sciences. https://nces.ed.gov/programs/digest/d23/tables/dt23_205.20.asp

Table S2. Share of enrollment in charter schools in NAEP and NCES

Category	Survey	2005	2006	2007	2009	2011	2013	2015	2017	2018	2019	2021	2022
Overall	NAEP	1.39		1.77	2.30	2.61	3.45	4.59	4.36		5.47		6.12
	NCES	1.80	2.10		3.30	3.60	4.60	5.40	6.20			7.50	7.60
White	NAEP	40.68		57.22	33.79	34.27	30.67	33.05	32.18	32.10	28.13		25.45
	NCES					36.20						30.80	
Black	NAEP	35.78		16.29	33.41	34.65	33.88	27.36	29.64		26.60		27.22
	NCES					28.90				25.80		24.30	
Hispanic	NAEP	18.15		19.51	27.38	25.52	28.20	32.09	29.19	33.10	37.54		37.82
	NCES					27.30						35.10	
Asian	NAEP	3.22		4.78	3.45	3.50	4.49	4.81	5.48	4.40	3.73		5.26
	NCES					3.70						4.20	
FRL Eligible	NAEP	44.48		48.94	55.93	58.58	59.71	57.81	53.99		60.20		62.73
	NCES						51.30				52.08	48.64	53.27

Note. See Table S1.

Source: National Center for Education Statistics. (2023). *Table 216.90. Enrollment in elementary and secondary schools, by level of school and control of institution: 2000–2022*. U.S. Department of Education, Institute of Education Sciences. https://nces.ed.gov/programs/digest/d23/tables/dt23_216.90.asp

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U.S. Department of Education, National Center for Education Statistics. (2018). *Digest of Education Statistics 2019, table 216.30: Public elementary/secondary school universe survey, 2000–01 and 2017–18*. U.S. Department of Education, Institute of Education Sciences. https://nces.ed.gov/programs/digest/d18/tables/dt18_216.30.asp

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U.S. Department of Education, National Center for Education Statistics. (2017). *Digest of Education Statistics 2018, table 216.20: Public elementary/secondary school universe survey, 2000–01 and 2017–18*. U.S. Department of Education, Institute of Education Sciences. https://nces.ed.gov/programs/digest/d18/tables/dt18_216.30.asp

U.S. Department of Education, National Center for Education Statistics. (2018). *Digest of Education Statistics 2018, table 216.20: Public elementary/secondary school universe survey, 2000–01 and 2017–18*. U.S. Department of Education, Institute of Education Sciences. https://nces.ed.gov/programs/digest/d19/tables/dt19_216.30.asp

Table S3. Share of enrollment in Catholic schools in NAEP and NCES

Category	Survey	2005	2007	2009	2011	2013	2015	2017	2019	2022
Overall	NAEP	4.71	4.43	4.42	4.00	3.83	3.38	3.38	3.17	3.11
	NCES	4.74	4.61	4.29	4.15	3.95	3.80	3.62	3.42	3.40
White	NAEP	71.82	72.24	73.24	68.40	68.65	66.86	63.87	64.94	58.66
	NCES	74.10	73.10	70.80	69.30	67.70	65.90	65.60	63.00	62.10
Black	NAEP	8.20	8.67	6.51	8.27	9.34	7.67	7.88	7.81	7.68
	NCES	7.90	7.90	7.50	7.40	8.00	7.80	7.60	8.30	8.10
Hispanic	NAEP	12.70	10.52	12.85	14.81	14.38	16.59	17.54	17.61	22.60
	NCES	12.60	13.40	13.30	14.00	14.20	15.60	15.00	17.30	18.10
Asian	NAEP	4.43	5.64	4.79	5.55	4.75	6.15	6.51	4.59	5.37
	NCES	4.70	4.90	4.50	4.70	5.00	5.20	5.30	5.10	4.90
FRL Eligible	NAEP	10.38	9.69	9.99	11.16	13.14	11.67	13.91	15.22	10.87
	NCES									

Note. See Table S1.

Source: U.S. Department of Education, National Center for Education Statistics. (2023). *Private school universe survey, 2021-22*. U.S. Department of Education, Institute of Education Sciences. https://nces.ed.gov/surveys/pss/tables/TABLE09fl2122.asp

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U.S. Department of Education, National Center for Education Statistics. (2019). *Private school universe survey, 2017-18*. U.S. Department of Education, Institute of Education Sciences. https://nces.ed.gov/surveys/pss/tables/TABLE09fl1718.asp

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National Center for Education Statistics. (2013). Table 203.20. Enrollment in elementary and secondary schools, by grade level and control of institution: Fall 1995 through fall 2013. U.S. Department of Education, Institute of Education Sciences. https://nces.ed.gov/programs/digest/d13/tables/dt13_203.20.asp

Table S4. Share of enrollment in Department of Defense schools in NAEP and NCES

Category	Survey	2005	2007	2009	2011	2013	2015	2017	2019	2022
Overall	NAEP	0.18	0.17	0.16	0.16	0.15	0.14	0.14	0.13	0.13
	NCES	0.19	0.17		0.18	0.16	0.15	0.14	0.14	0.13
White	NAEP	46.03	48.75	47.93	47.25	45.54	45.70	45.63	44.80	43.64
	NCES									
Black	NAEP	20.35	18.16	15.85	15.88	14.87	13.92	13.36	11.83	10.00
	NCES									
Hispanic	NAEP	13.55	14.60	16.18	17.20	19.51	19.58	20.99	22.07	23.46
	NCES									
Asian	NAEP	8.07	7.41	7.83	7.93	7.97	8.27	7.56	7.95	7.36
	NCES									
FRL Eligible	NAEP									
	NCES									

Note. See Table S1.

Source: National Center for Education Statistics. (2023). Table 203.20. Enrollment in elementary and secondary schools, by grade level and control of institution: Fall 2000 through fall 2023. U.S. Department of Education, Institute of Education Sciences. https://nces.ed.gov/programs/digest/d23/tables/dt23_203.20.asp

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https://nces.ed.gov/programs/digest/d07/tables/dt07_034.asp

National Center for Education Statistics. (2009). Table 34. Enrollment in elementary and secondary schools, by race/ethnicity and type of school: Fall 1995 through fall 2009. U.S. Department of Education, Institute of Education Sciences. https://nces.ed.gov/programs/digest/d09/tables/dt09_034.asp

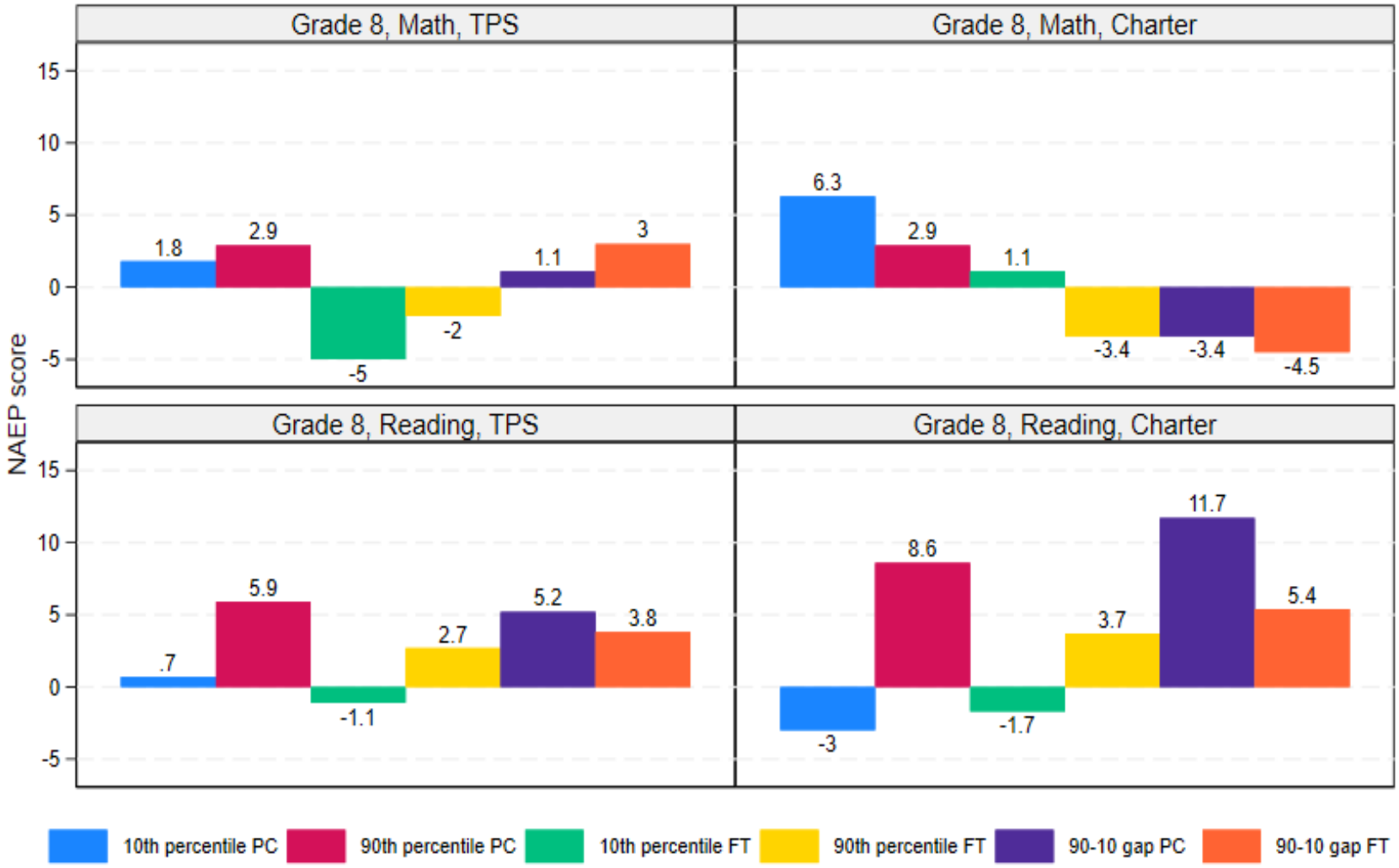
National Center for Education Statistics. (2023). *Table 203.20. Enrollment in public elementary and secondary schools, by state: Fall 2021 and fall 2022*. U.S. Department of Education, Institute of Education Sciences. Retrieved December 4, 2024, from https://nces.ed.gov/programs/digest/d23/tables/dt23_203.20.asp

Table S5. Observations by year, subject, grade and sector in NAEP

Year	Subject	Grade	TPS	Charter	Catholic	DoD
2005	Math	4	160600	2380	2920	2420
2005	Math	8	150400	2380	3210	1740
2005	Reading	4	154490	2300	2880	2350
2005	Reading	8	148240	2350	3250	1740
2007	Math	4	186470	3390	1590	3260
2007	Math	8	144340	3000	1490	1590
2007	Reading	4	180140	3280	1610	3170
2007	Reading	8	151570	3160	1590	1660
2009	Math	4	159340	3630	1370	2040
2009	Math	8	152050	4130	1530	1580
2009	Reading	4	168600	3940	1490	2160
2009	Reading	8	151300	4090	1530	1570
2011	Math	4	193520	5360	3230	3130
2011	Math	8	159060	5340	4350	1720
2011	Reading	4	197370	5550	3300	3080
2011	Reading	8	152600	5160	4230	1580
2013	Math	4	173500	6750	1590	3050
2013	Math	8	157950	6600	1730	2240
2013	Reading	4	177140	6900	1650	3040
2013	Reading	8	159640	6640	1780	2160
2015	Math	4	128800	5940	1300	1890
2015	Math	8	126440	6090	1260	1380
2015	Reading	4	128130	5920	1290	1820
2015	Reading	8	125860	6010	1430	1340
2017	Math	4	138070	5980	1610	2270
2017	Math	8	132790	7390	1630	1610
2017	Reading	4	137470	5910	1630	2220
2017	Reading	8	129930	7230	1600	1570
2019	Math	4	135890	7690	1280	2400
2019	Math	8	134220	7990	1460	1780
2019	Reading	4	136920	7730	1300	2420
2019	Reading	8	130340	7790	1400	1660
2022	Math	4	105430	6690	1040	2390
2022	Math	8	100580	7170	920	1700
2022	Reading	4	98160	6230	980	2280
2022	Reading	8	100840	7200	940	1670
Total			5268190	195240	67370	75670

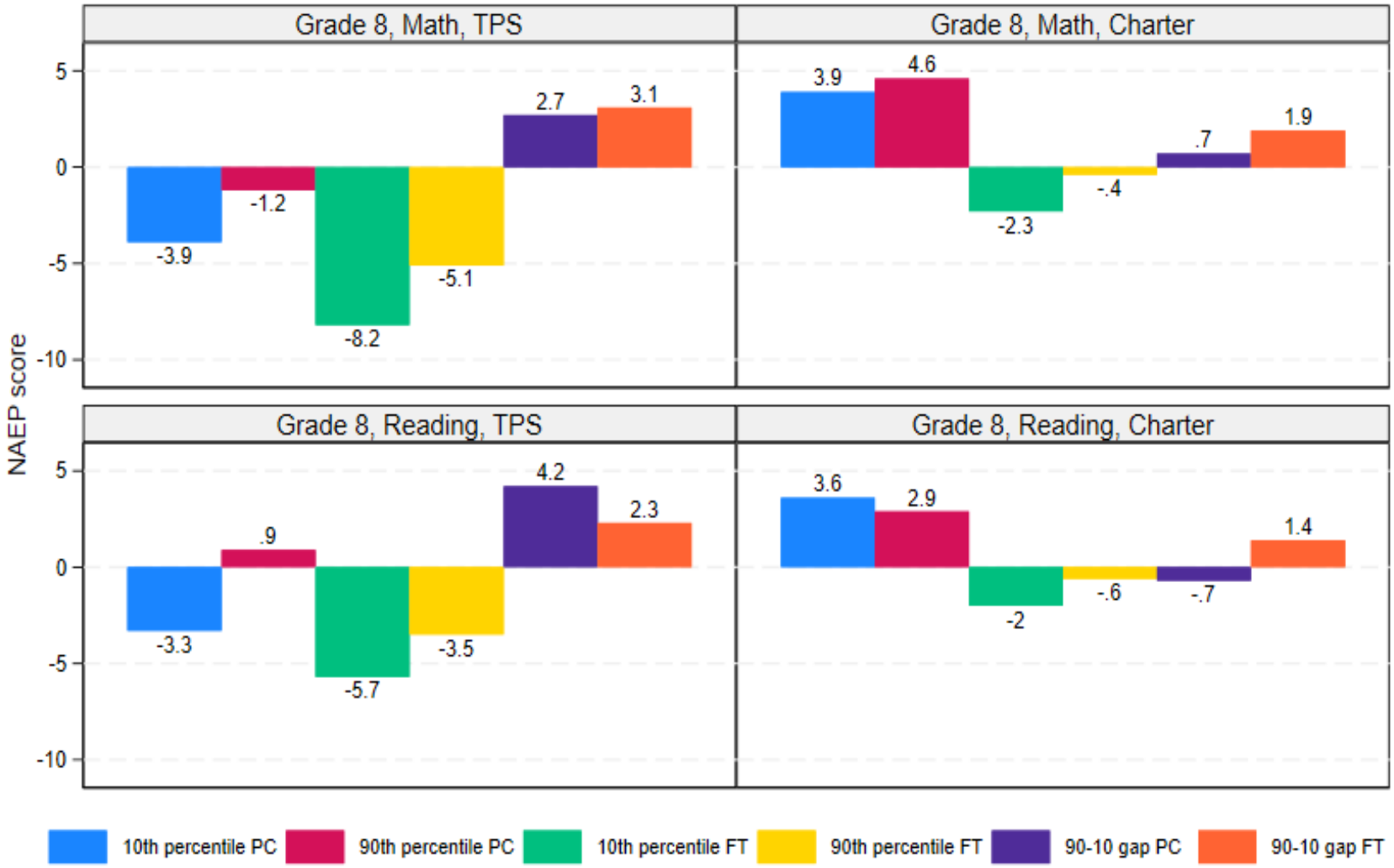
Note. Observations have been rounded off to nearest tens in compliance with NCES requirements.

Figure S1. Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for students with parental education as less than high school by grade, subject, and school sector



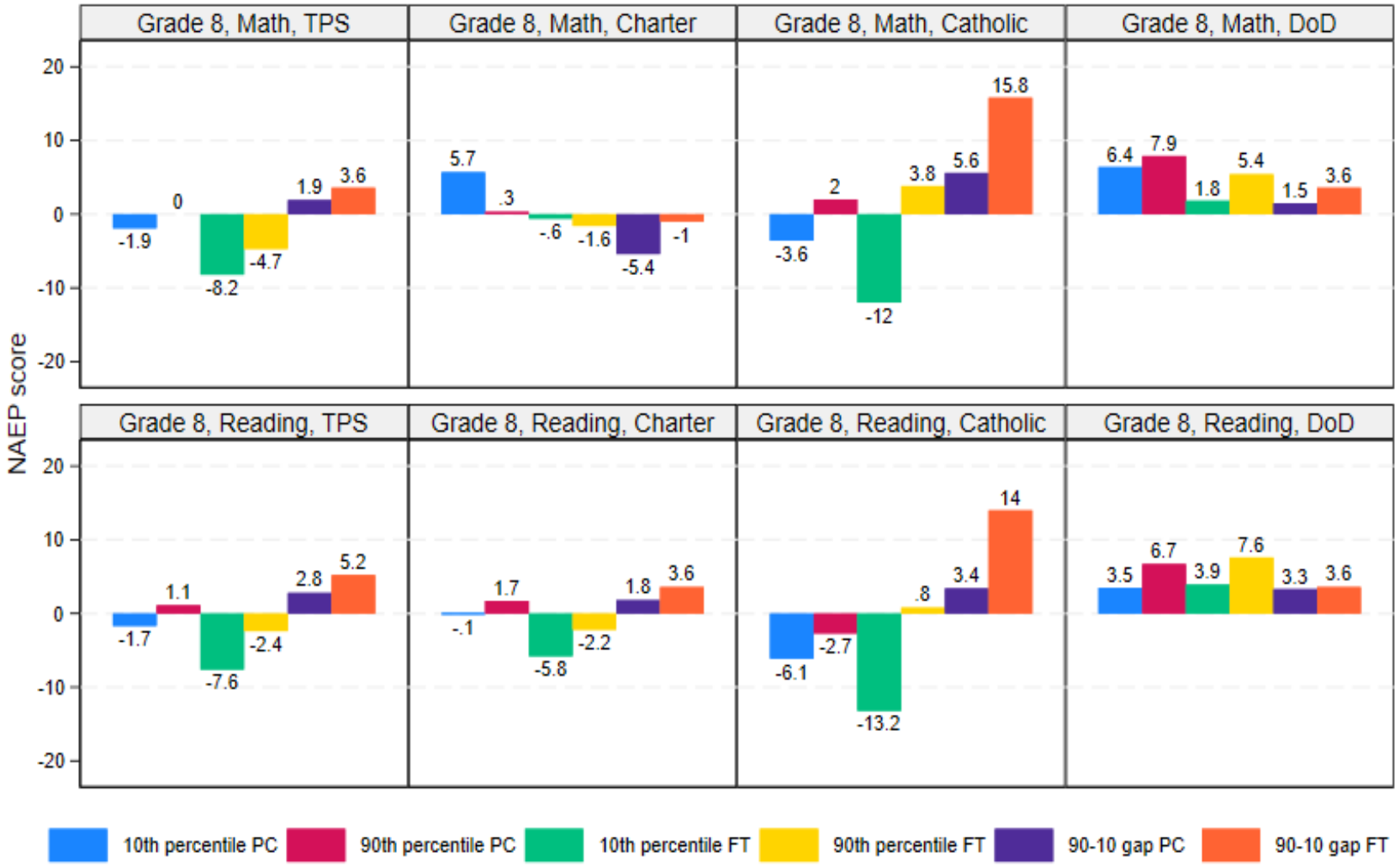
Notes: See Fig. 2.

Figure S2. Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for students with parental education as graduated high school by grade, subject, and school sector



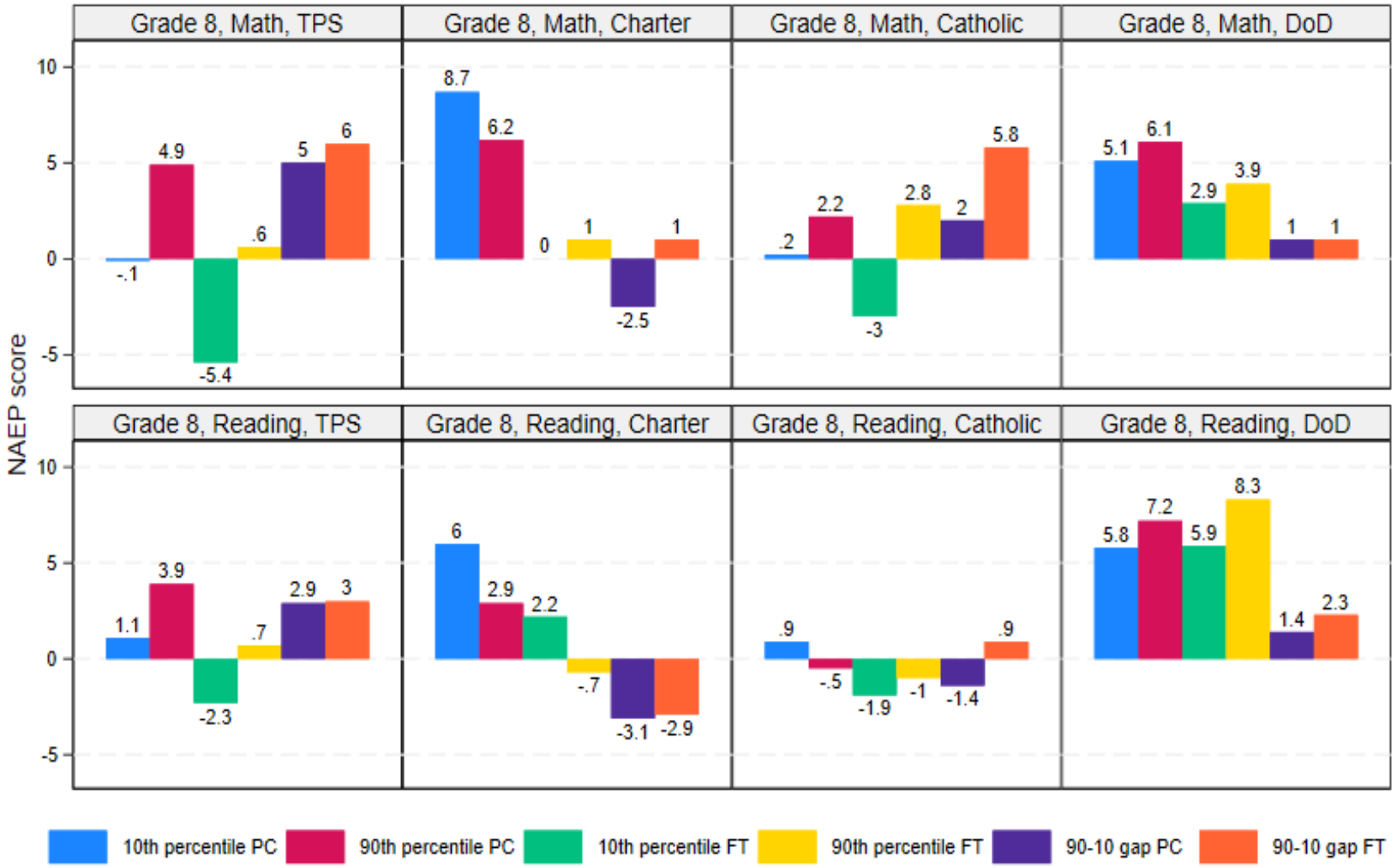
Notes: See Fig. 2.

Figure S3. Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for students with parental education as some college by grade, subject, and school sector



Notes: See Fig. 2.

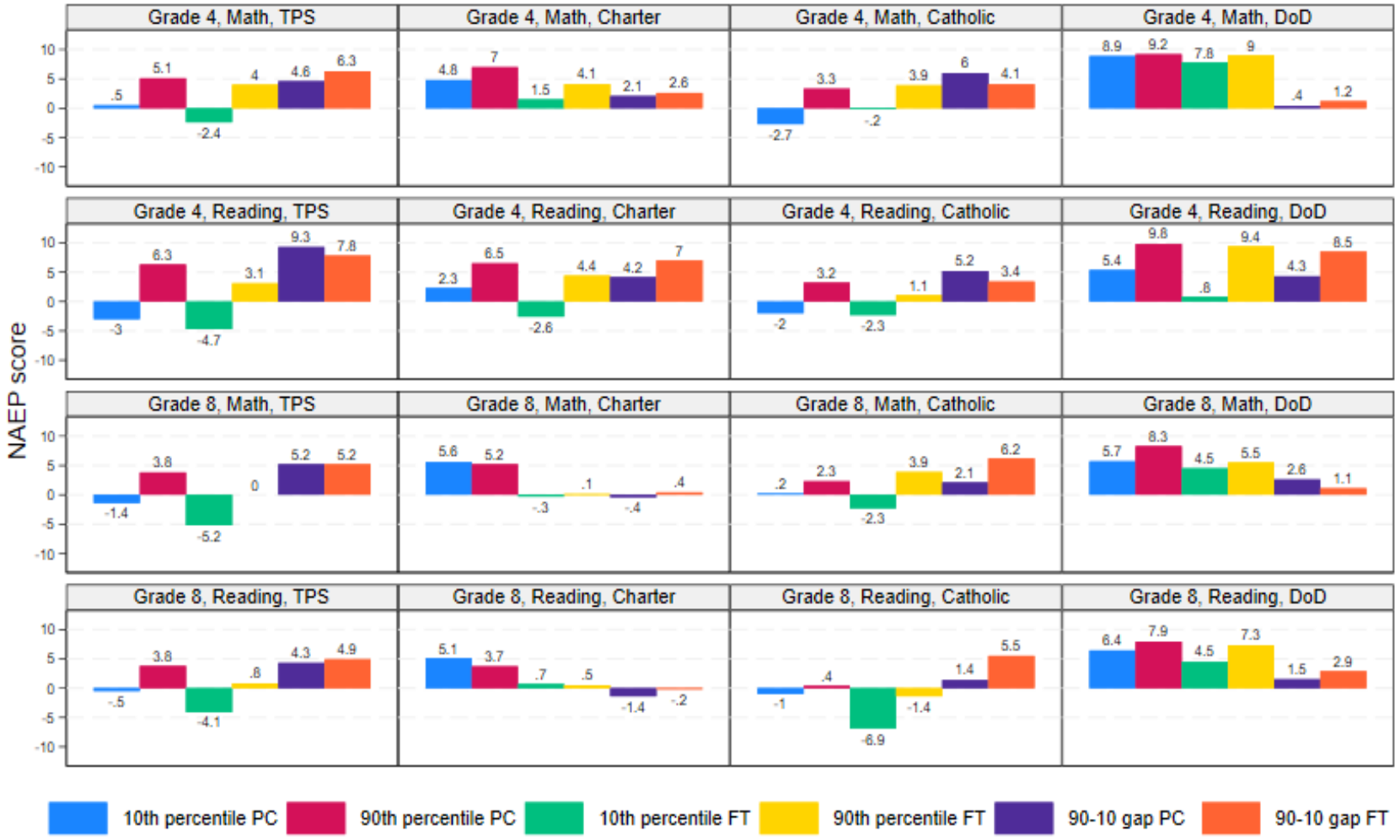
Figure S4. Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for students with parental education as graduated college by grade, subject, and school sector



Notes: See Fig. 2.

Figure S5

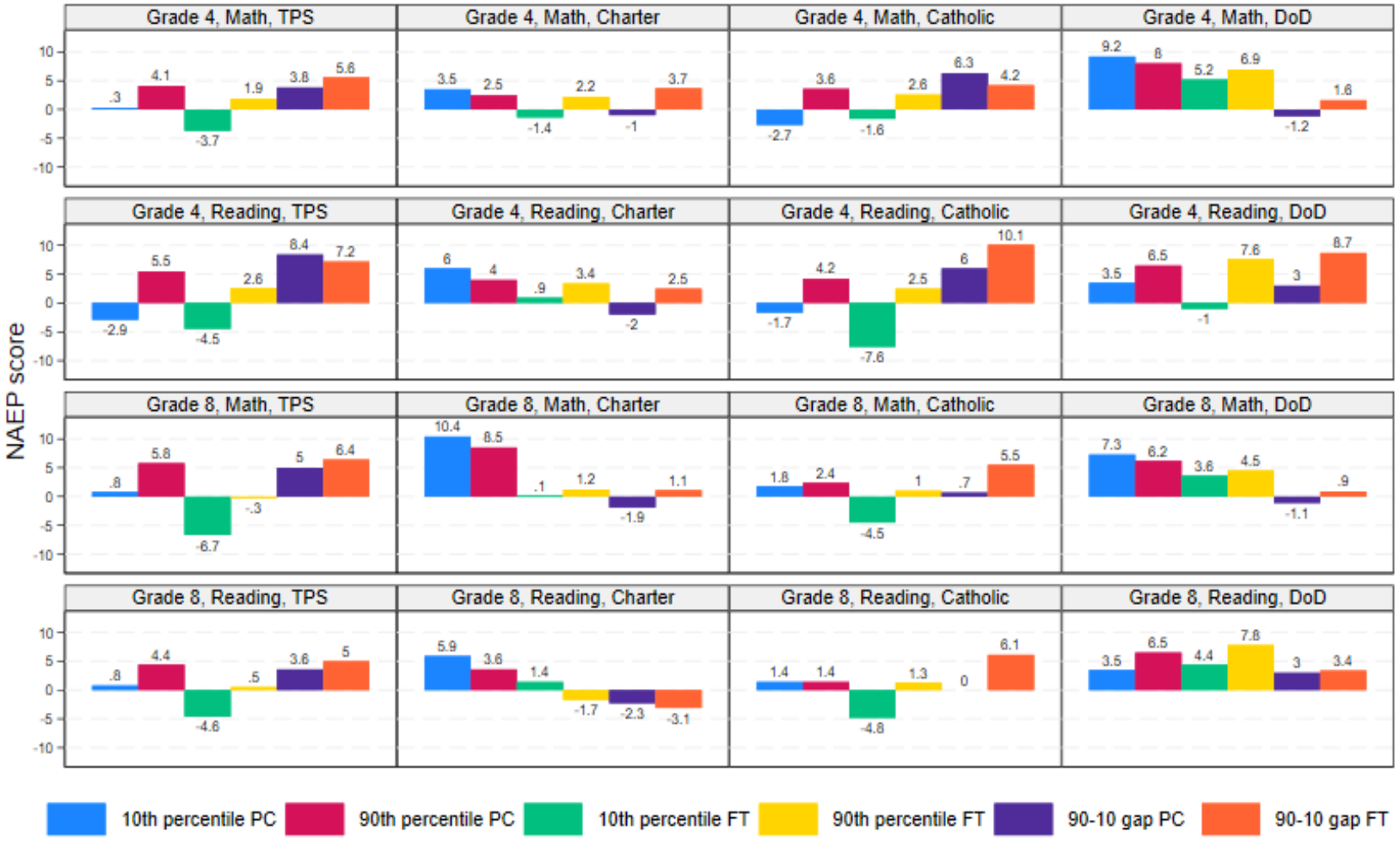
Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for male students by grade, subject, and school sector



Notes: See Fig. 2.

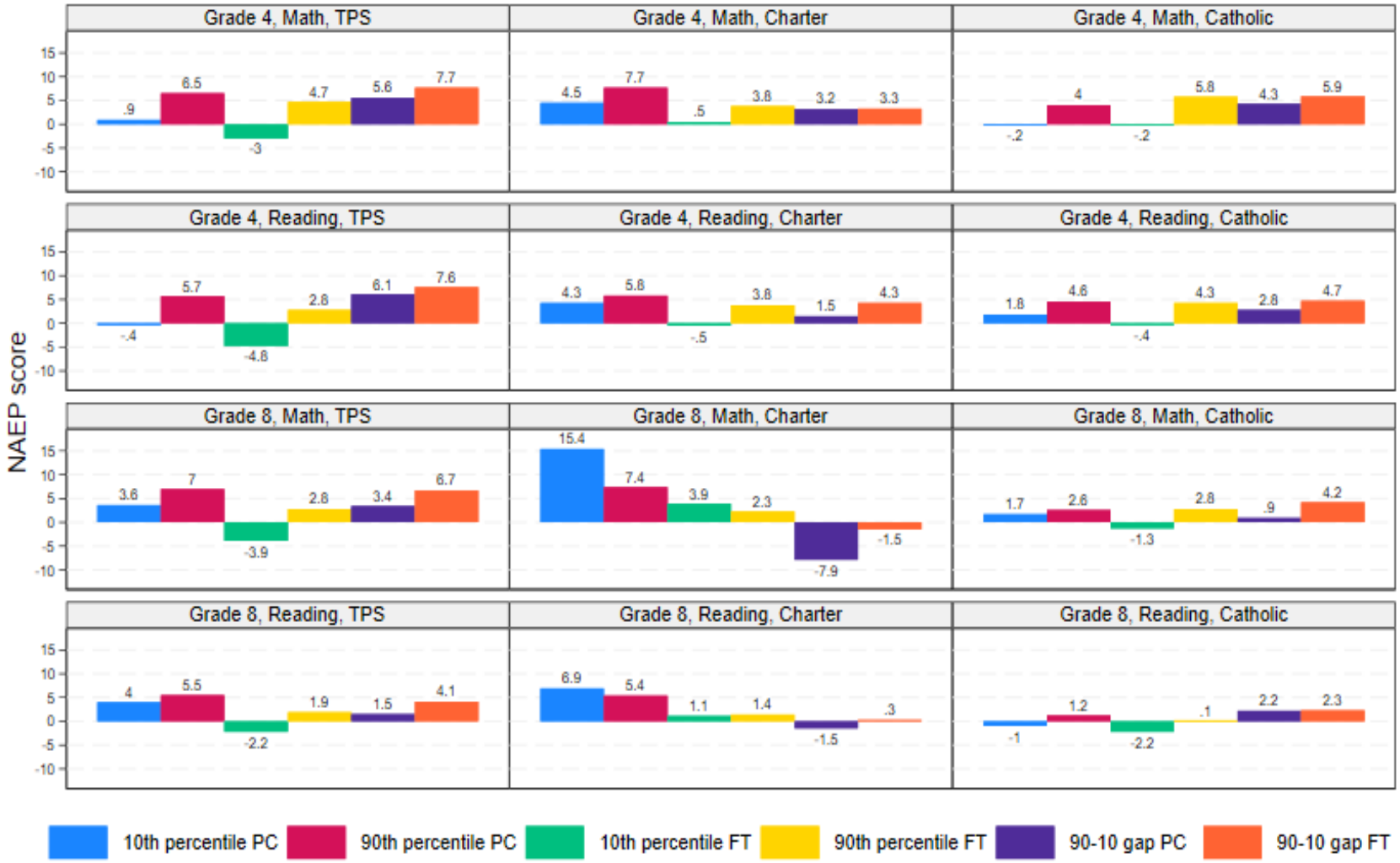
Figure S6

Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for female students by grade, subject, and school sector



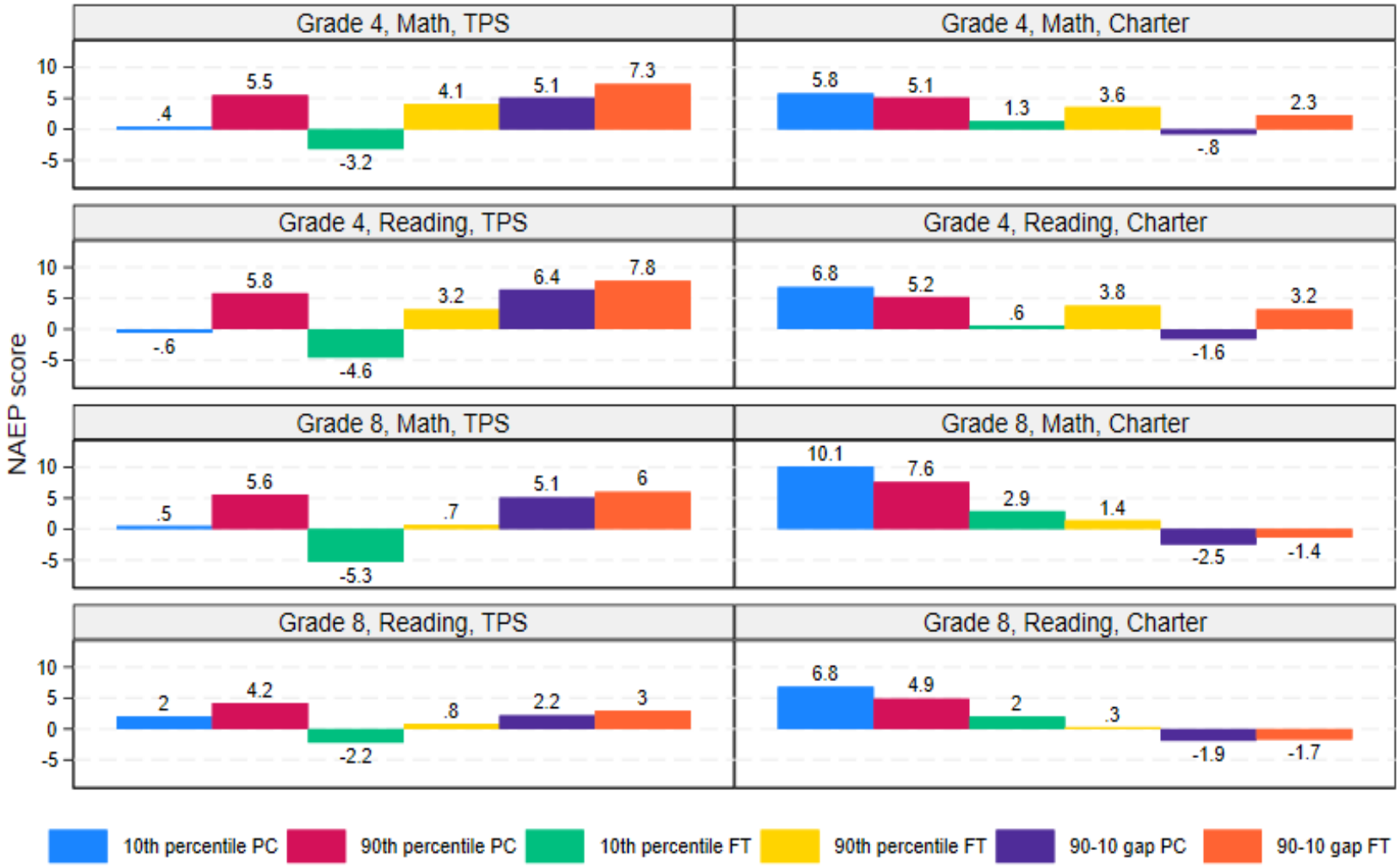
Notes: See Fig. 2.

Figure S7. Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for not economically disadvantaged students by grade, subject, and school sector



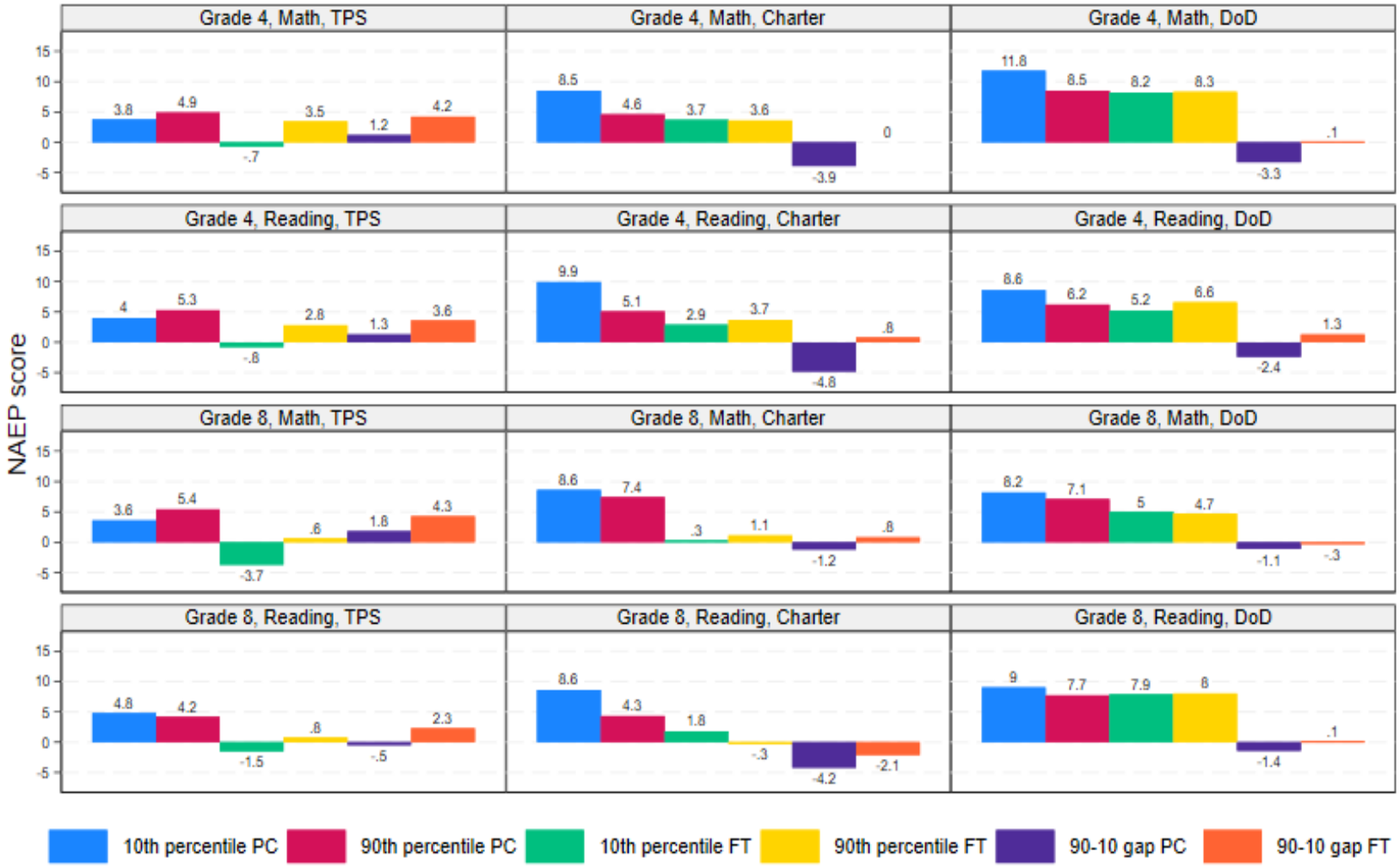
Notes: See Fig. 2.

Figure S8. Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for not English language learner students by grade, subject, and school sector



Notes: See Fig. 2.

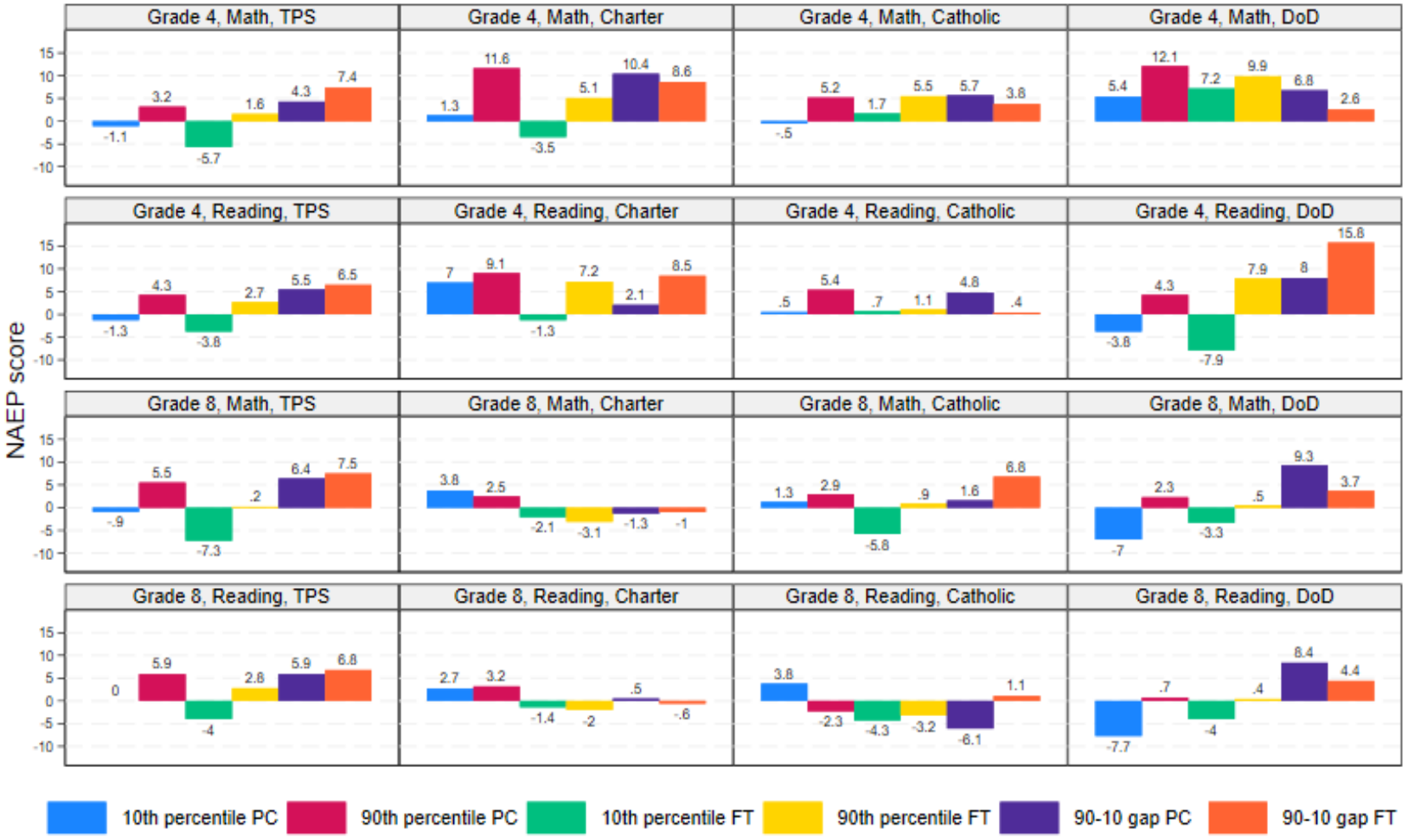
Figure S9. Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for not disabled students by grade, subject, and school sector



Notes: See Fig. 2.

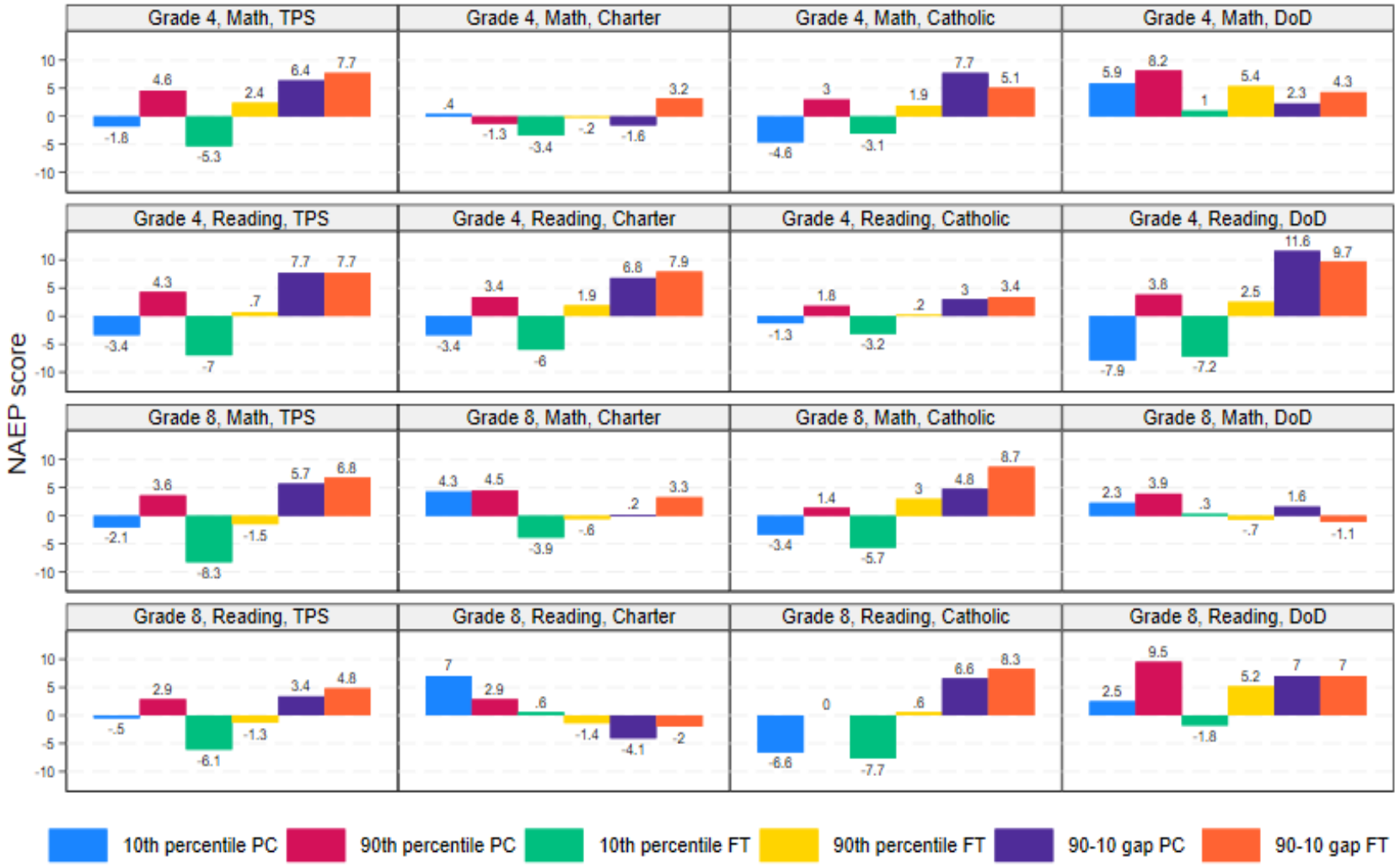
Figure S10

Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for urban students by grade, subject, and school sector



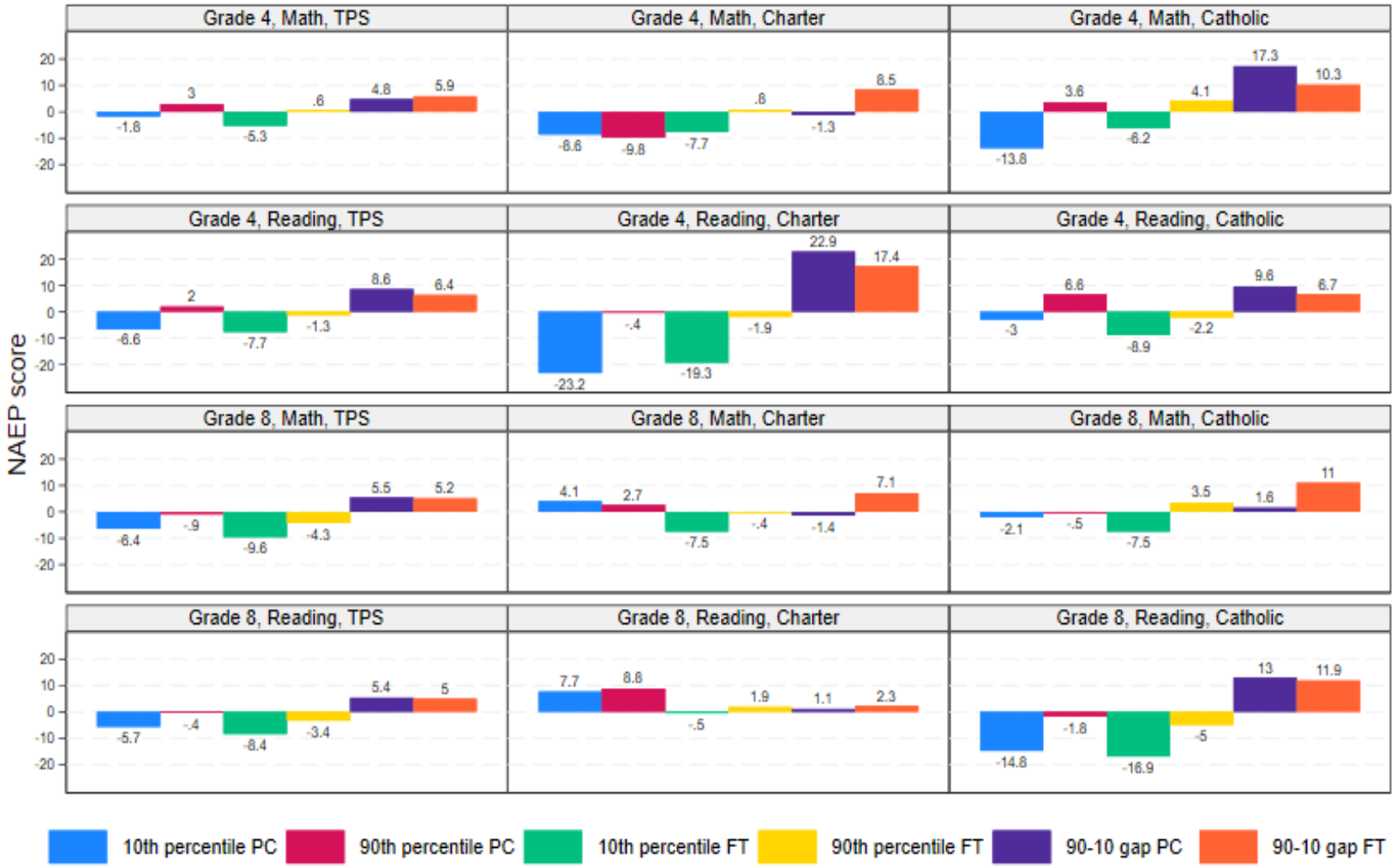
Notes: See Fig. 2. Locale data in NAEP is consistently coded starting in 2007, so the results represent changes between 2007—2024.

Figure S11. Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for suburb students by grade, subject, and school sector



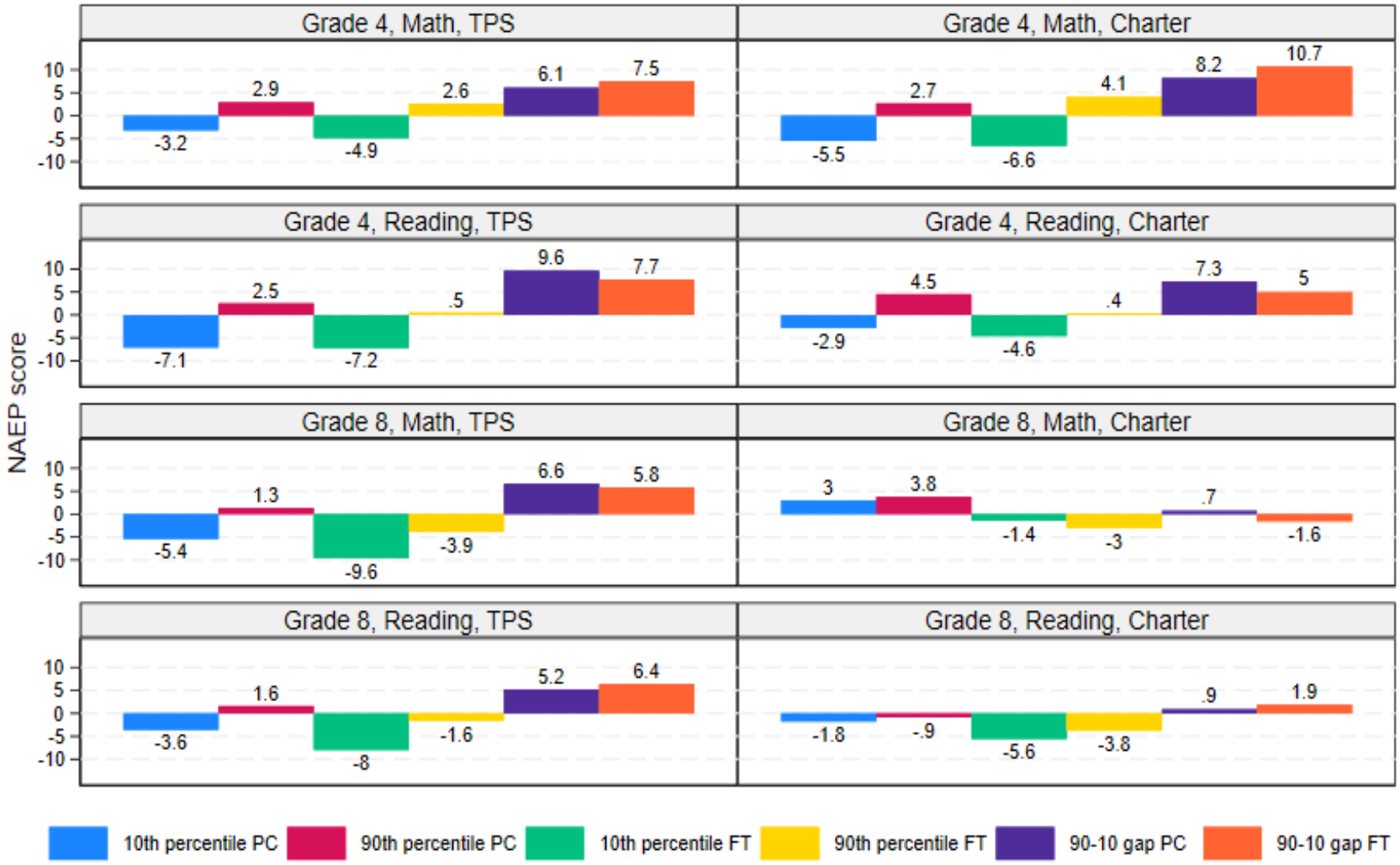
Notes: See Figs. 2 and S10.

Figure S12. Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for town students by grade, subject, and school sector



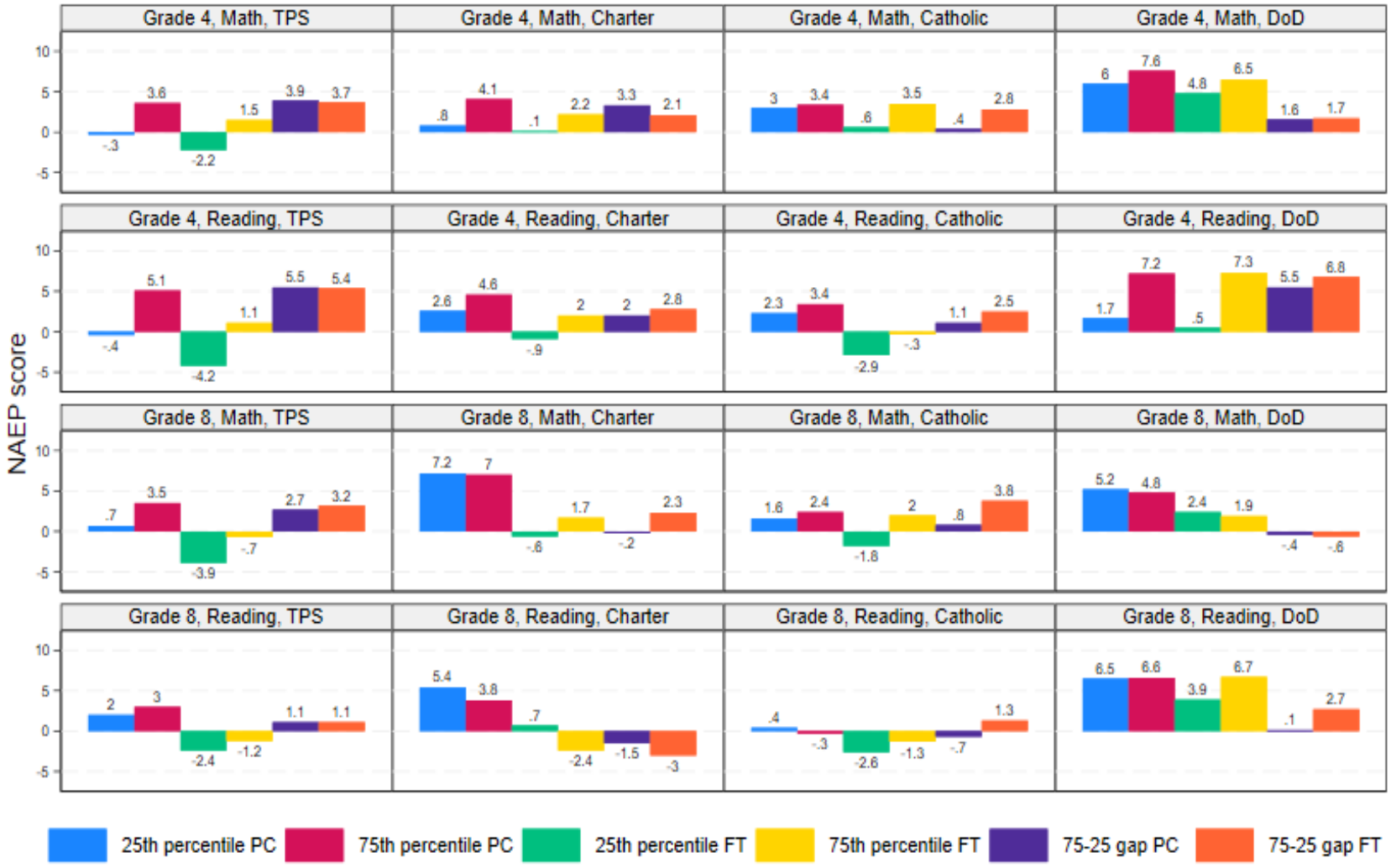
Notes: See Figs. 2 and S10.

Figure S13. Change/decade in adjusted 90th and 10th percentile scale scores, and the 90–10 gap for rural students by grade, subject, and school sector



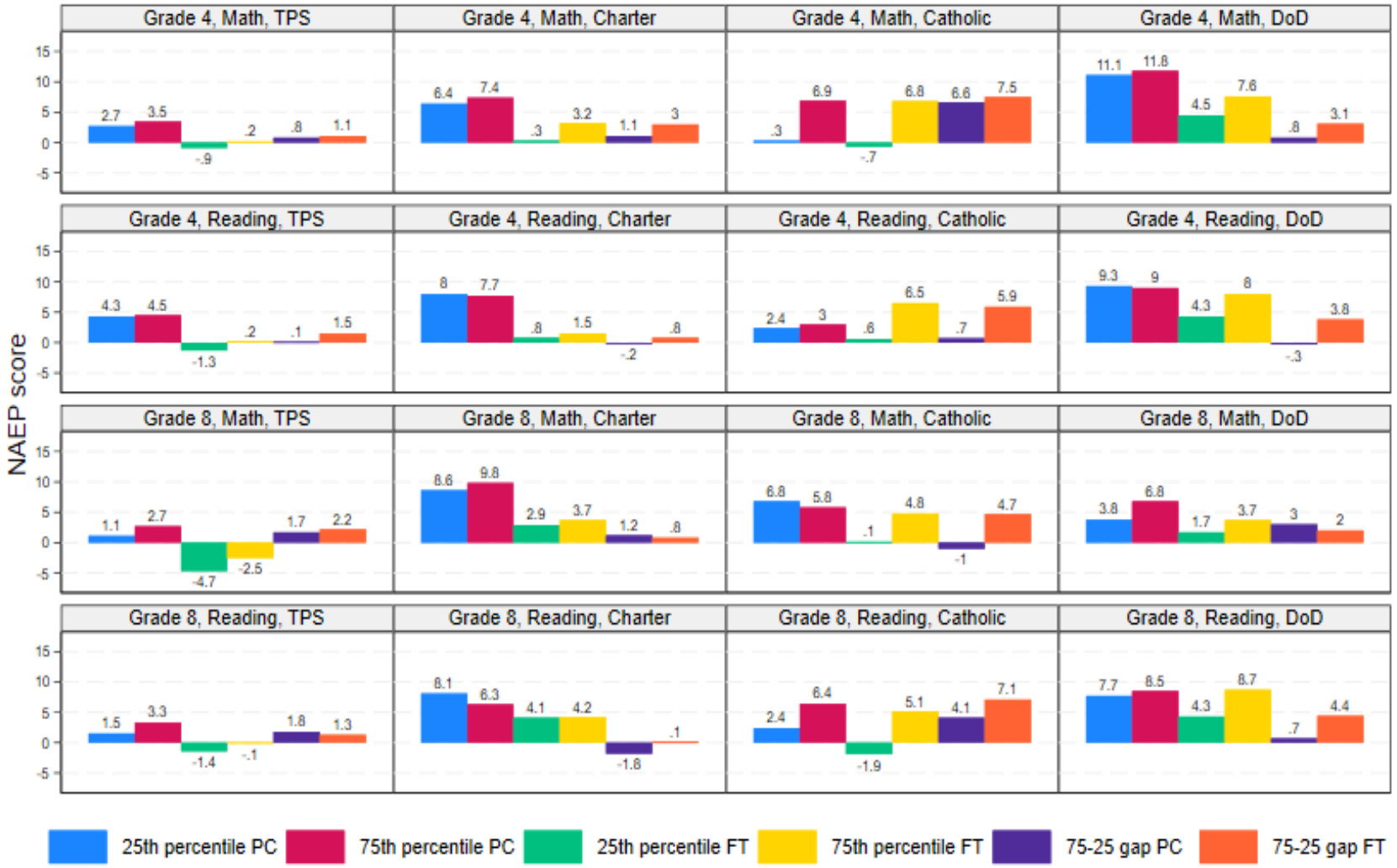
Notes: See Figs. 2 and S10.

Figure 14. Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for white students by grade, subject, and school sector



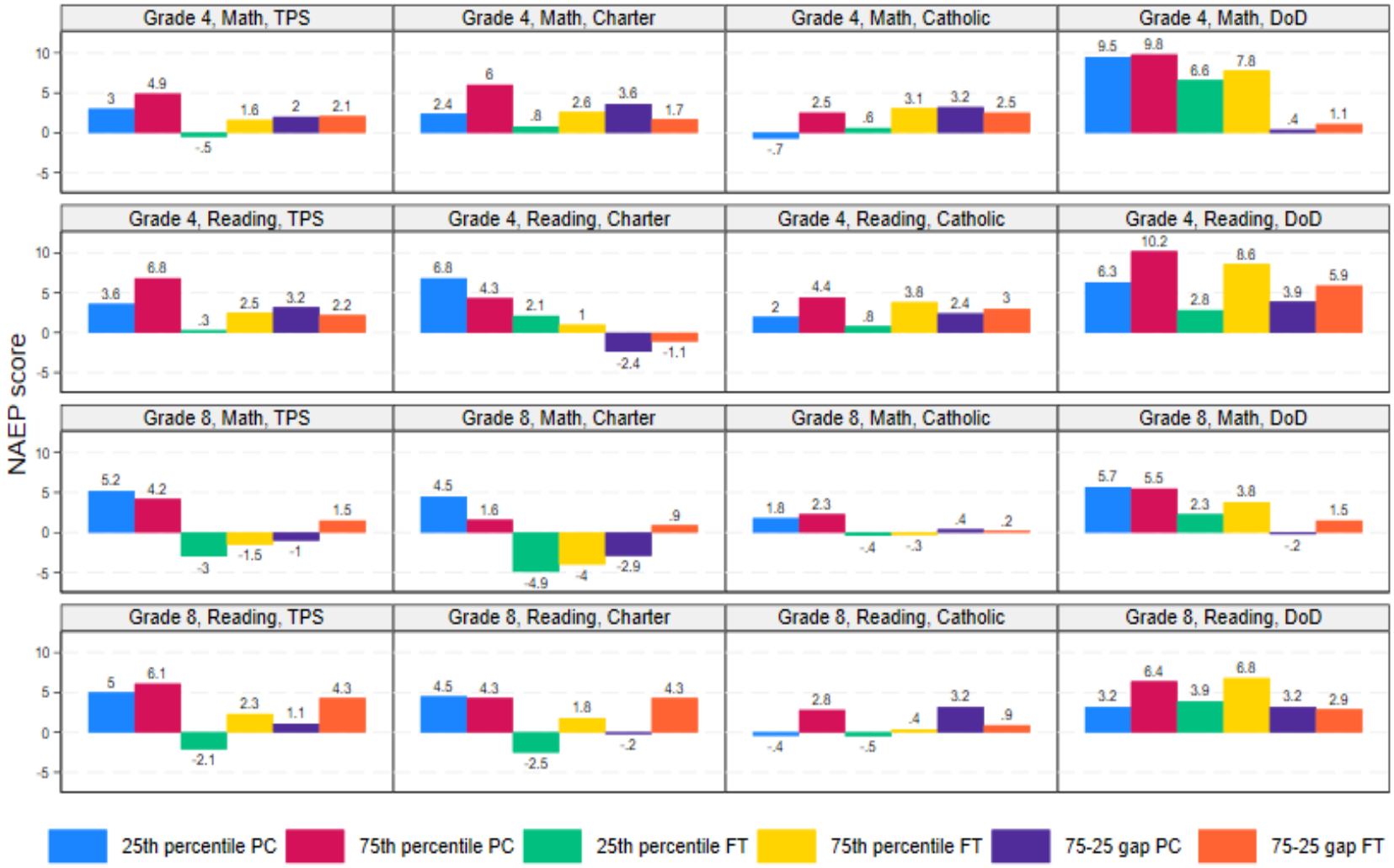
Notes: See Fig. 2.

Figure 15. Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for black students by grade, subject, and school sector



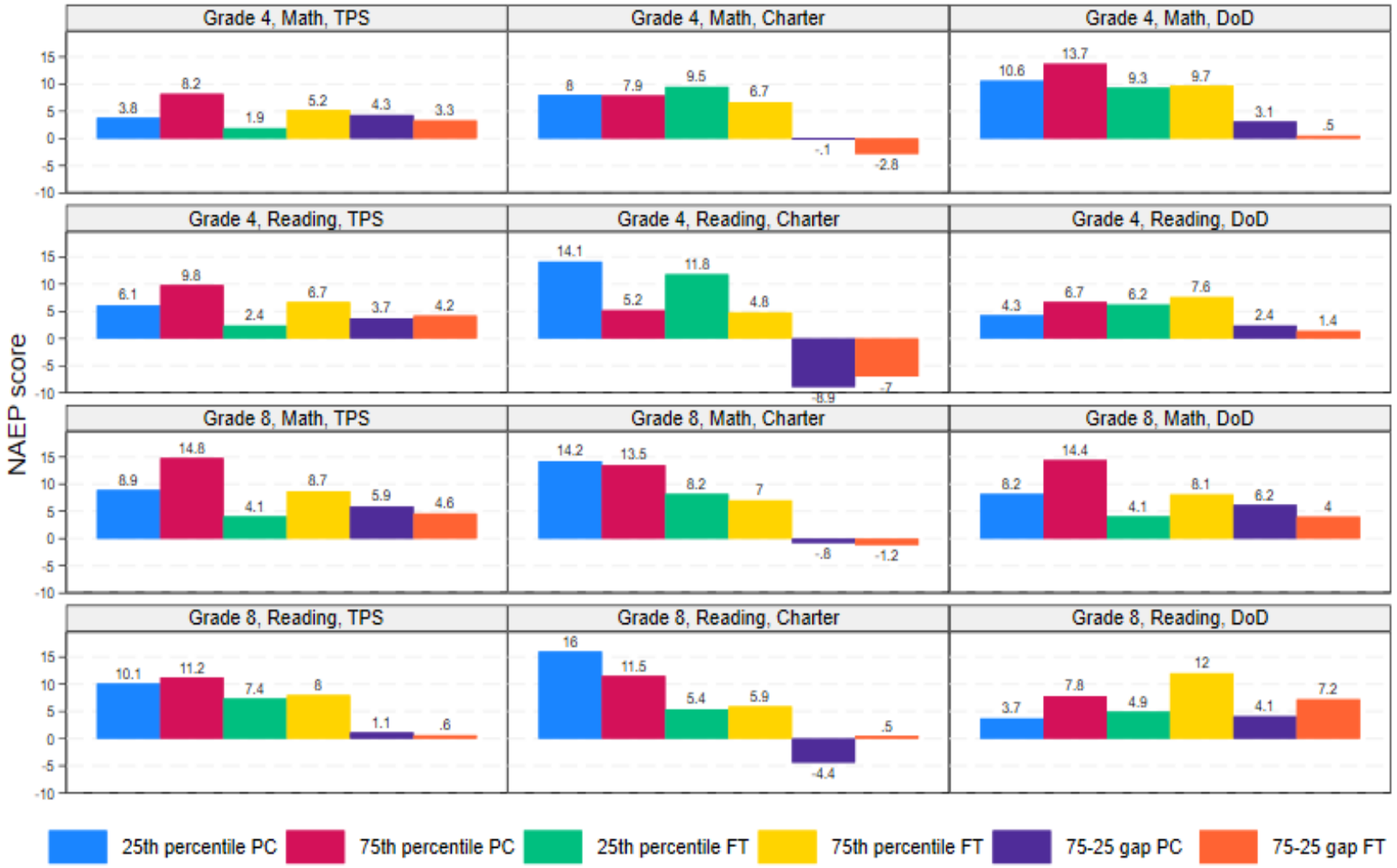
Notes: See Fig. 2.

Figure 16. Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for Hispanic students by grade, subject, and school sector



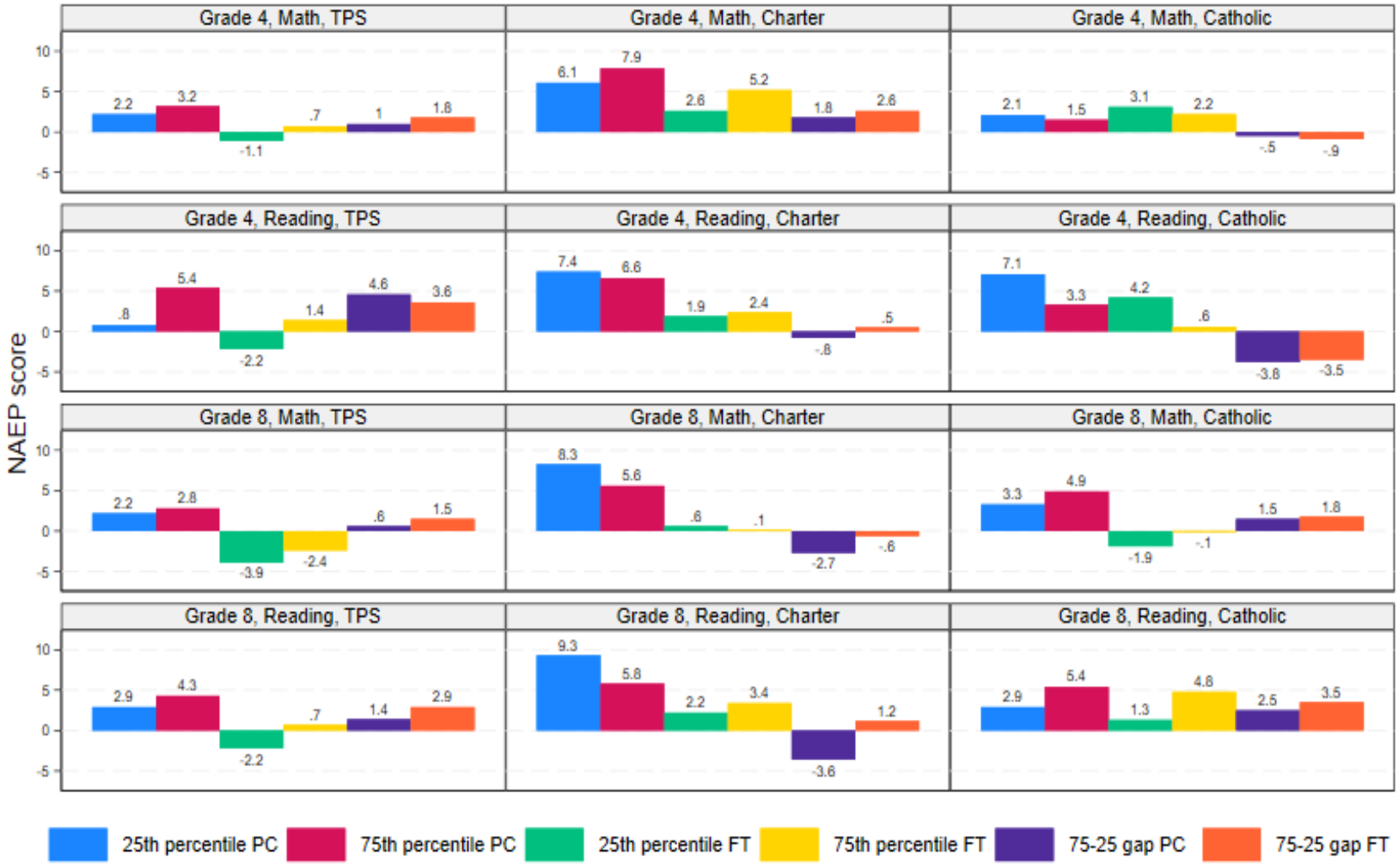
Notes: See Fig. 2.

Figure 17. Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for Asian students by grade, subject, and school sector



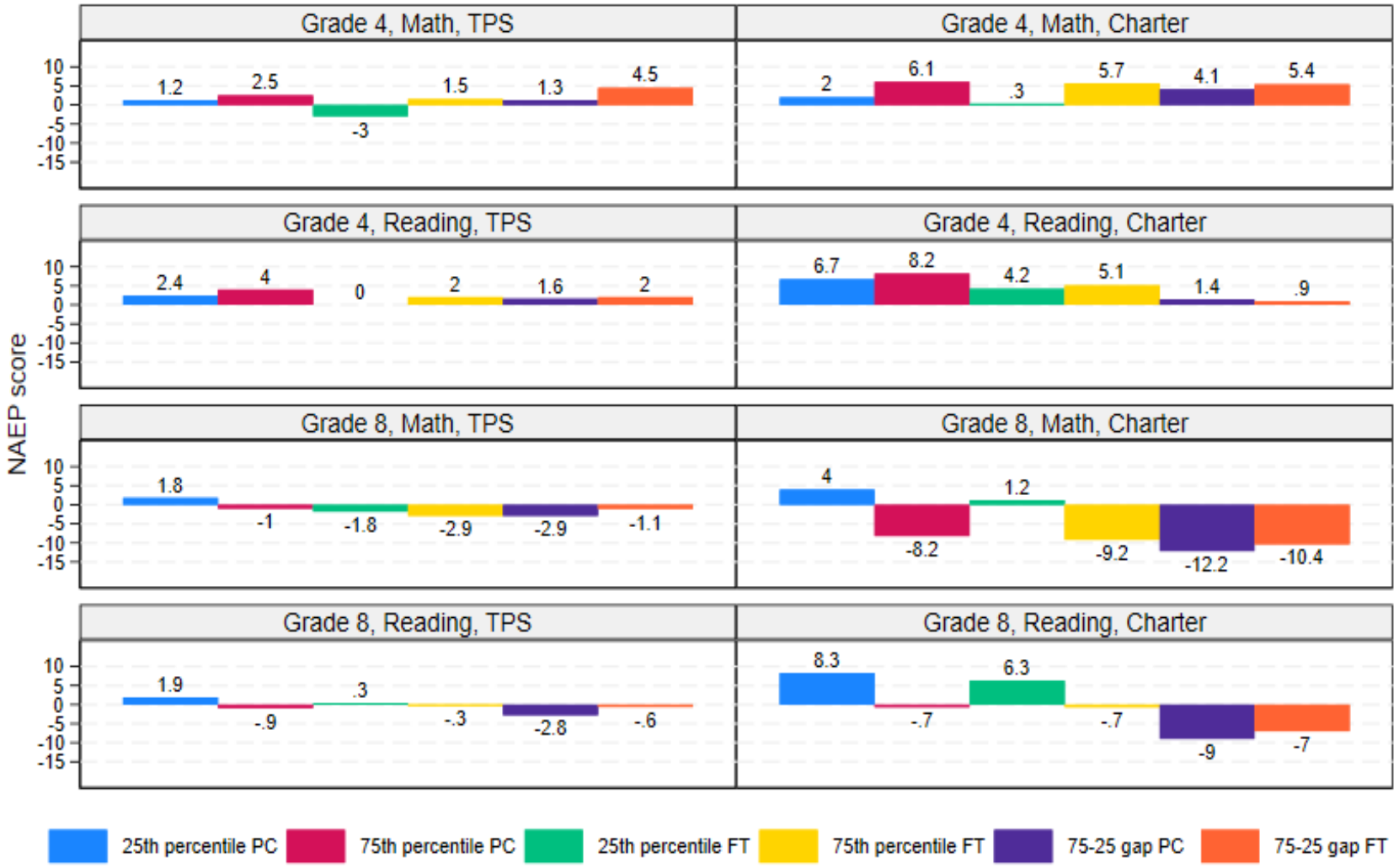
Notes: See Fig. 2.

Figure 18. Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for economically disadvantaged students by grade, subject, and school sector



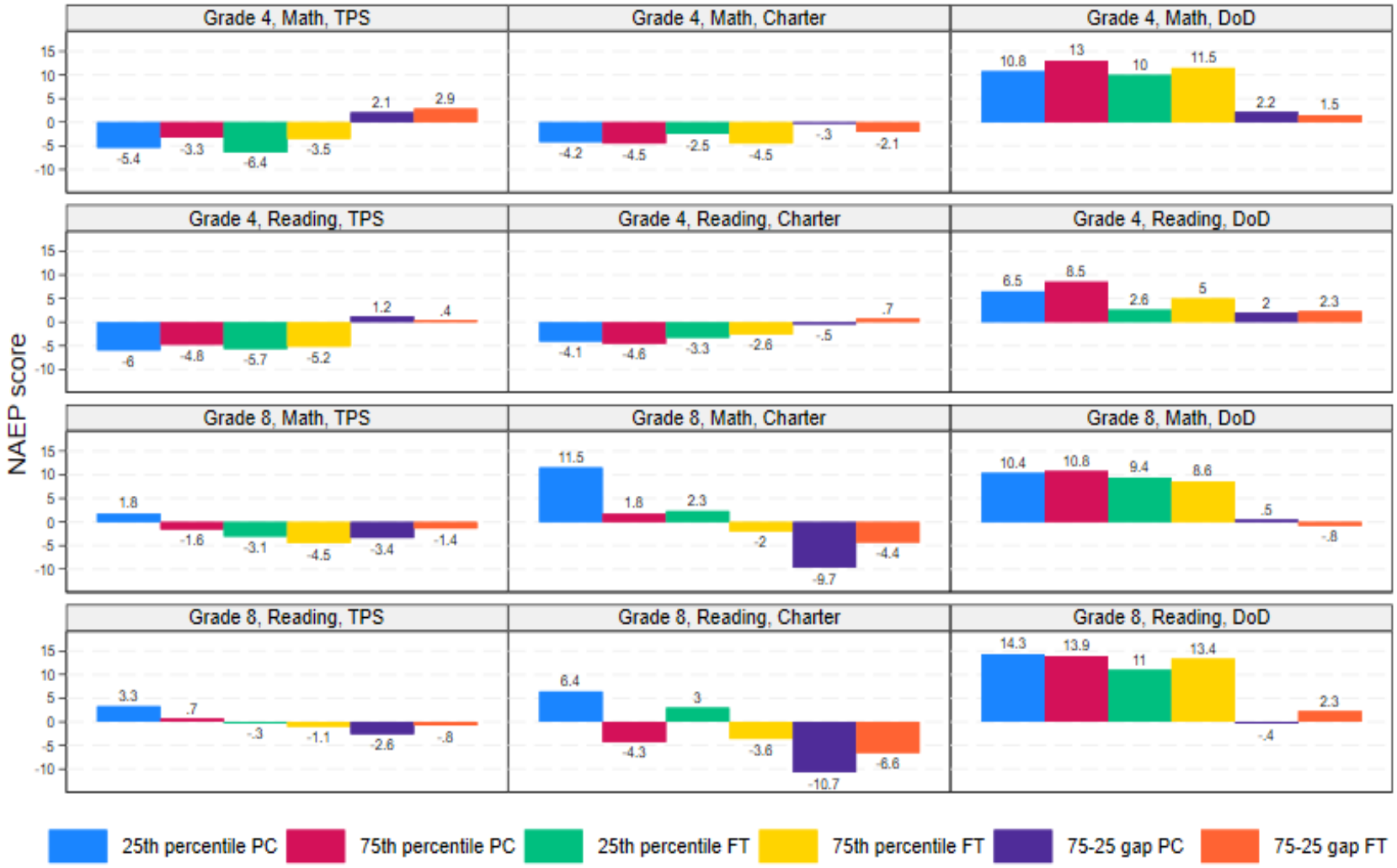
Notes: See Fig. 2.

Figure 19. Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for English language learner students by grade, subject, and school sector



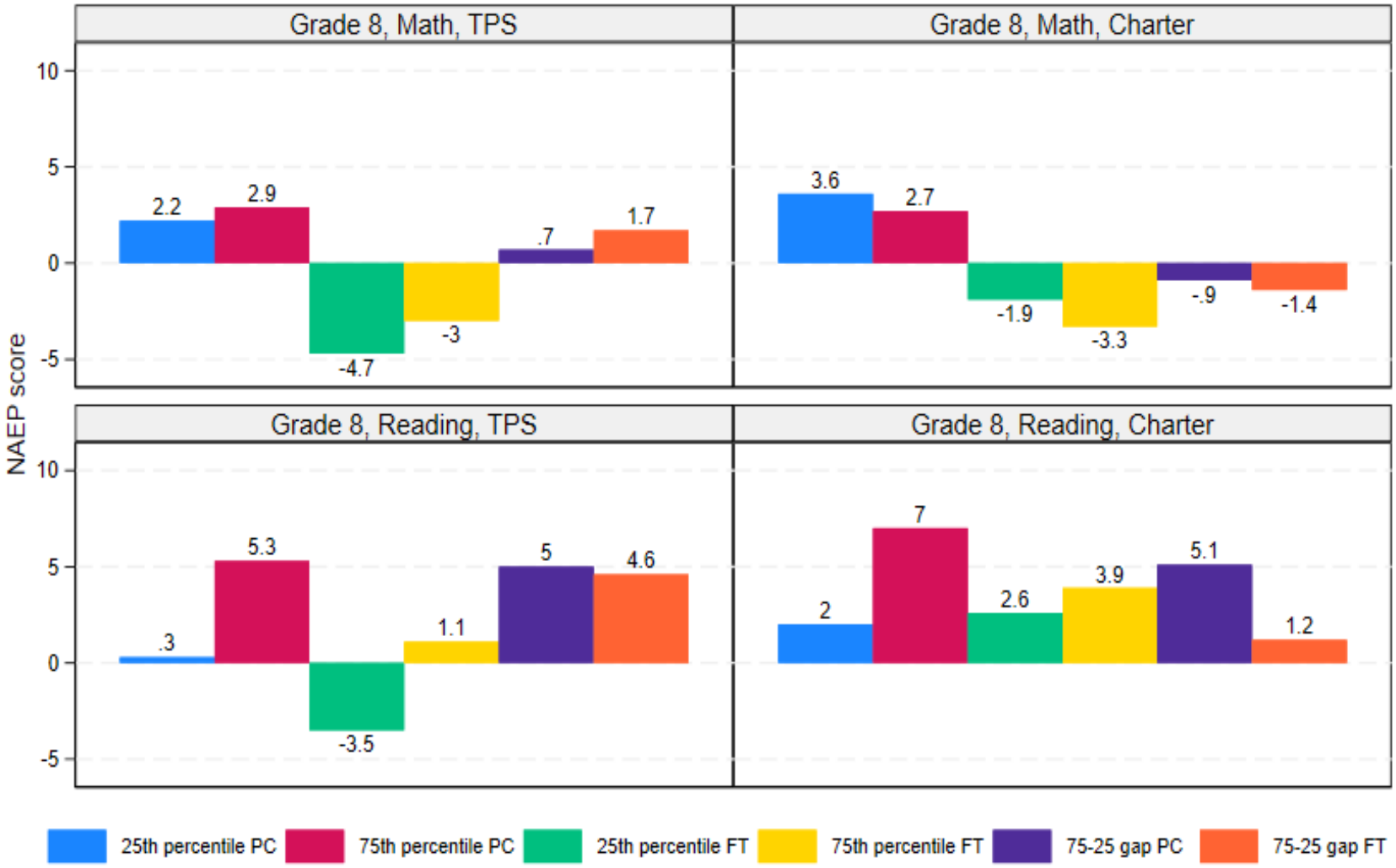
Notes: See Fig. 2.

Figure 20. Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for students with disabilities by grade, subject, and school sector



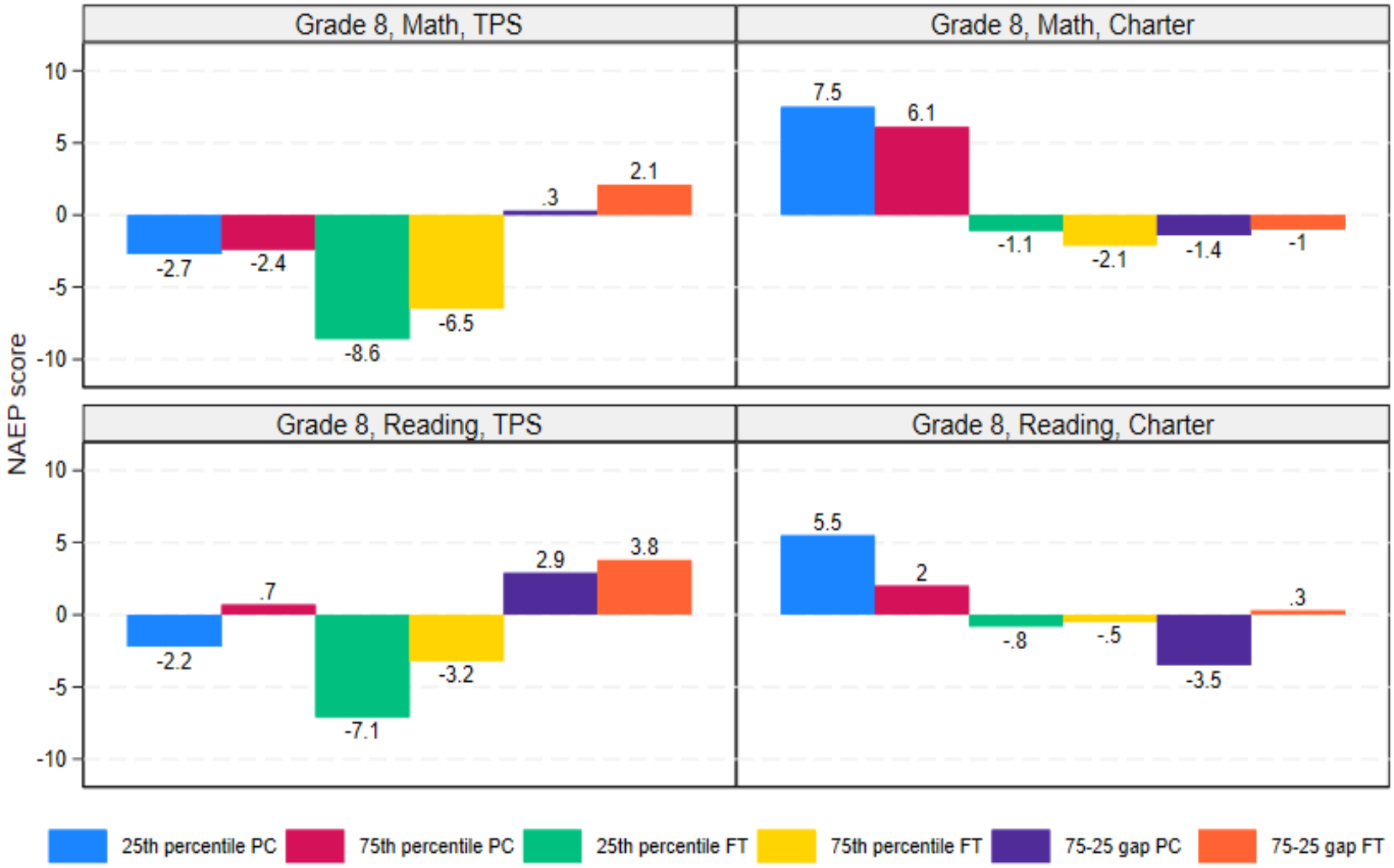
Notes: See Fig. 2.

Figure S21. Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for students with parental education as less than high school by grade, subject, and school sector



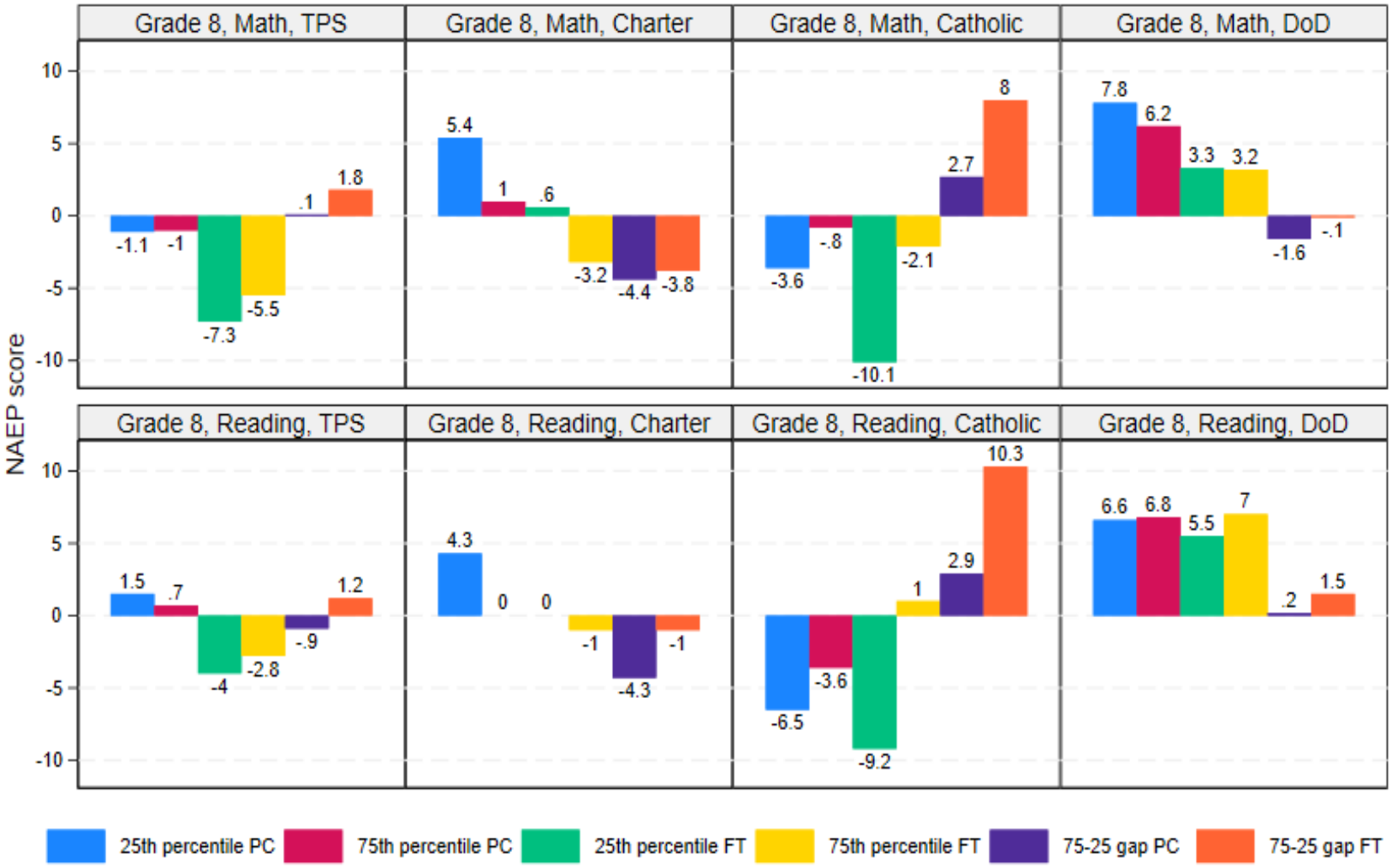
Notes: See Fig. 2.

Figure S22. Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for students with parental education as graduated high school by grade, subject, and school sector



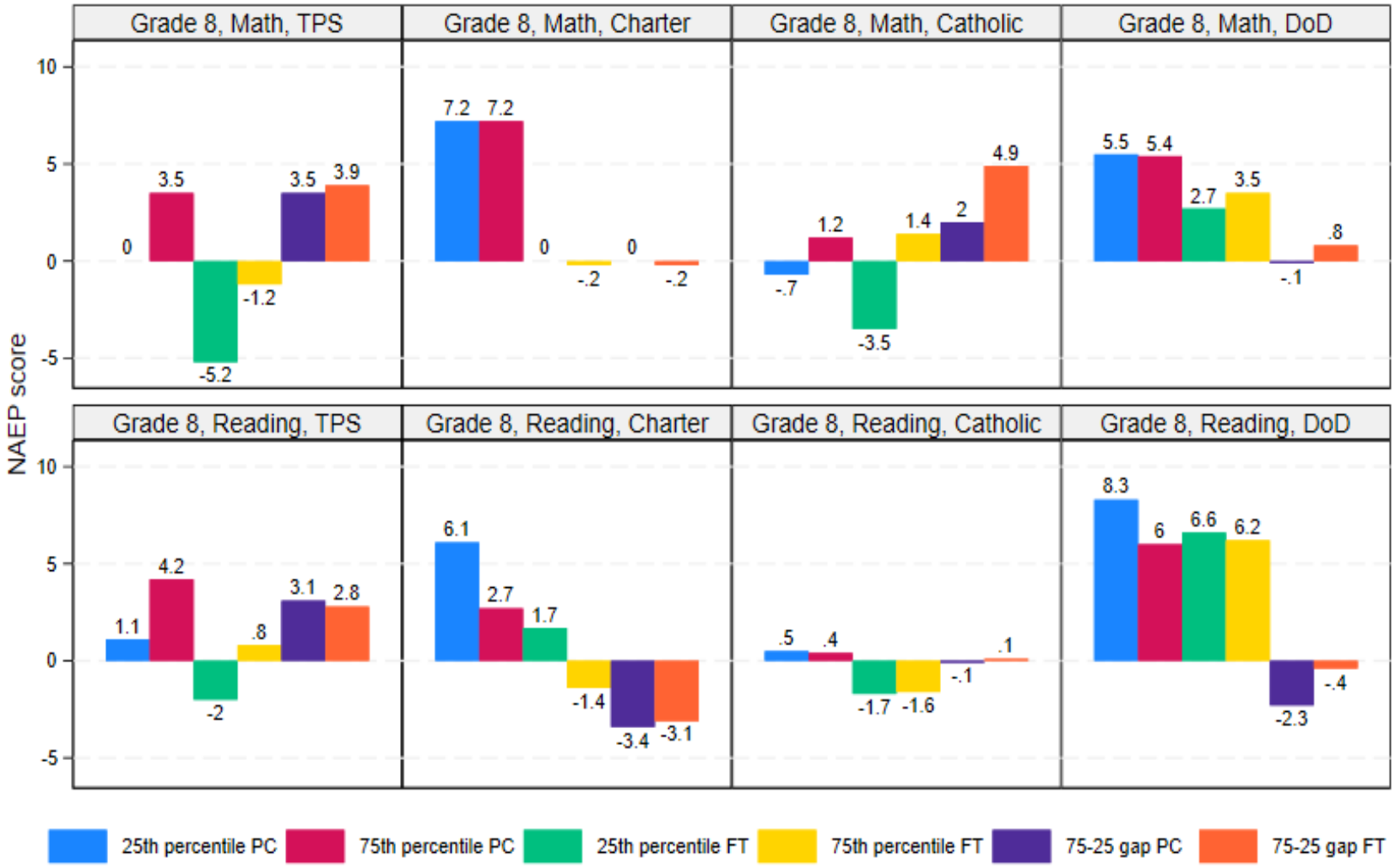
Notes: See Fig. 2.

Figure S23. Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for students with parental education as some college by grade, subject, and school sector



Notes: See Fig. 2.

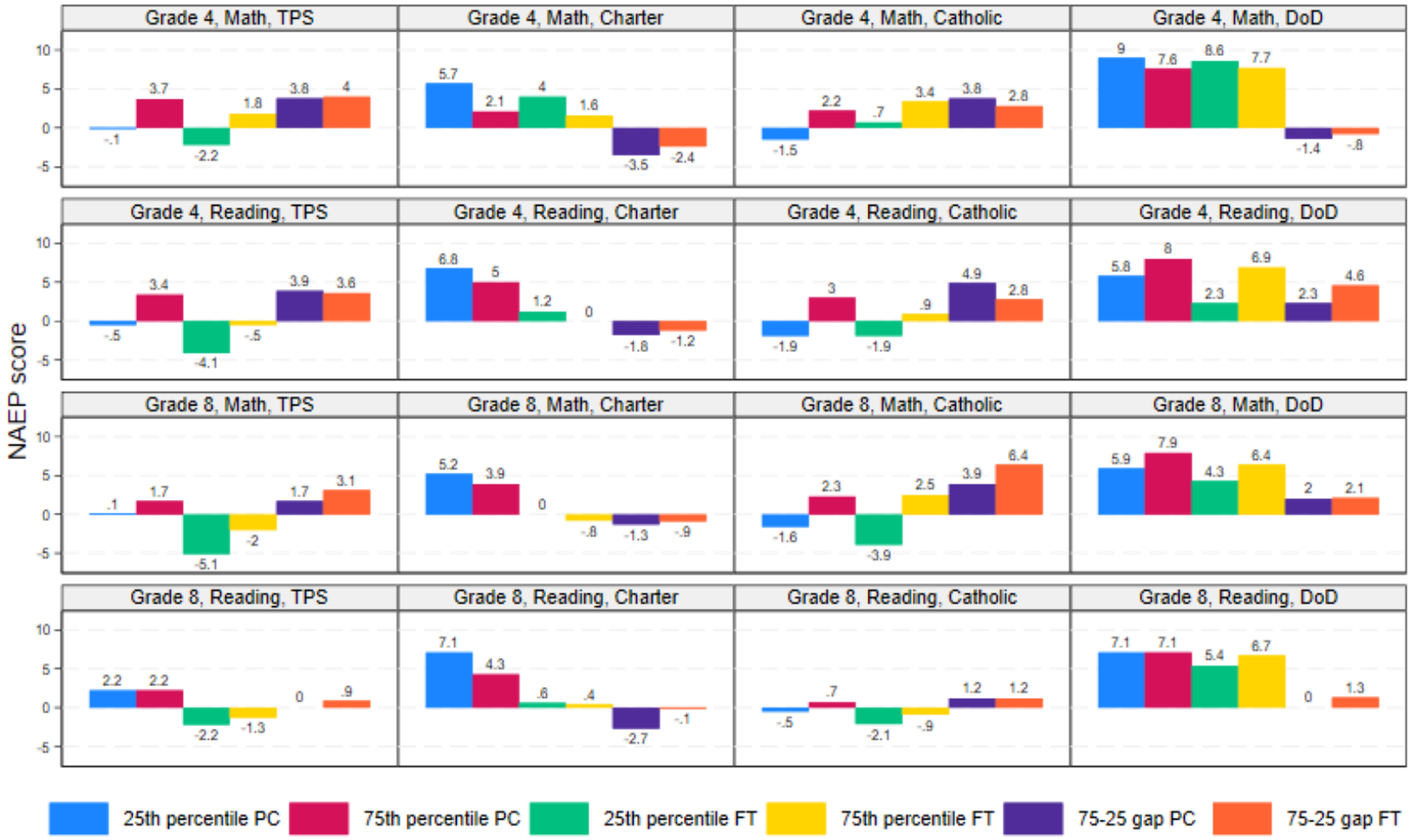
Figure S24. Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for students with parental education as graduated college by grade, subject, and school sector



Notes: See Fig. 2.

Figure S25

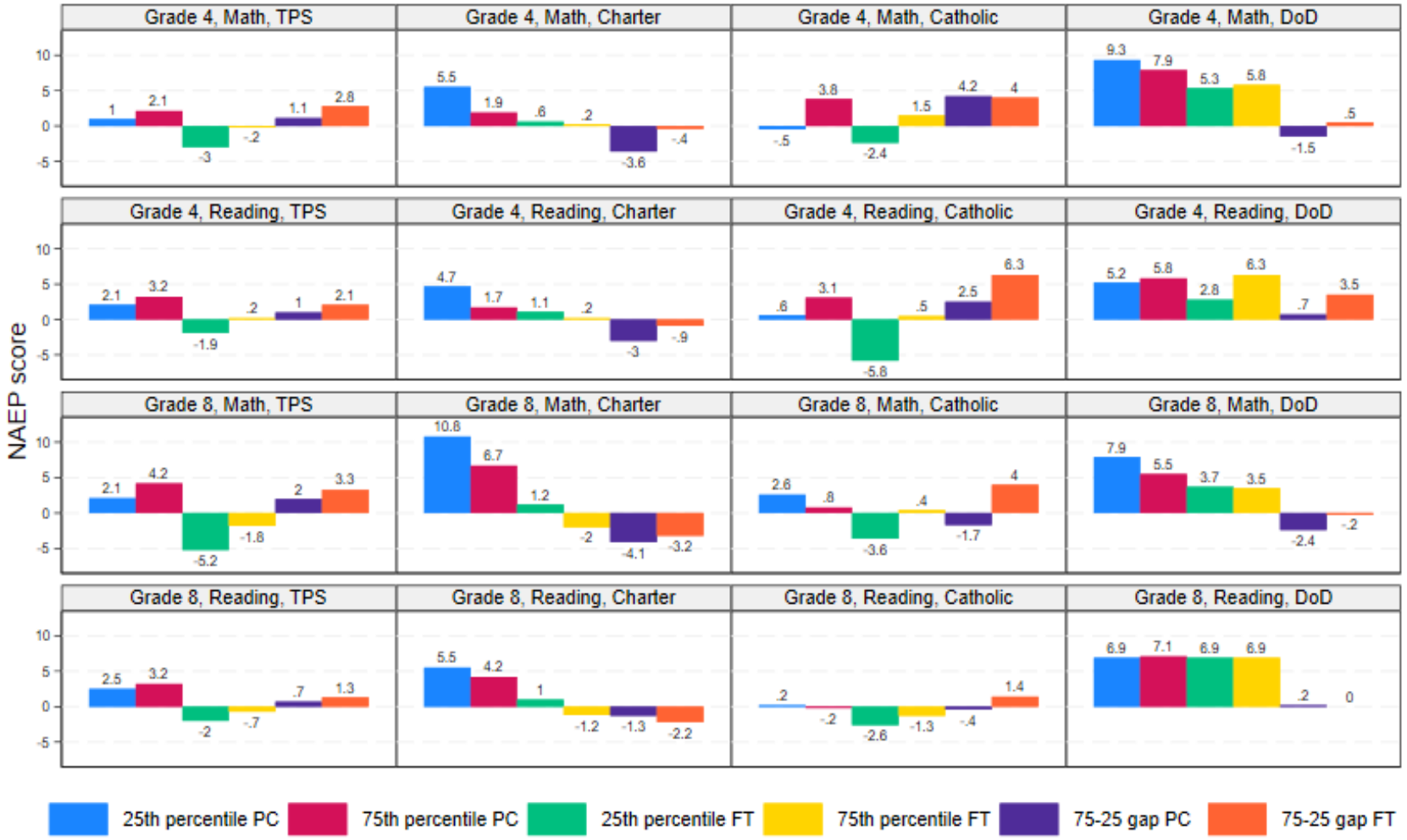
Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for male students by grade, subject, and school sector



Notes: See Fig. 2.

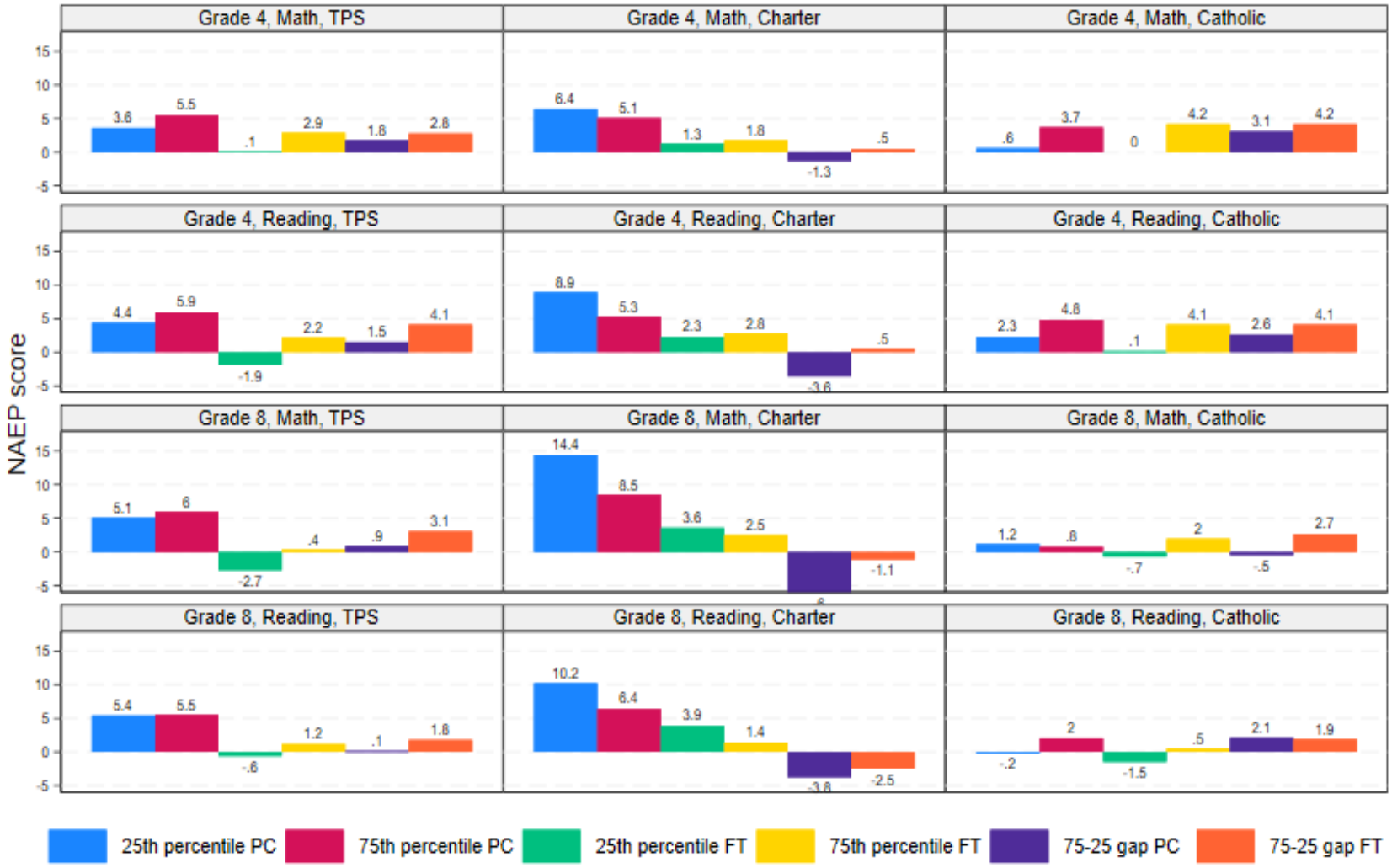
Figure S26

Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for female students by grade, subject, and school sector



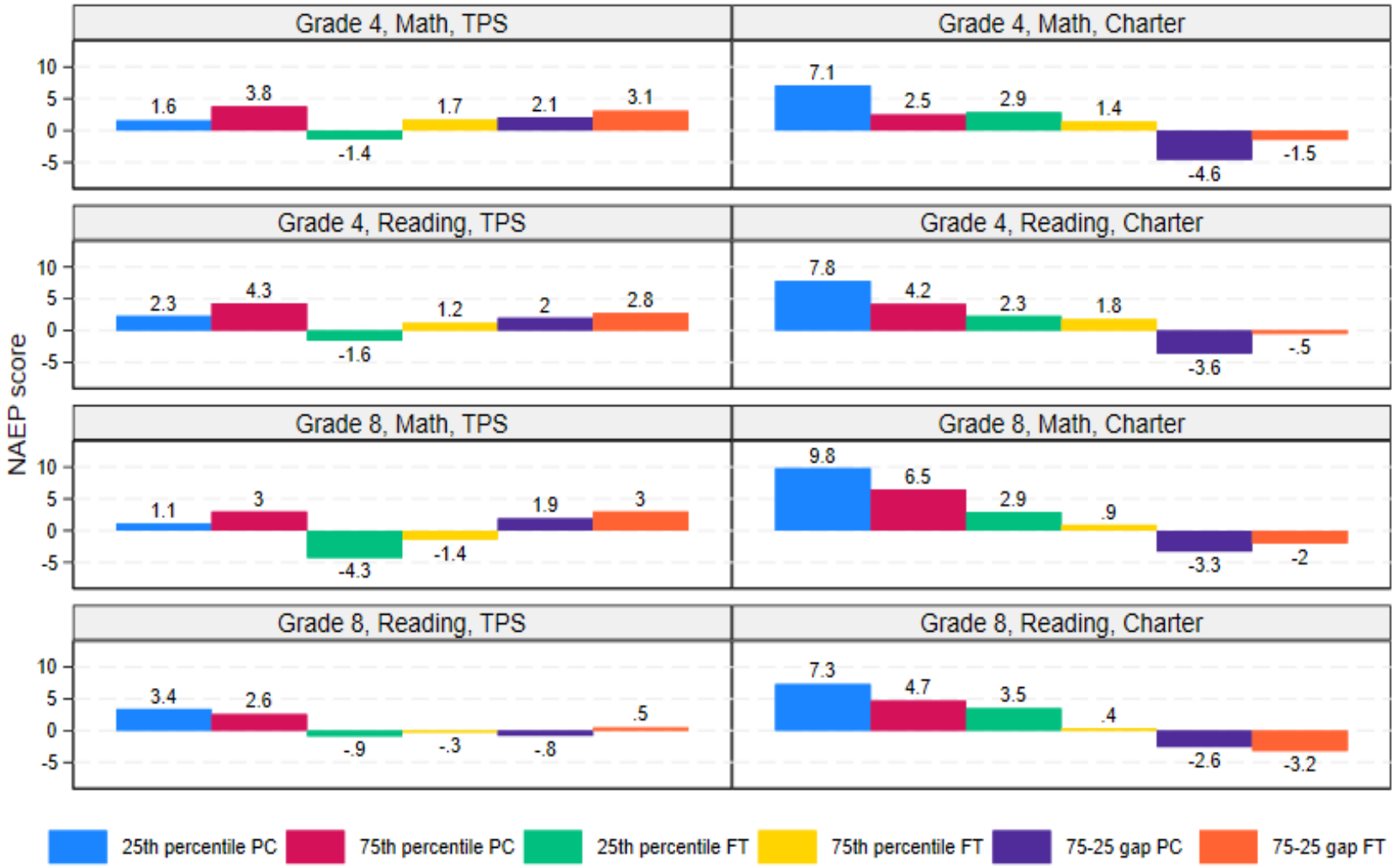
Notes: See Fig. 2.

Figure S27. Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for not economically disadvantaged students by grade, subject, and school sector



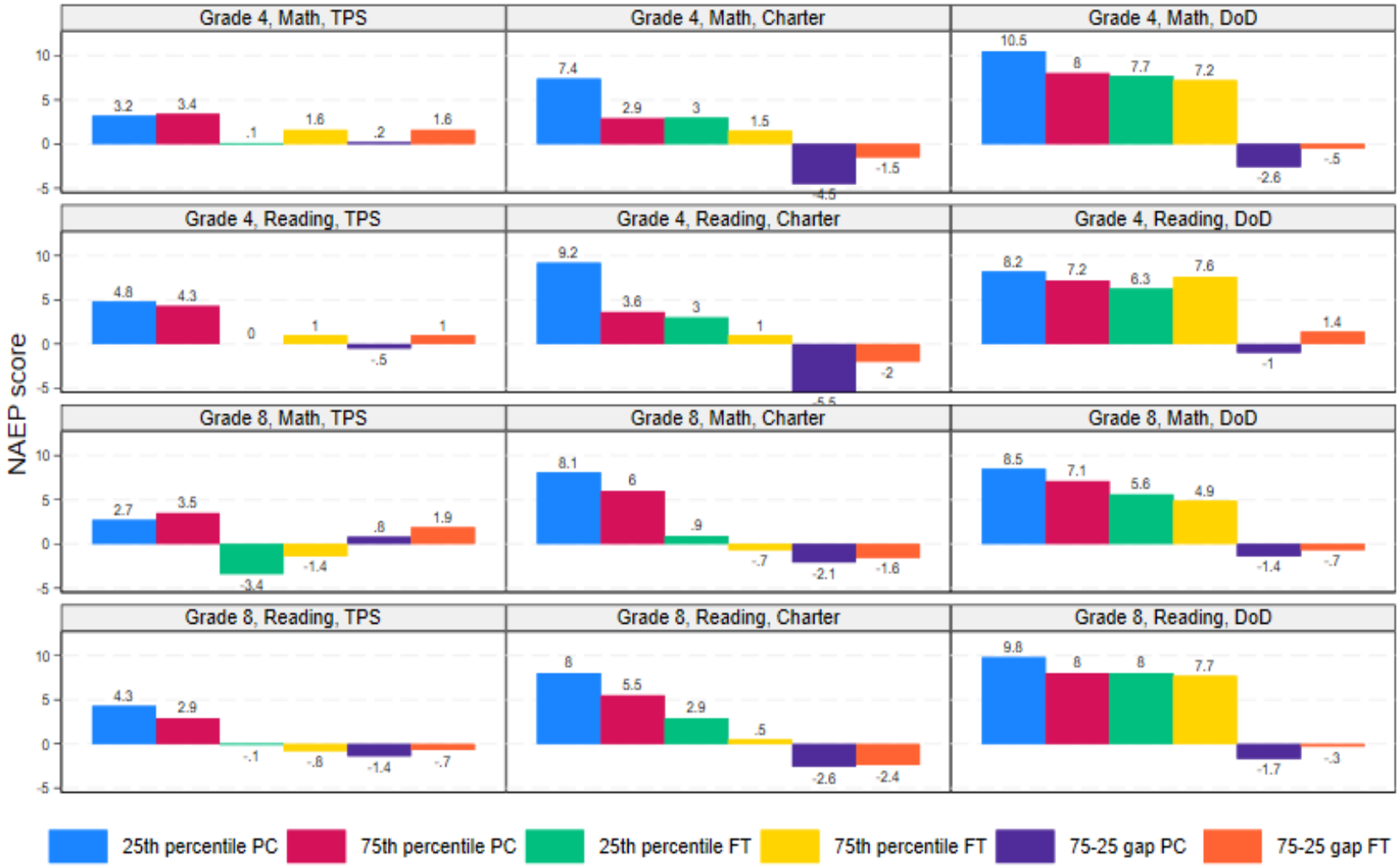
Notes: See Fig. 2.

Figure S28. Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for not English language learner students by grade, subject, and school sector



Notes: See Fig. 2.

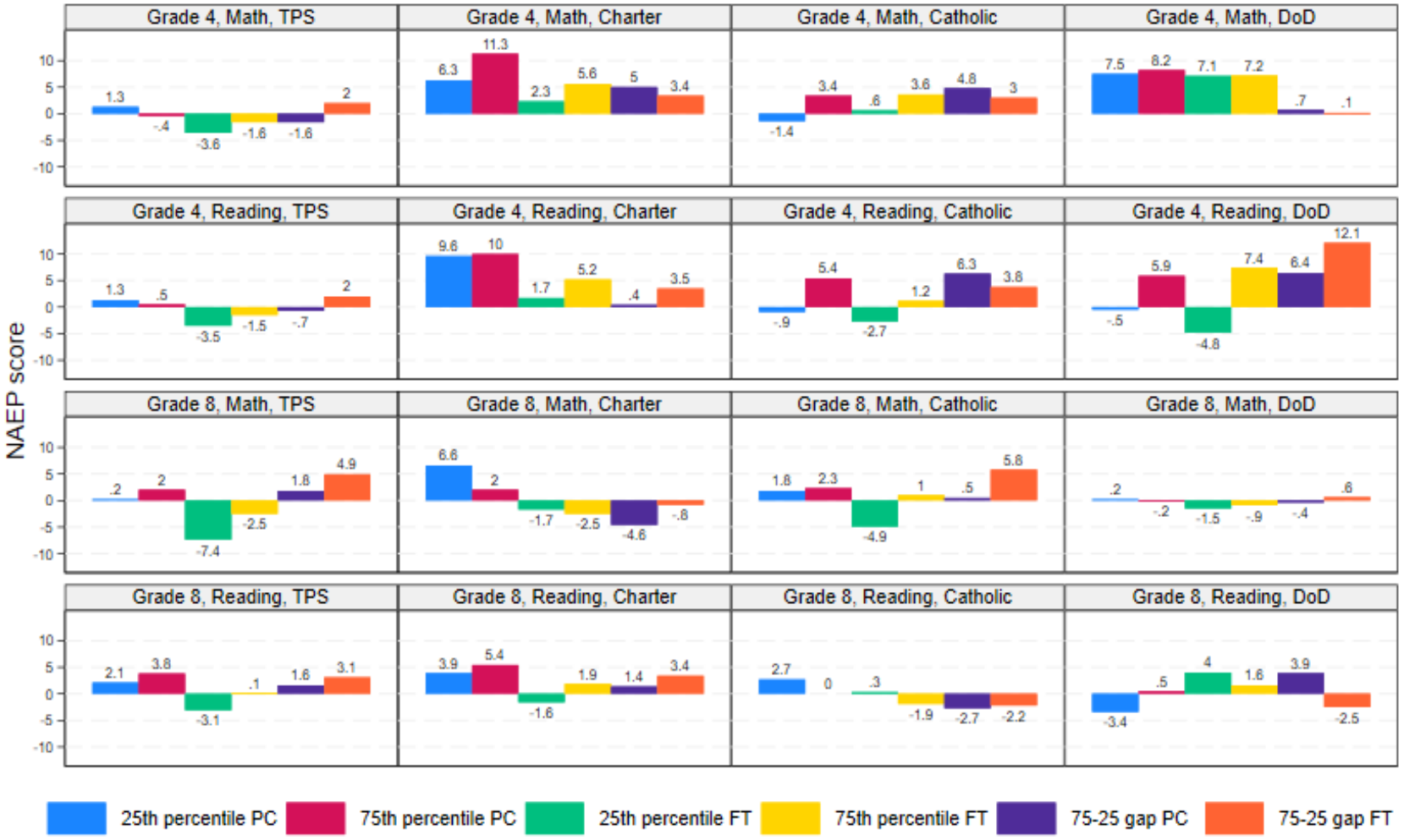
Figure S29. Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for not disabled students by grade, subject, and school sector



Notes: See Fig. 2.

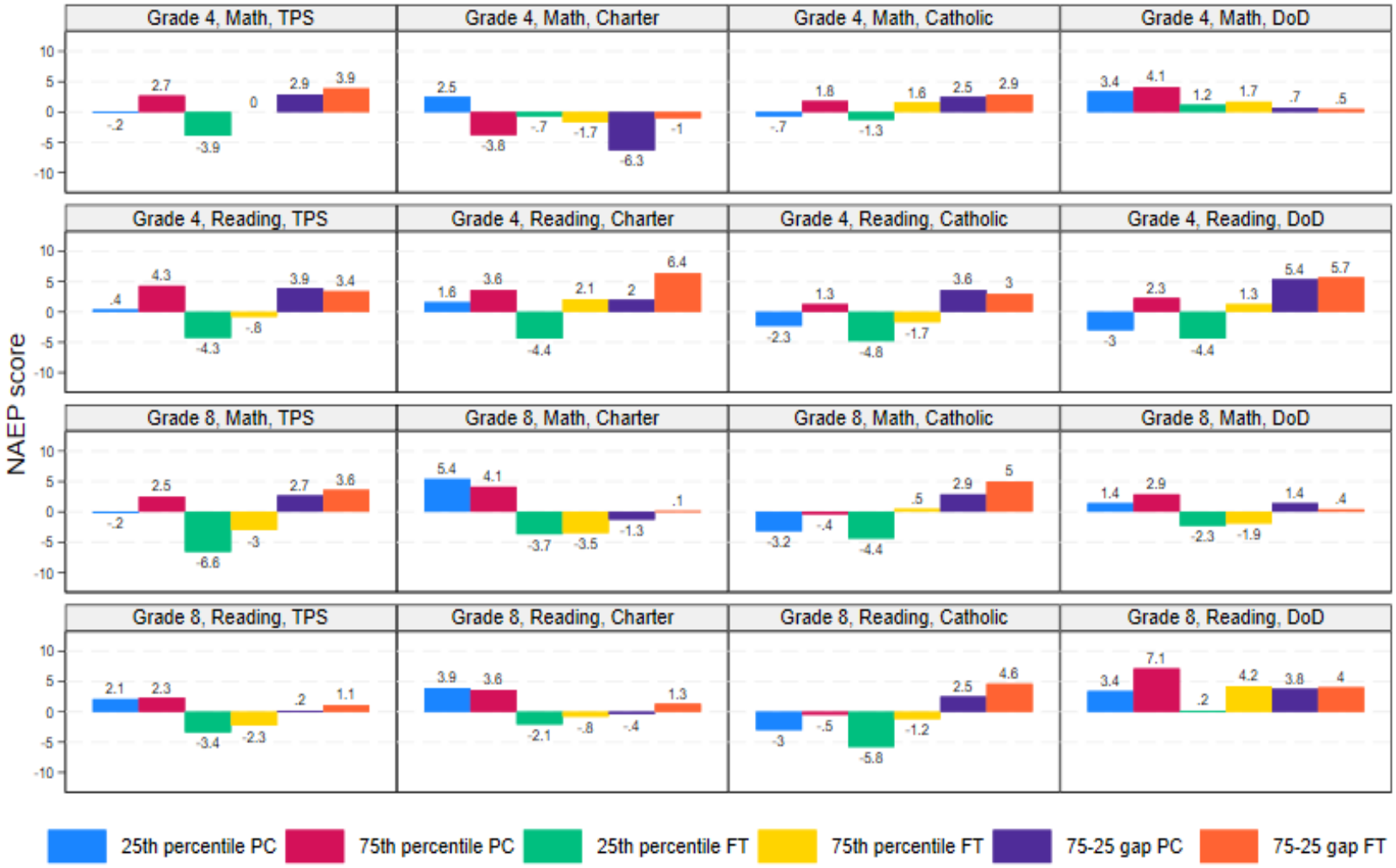
Figure S30

Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for urban students by grade, subject, and school sector



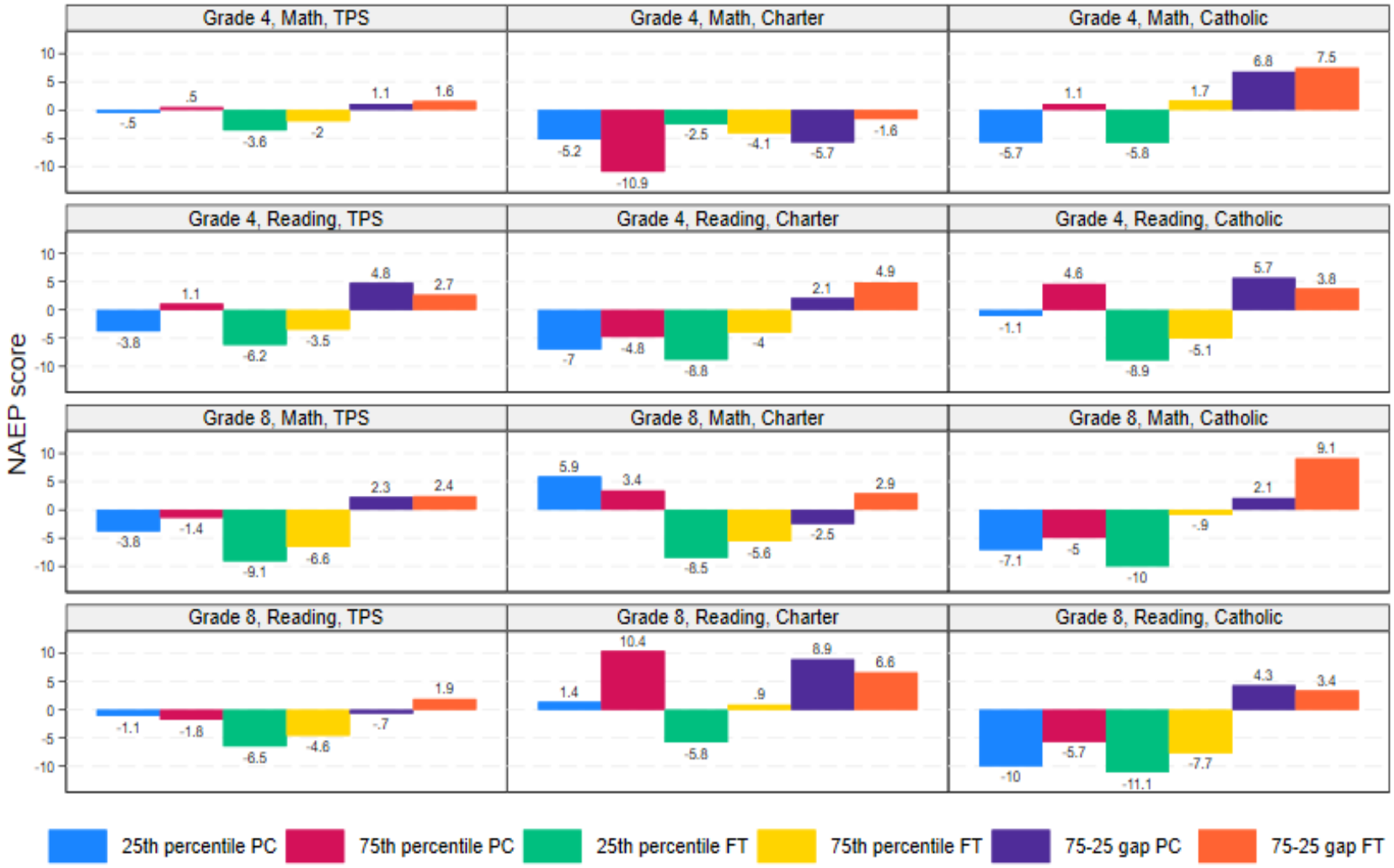
Notes: See Figs. 2 and S10.

Figure S31. Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for suburb students by grade, subject, and school sector



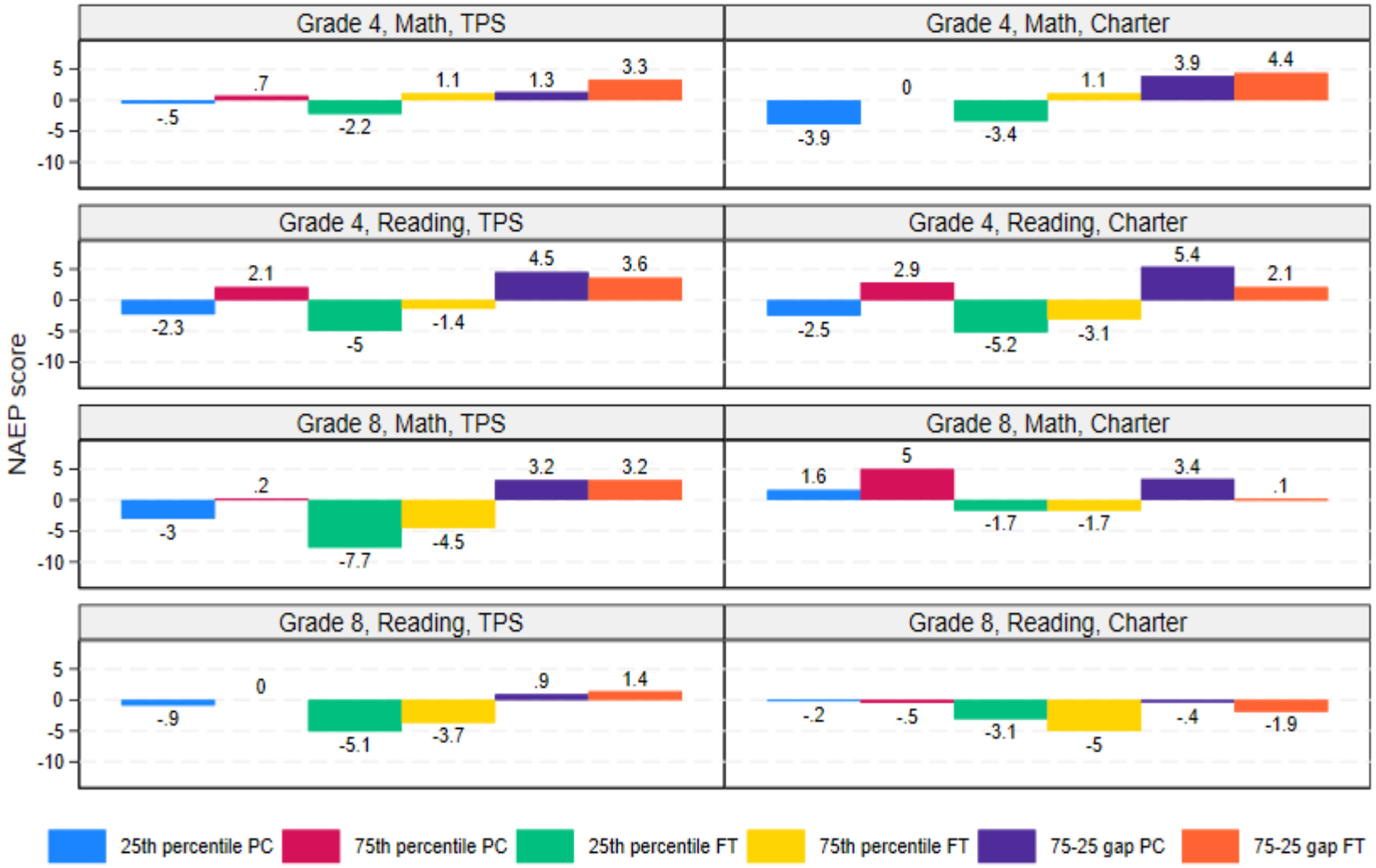
Notes: See Figs. 2 and S10.

Figure S32. Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for town students by grade, subject, and school sector



Notes: See Figs. 2 and S10.

Figure S33. Change/decade in adjusted 75th and 25th percentile scale scores, and the 75–25 gap for rural students by grade, subject, and school sector



Notes: See Figs. 2 and S10.