Sociology Mind, 2025, 15(2), 93-104
https://www.scirp.org/journal/sm
ISSN Online: 2160-0848
ISSN Print: 2160-083X

The Enduring Allegorical Appeal of "Structural Inequality:" Comment on "Racial Inequality in 8th-Grade Math Course-Taking" by Carbonaro, Lee and Langenkamp in *American Sociological Review*

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How to cite this paper: Sakamoto, A. (2025). The Enduring Allegorical Appeal of "Structural Inequality:" Comment on "Racial Inequality in 8th-Grade Math Course-Taking" by Carbonaro, Lee and Langenkamp in *American Sociological Review. Sociology Mind, 15,* 93-104.
https://doi.org/10.4236/sm.2025.152005

Received: February 7, 2025
Accepted: March 28, 2025
Published: March 31, 2025

Abstract

In a recent article entitled "Racial Inequality in 8th-Grade Math Course-Taking: Between-School Inequality, Local Achievement Queues, and Course Placements," Carbonaro et al. (2024) argue that African American 8th-grade students are less likely to be enrolled in algebra or geometry courses compared to White students with similar prior achievement levels. Carbonaro, Lee and Langenkamp claim that this racial disadvantage derives from "structural inequality" because "racialized sorting" results in Black students encountering greater constraints due to queuing for "course-taking opportunities." However, Carbonaro, Lee and Langenkamp's investigation is not convincing. Their statistical methods do not fit their theory, which is ad hoc and inadequately developed. Their regression equations resemble mis-specified status attainment models rather than queuing models. Their empirical results, in any event, do not provide adequate support for their emphasis on structural inequality in terms of being enrolled in advanced math courses in the 8th grade. Their assertion that "discrimination and structural inequality" are "the primary drivers of racial inequality" does not explain why their findings show that Asian Americans are consistently advantaged over Whites. Sociologists' enduring interest in structural inequality may be laudable, but Carbonaro, Lee and Langenkamp's investigation of it is not informative.

Keywords

Racial Inequality, Test Scores, Education, Queuing Models

1. Introduction

Sociological references to "structural inequality" have been popular for many decades especially in research relating to socioeconomic inequalities (e.g., Kalleberg and Sorensen, 1979; Bonilla-Silva, 1997; Davies and Zarifa, 2012). The perennial problem has always been analytically defining "structural inequality" in a way that is both theoretically sound as well as supported by empirical evidence (Hodson and Kaufman, 1982; Smith, 1990; Sewell, 1992). Adding to this complexity, "structural inequality" naturally evolves over time (Kim et al., 2018) including in regard to racial disadvantage (Sakamoto and Tzeng 1999; Sakamoto et al., 2000).

"Structural inequality" is a major concern in "Racial Inequality in 8th-Grade Math Course-Taking: Between-School Inequality, Local Achievement Queues, and Course Placements," by Carbonaro et al. (2024) in *American Sociological Review*. They argue that "racialized sorting between schools constrains course-taking opportunities and shapes achievement distributions within schools (local achievement schools)…. Our findings show that course-taking opportunities in 8th-grade math vary markedly across schools, and Black students are much more likely than white students to attend schools that offer no advanced courses (algebra or geometry). By failing to account for this structural inequality, prior research has underestimated racial inequality in course placements" Carbonaro et al. (2024).

Carbonaro et al. (2024) assert that "we note the importance of examining factors associated with race (i.e., discrimination and structural inequality) as the primary drivers of racial inequality, rather than an essentializing notion of a 'race effect.'" In other words, instead of empirically assessing the evidence in an objective manner, Carbonaro, Lee and Langenkamp (hereafter, CLL) have decided a priori that "discrimination and structural inequality" must be the "primary" cause of math score differences between White and Black students. In contrast to Merton's (Merton, 1973) norms of organized skepticism and disinterestedness, CLL have decided in advance what the conclusions of their investigation should be, and their objective is apparently to ensure that their results fit their predetermined presumption. CLL is an example of excessive ideological bias in contemporary American sociology (Smith, 2014; Jindra and Sakamoto, 2023).

Using seven years of administrative data for the state of Indiana, CLL adapt queuing theory as the substantive basis for their analysis of "structural inequality" citing the classic work by Thurow (1975). As stated by CLL:6, "queuing practices within schools should reward students for their relative position within the local achievement queue." The basic process that CLL envision is essentially a crowding-out effect whereby qualified African American 8th-grade students are unable to enroll in algebra or geometry classes because the availability of these courses is said to be insufficient to meet demand and is therefore rationed out to more qualified students (i.e., those higher in the queue based on their prior math test scores) who are more likely to be Whites rather than Blacks (at least on average).

However, CLL's investigation is not convincing. Their regression equations resemble mis-specified status attainment models rather than queuing models. Their empirical results in any event do not provide support for their emphasis on "structural inequality" in regard to the enrolment of Blacks in advanced math courses in the 8th grade. Although the title of their article refers to "racial inequality," their discussion curiously ignores other racial categories (besides Whites and Blacks) such as Asians for whom the results are not consistent with the CLL's view than Whites are racially advantaged being enrolled in advanced math courses in the 8th grade.

2. Theoretical Background

First of all, CLL's conclusions about "racial inequality" in the contemporary U.S. are obviously incomplete if they only refer to Whites and Blacks because other racial groups have notably increased their share of the American population in the 21st century (Frey, 2018; Ren et al., 2022). CLL's assertion that "discrimination and structural inequality" favor Whites due supposedly to "racialized sorting" does not explain why their findings show that Asian Americans are consistently advantaged over Whites. Indeed, their results indicate that the Asian advantage over Whites exceeds the latter's advantage over Blacks. Completely ignoring the former differential and only focusing on the latter differential seems logical inconsistent for a study that is purportedly considering "racial inequality" in general.

CLL's failure to mention their findings in regard to Asians might not be an arbitrary omission. Because the results for Asians do not corroborate CLL's claims about "structural inequality" and "racialized sorting" favoring Whites over minorities, disregarding Asians seems to be an attempt to promote an ideologically motivated theory. Ignoring "inconvenient facts" about Asians in studies of "racial inequality" is a common practice that has a long history in American sociology (Sakamoto et al., 2009). This lack of acknowledgment may furthermore reflect a reluctance to consider other variables that are omitted from CLL's analysis (though relevant to explaining their outcomes of interest) thereby again attempting to prop up their claims.

For example, although ignored by CLL, racial differences in the amount of time that students spend studying are prominent and well-known. On average, Asians study more than Whites while Blacks study less than Whites (Aud et al., 2010; Hsin and Xie, 2014; Dunatchik and Park, 2022). These racial differences in hours studied ultimately derive from a variety of social background factors and family behaviors (Schneider and Lee 1990; Sun, 1998), but notable among them is family structure. Approximately 70% of Black fertility has been non-marital for several decades in contrast to much lower rates among Whites and especially Asians (McLanahan and Sandefur, 1994; McLanahan, 2009; Kim and Raley, 2015; Cai and Morgan, 2019).

Non-marital fertility leads to female-headed families in which children receive fewer parental investments, less parental supervision, lowered educational expectations, and greater levels of stress (Kearney, 2023). According to McLanahan (2009), "nonmarital childbearing reproduces class and racial disparities through its association with partnership instability and multi-partnered fertility. These processes increase maternal stress and mental health problems, reduce the quality of mothers' parenting, reduce paternal investments, and ultimately lead to poor outcomes in children. Finally, by spreading fathers' contributions across multiple households, partnership instability and multi-partnered fertility undermine the importance of individual fathers' contributions of time and money, which is likely to affect the future marriage expectations of both sons and daughters."

CLL do not mention any of the aforementioned factors and erroneously assume that Whites, Blacks and Asians all have identical distributions in the motivation to undertake advanced math courses in the 8th grade. However, even high-ability Blacks in junior high school appear to place a lower "intrinsic value" on mathematics and a lower "attainment value" on mathematics in comparison to high-ability Whites (Andersen and Ward, 2014). High-ability Blacks in junior high school place a lower "intrinsic value" on science and STEM as well as rate themselves lower in "mathematics self-efficacy" in comparison to high-ability Whites (Andersen and Ward, 2014).

In other pertinent research, Conwell (2021) finds that the Black-White gap in math test scores for several decades has been greater among students with higher-income parents than among students with lower-income parents. Higher-income parents presumably have more capacity to provide educational opportunities for their children. Higher-income parents can purchase more educational and learning materials (e.g., books, computers, software); hire tutors or utilize supplemental training services (Park et al., 2016); send their children to higher-quality private schools; or move to neighborhoods with better public schools (Tian, 2023). If "structural inequality" relating to the lack of opportunities were the "primary drivers" of the Black-White test score gap as assumed by CLL, then the latter would presumably be lower among higher-income parents rather than greater as reported by Conwell (2021).

These patterns seem consistent with parents' aspirations for their children to complete college being higher among Whites than among Blacks (Kao, 2002). Relatedly, Arcidiacono et al. (2015) find that socioeconomic outcomes for Black men raised by White mothers do not appreciably differ from White men. By contrast, Black men raised by Blacks mothers tend to complete less schooling than White men even after controlling for mother's education and fixed effects on children's schools (Arcidiacono et al., 2015).

3. Methodological Issues

CLL do not provide any rationale, explanation or evidence about why some schools might not offer a sufficient number of algebra and geometry classes. CLL make passing references such as "schools are also constrained by limited resources (e.g., personnel and funding) that affect which courses and how many seats are offered…." (CLL:5), but no data about these or other structural variables about schools (e.g., Davies and Zarifa, 2012) are considered. CLL's investigation of "structural inequality" is more allegorical than actual.

In queuing theory, the desirable jobs in the primary sector (i.e., those providing valuable training opportunities, higher wages, better benefits or work conditions) are rationed because their wages are relatively fixed and therefore do not adequately equilibrate supply and demand (Sakamoto and Chen, 1991). For example, applicants for a tenure-track assistant professor job are not hired because they are willing to work for a lower salary. Rather, they are ranked (i.e., ordered in a queue) in terms of their desirability (Thurow, 1975) which typically is heavily influenced by their research productivity. By contrast, wages in lower-skilled jobs in the secondary sector are highly influenced by external market conditions to more fully equilibrate supply and demand (Aeppli and Wilmers, 2022).

The consequence of queuing is that it promotes zero-sum competition among the applicants. If applicant A is offered the tenure-track assistant professor job, then the other applicants cannot obtain that job offer. Only if applicant A decides to decline the offer is the next applicant in the queue then able to get the offer. This sort of zero-sum competition is associated with the non-wage rationing of primary sector employment (Sakamoto and Chen, 1991).

CLL do not explain or analyze why studying algebra entails any zero-sum competition or other organizational constraints. While retaining competent teachers in "challenging schools" (Greenlee and Brown, 2009) may sometimes be a general problem, that is a different situation from having too many 8^{th}-grade students wanting to enroll in higher level math courses. Rather than being a zero-sum competition, a few students studying geometry would probably be better off having other classmates who are also studying geometry. CLL do not present any evidence that administrators are particularly incentivized or constrained to schedule more basic math courses and fewer algebra and geometry courses. In fact, CLL:5 acknowledge that "one consistent finding is that schools that offer more advanced course-taking opportunities tend to have higher-achieving students."

While CLL:18 do refer to "seat-allocations in advanced math courses," this variable seems to refer to the proportion of 8^{th}-grade students who are observed to be enrolled in algebra or geometry classes in the given school. However, CLL do not provide any information about actual seats in the classroom. Simply because a certain proportion of students were enrolled in algebra does not demonstrate that not a single seat was available in any of the algebra classrooms. Despite CLL's reference to "seat-allocations in advanced math courses," this variable does not appear to represent a fixed organizational constraint that remains constant over the seven years of the data for each school. Thus, "seat-allocations in advanced math courses" is not really an exogenous "structural inequality" variable that is adding new information about schools as organizations being too financially constrained to enroll more students in advanced math courses.

In the context of CLL's discrete dependent variable regressions (i.e., multinomial regressions) predicting whether a student is enrolled in an algebra or geometry class, CLL's "seat-allocations in advanced math courses" is akin to being the observed mean for the dependent variable at the level of the student's school. CLL:23's finding that students in schools with more students enrolled in advanced math courses are more likely to enroll in advanced math courses is more of a statistical tautology than a theoretically informative research conclusion. The extremely large incremental R-squared (which is generally unusual for discrete dependent variable regression models) associated with this variable undoubtedly reflects this statistical tautology (CLL:24).

In the queuing model of Sakamoto and Powers (1995), the available quantity of primary-sector jobs is affected by the aggregate level of education among new cohorts of workers entering the labor market annually during two decades of high economic growth in Japan (following Thurow's [Thurow, 1975] view of education as a valid market signal of trainability rather than merely credentialism). By contrast, CLL's model unrealistically implies that the availability of advanced math courses is completely exogenous irrespective of students' prior math achievement. A more informative approach would have been for CLL is utilize the annual variation in students' prior math achievement and to estimate its impact on changes in enrolment in advanced math courses over time in specific schools. Rather than leveraging the temporal information contained in their data, CLL's model simply includes year-fixed effects that lack substantive interpretation and are never discussed.

CLL makes frequent reference to "opportunities" (on almost every page of text) but CLL really only measures observed outcomes. In general, opportunity is a more nuanced concept associated with potentiality that is not the same as actually observed values on some variable. For example, in my long career, I have received several offers to become an assistant dean. I declined all of those offers because I have no interest in becoming an assistant dean. The fact that I have never been observed working as an assistant dean does not necessarily imply that I have never had any "opportunities" to become an assistant dean. In other words, "opportunities" are not identical to the distribution of observed outcomes. By including in their models the number of students observed to be enrolled in advanced math courses in a given school, CLL are misinterpreting actual outcomes as being a direct measure of "opportunities."

The queuing models of Dickens and Lang (1985), Gamoran and Mare (1989), Sakamoto and Chen (1991), and Eliason (1995) incorporate estimates of the expected outcomes for persons who are not actually observed in the advantaged structural positions of interest. Those models thereby incorporate "opportunities" as latent variables that are not directly observed but may nonetheless discerned to be operating based on other observed quantities that are affected by the queuing processes. Applying this approach to CLL's research concerns, the allocation (or queuing) equation for the structural positions would predict whether or not they are enrolled in an advanced math course. The "behavioral" equation would then be some measure of academic performance such as a grade or test score. This sort of multi-equation model could provide more convincing evidence about rationing if the students not enrolled in advanced math courses would have been estimated to have performed adequately had they been so enrolled. More generally, a properly specified queuing model is more capable of discerning rationing by investigating the processes of achievement and allocation simultaneously (Mare and Winship, 1988). Note that a large incremental R-squared (CLL:24) per se does not indicate that a statistical model is properly specified and theoretically informative.

Another problem with CLL's analysis is that allocation is investigated at the state level (for Indiana as a whole) whereas the queuing is conceptualized to be ongoing primarily within schools. CLL's data include over 500 schools in a geographically large state, but qualified 7th-grade students do not immediately move to the school elsewhere in the state where there is an available 8th-grade algebra class. In queuing models, one's ranking should be based on one's relative educational attainment among persons in direct competition with other (Thurow, 1975; Sorensen and Kalleberg, 1981; Sakamoto and Powers, 1995).

Relatedly, CLL's combining of all cohorts together is problematic because the availability of advanced math courses is cohort-specific; 7th-grade students in any given cohort are not competing with 7th-grade students in older or later cohorts. Accordingly, relative educational attainment for the purposes of queuing analyses is typically measured by cohort (Sakamoto and Chen, 1991; Sakamoto and Powers, 1995; Sakamoto et al., 2012). To analyse queuing beyond a particular school in a given year, the statistical model would need a sufficient time lag to allow for parents to move to different school districts in order to increase educational opportunities for their children (Tian, 2023).

In sum, in order to be a more valid indicator of zero-sum competition, the most basic queuing model would need to be more carefully measured at the school level by cohort and year. This approach would provide a more realistic analysis of organizational constraints (Hallinan and Sorensen, 1983). The rationing of learning opportunities needs to be empirically demonstrated (Gamoran and Mare, 1989; Sakamoto and Powers, 1995) relative to the counterfactual of being simply a direct effect of prior achievement levels. That is, restricted "opportunities" should be verified through testing the empirical evidence about whether queuing may actually be discerned by the statistical model.

Queuing models were originally developed for the study of wage inequality in the labor market. Their application to processes underlying educational achievement is not straightforward. Schools and labor markets operate on very different "institutional logics" (Durand and Thornton, 2018). Everyone is "entitled" to being enrolled in the 8th grade, but not everyone is able to obtain a high-wage job in the private sector of the economy (Sakamoto and Chen, 1991).

4. Empirical Analysis

CLL:21's Model 1 is the bivariate baseline regression while their Model 2 is a status attainment model showing the socioeconomic outcome based on prior individual-level characteristics. Whereas Black students are less likely to be enrolled in advanced math courses overall as shown in the results of Model 1, after accounting for their prior achievement, the status attainment model (i.e., Model 2) reveals that Black students are more likely to be enrolled in advanced math courses. As acknowledged by CLL:22 in regard to these results, "Black students are actually *advantaged* in the placement process."

CLL's Models 3 and 4 are their queuing models, which we have argued above are incorrectly specified based on CLL's theory. Nonetheless, taken at face value, even CLL:23's results for Model 3 provide no evidence of a Black disadvantage because African American students are 7.2 percent less likely to take basic math and 7.2 percent more likely to take algebra compared to White students controlling for prior achievement. That is, CLL's Model 3 is unsuccessful in portraying Black students as being disadvantaged in enrolling in algebra. CLL:23's Model 4 is their preferred and longest regression, but even its coefficients indicate that African American students are 1.6 percent more likely to take algebra compared to White students controlling for prior achievement. In other words, even in CLL's most elaborate model, Black students are still slightly advantaged in enrolling in algebra.

In the findings for Model 4 (CLL:23), one statistically significant coefficient indicates a Black disadvantage, which is that African American students are .0026 percent less likely to take geometry compared to White students controlling for prior achievement. However, this net effect is miniscule. Less than three-tenths of one percentage point is not substantively significant. Such a small net effect does not provide not adequate support for CLL:27's conclusion that "racial inequality remains an urgent problem in education…."

5. Discussion and Conclusion: Political Correctness Versus Statistical Correctness

> *Normative* sociology, the study of what the causes of problems *ought to be*, greatly fascinates us all. If X is bad, and Y which is also bad can be tied to X via a plausible story, it is very hard to resist the conclusion that one causes the other. We *want* one bad thing to be caused by another…we happily *leap* to the conclusion that the second evil is *caused by* the first.
>
> Robert Nozick (Nozick, 1974)

In conclusion, sociologists' enduring interest in "structural inequality" may perhaps be laudable, but CLL's investigation of it is unconvincing. Their statistical methods do not fit their theory which is itself ad hoc and inadequately developed. Their empirical findings do not provide any evidence that queuing processes emanating from "structural inequality" have substantively significant effects. Sociologists may find certain narratives about racial differentials to be perennially appealing, but those intriguing stories may sometimes be quite inaccurate summaries of the real world (Kim et al., 2018; Jindra and Sakamoto, 2023).

To advance this area of study in a more fruitful direction, a broader range of variables needs to be considered in regard to schooling behavior and family background factors (e.g., Schneider and Lee, 1990; Andersen and Ward, 2014; Xie et al., 2015; Liu and Xie, 2016) as well as school-level characteristics and processes (Sørensen, 1970; Hansen, 2014; Bottia et al., 2018). While the focus of CLL is on queuing processes, these models are not convincing when they are seriously misspecified as discussed above. Their application needs to be more empirically justified utilizing data in conjunction with the aforementioned variables. Queuing models used simply to promote a particular political narrative are more allegorical in nature and are not informative for public policy deliberations.

Acknowledgements

Direct correspondence to Arthur Sakamoto. The opinions expressed are the sole responsibility of the author. No funding was received to support this research. No conflicts of interest are involved in this research or its publication.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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