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Does STEM Stand Out? Examining Racial/Ethnic Gaps in Persistence Across Postsecondary Fields

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Informed by the theoretical lens of opportunity hoarding, this study considers whether STEM postsecondary fields stand apart via the disproportionate exclusion of Black and Latina/o youth. Utilizing national data from the Beginning Postsecondary Study (BPS), the authors investigate whether Black and Latina/o youth who begin college as STEM majors are more likely to depart than their White peers, either by switching fields or by leaving college without a degree, and whether patterns of departure in STEM fields differ from those in non-STEM fields. Results reveal evidence of persistent racial/ethnic inequality in STEM degree attainment not found in other fields.

Keywords: higher education; postsecondary education; race; regression analyses; secondary data analysis

In recent decades, scholars have directed considerable attention to disparities in educational outcomes in the fields of science, technology, engineering, and mathematics (STEM). This focus is motivated at least in part by the U.S. government's expressed need for more STEM workers to maintain not only the nation's economic prominence but also its status as the global leader of technological and scientific innovation (National Academy of Science, 2010). Yet in contrast to the large body of research on the underrepresentation of women in STEM fields, there is much less research on postsecondary patterns of racial/ethnic inequality in STEM. To this point, despite a number of recent national studies showing that Black and Latina/o youth are as likely to enter STEM majors as their White peers (Chen, 2009; Garrison, 2013; Riegle-Crumb & King, 2010; Xie, Fang, & Shauman, 2015), little national research examines their subsequent persistence to degree within a comparative context that also considers inequality across the larger U.S. postsecondary landscape.

Specifically, our study aims to contribute new insights regarding whether racial/ethnic inequality in patterns of STEM persistence might be distinct from inequality observed in other fields. Using a sociological lens, we consider whether STEM fields represent a key location of opportunity hoarding (Tilly, 1997), such that White privilege on the one hand, and the relative exclusion of Black and Latina/o youth on the other, may be greatest in these fields with high levels of social and economic value (Hershbein & Kearney, 2014; Xie & Killewald, 2012). Prior research provides some evidence of higher departure rates among underrepresented minority youth who initially declare STEM majors relative to their White peers. However, these studies are generally limited in scope as they typically fail to consider whether similar patterns are also found in non-STEM fields, and also omit students who leave college without a degree entirely (e.g., Chang, Sharkness, Hurtado, & Newman, 2014; Eagan, Hurtado, Figueroa, & Hughes, 2015). Regarding the latter point, as Black and Latina/o youth have lower rates of college attainment relative to Whites, it is critical to consider college exits, as well as changes in major, as pathways out of STEM for minority youth (Snyder & Dillow, 2012). In sum, understanding whether STEM fields stand out as a particularly pernicious case of inequality in higher education—consistent with the theory of opportunity hoarding—requires the consideration of racial/ethnic differences in types of persistence pathways across different fields of study.

Thus, using national data on a recent cohort of college matriculates from the Beginning Postsecondary Study (BPS), we investigate whether Black and Latina/o youth who begin college as STEM majors are more likely to depart, and thus are less likely to earn a STEM degree, than their White peers.

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Accordingly, we focus on two distinct pathways for departure: switching to another major and leaving college altogether. Importantly, we consider whether patterns of racial/ethnic departure in STEM fields differ from those in business, social sciences, and the humanities. Our analyses also examine whether racial/ethnic persistence gaps across these different fields remain after accounting for inequality in high school academic preparation, given prior evidence of educational opportunity hoarding, for example, through the exclusion of minority youth from advanced high school coursework (Lewis & Diamond, 2015). Results from this study will improve understanding of whether STEM fields stand apart by disproportionately excluding minority students who, at college entry, are comparable to their White peers on a host of critical factors. Ultimately, we seek to contribute new substantive and empirical knowledge that situates disparities in STEM degree attainment within the larger context of racial/ethnic inequality.

Literature Review

In outlining his theory of categorical inequality between social groups, Tilly (1997, 2000) proposes the concept of opportunity hoarding as foundational to understanding inequality. Within the opportunity hoarding framework, members of an in-group secure and subsequently maintain access to a resource that is both limited and highly valued—one that provides an advantage at present and into the future. According to Tilly, while the initial rationale for seizing the valuable opportunity is in-group favoritism, maintaining access (and all its related benefits) requires systematizing control and excluding out-group members through identity-defining boundaries, such that "whole sets of people on one side of a boundary or the other fare differently" (2007, p. 246). While more historical examples of hoarding focus on access to land or certain sectors of the labor market, sociologists of education argue that a clear example of opportunity hoarding emerges when groups create social advantages through some form of educational segregation and, thus, essentially gain control of education as a highly valuable resource (Anderson, 2010; Lewis & Diamond, 2015; Lewis-McCoy, 2014). Further, education scholars building on Tilly's work argue that in contemporary times, one of the primary and most powerful mechanisms through which the in-group creates and maintains such advantages is the construction and perpetuation of stereotyped assumptions and beliefs regarding the attributes of members of the out-group, which are then used to justify their exclusion (Anderson, 2010; Lewis & Diamond, 2015).

Recent studies have used the lens of opportunity hoarding to investigate racial/ethnic inequality both between and within K–12 schools (Anderson, 2010). For example, Hanselman and Fiel (2017) examine how White and Asian families might hoard high-achieving or high-growth elementary schools as a way of maintaining their educational privilege. Similarly, Rury and Saatcioglu (2011) consider racial/ethnic segregation between suburbs and cities, arguing that this reflects a process of advantage-seeking on the part of White suburbanites that enables them to hoard the best educational opportunities. Other studies point to the hoarding of valuable educational resources within high schools, where privileged youth are often disproportionately represented in the most advanced academic classes (Kelly, 2009; Kelly & Price, 2011; Lewis & Diamond, 2015; Lewis-McCoy, 2014), which provide them subsequent benefits for both access to and performance in college. Indeed, Lewis and Diamond's (2015) qualitative study of a high school serving an affluent and diverse district provides a compelling account of the mechanisms at work, where the biased beliefs and actions of White parents, their children, and the teachers in the school all coalesce in sometimes nuanced ways, ultimately leading to the systematic exclusion of many minority youth from advanced classes.

In this article, we extend these insights from research on K–12 schooling to the realm of postsecondary education. Specifically, we consider STEM postsecondary fields as a site of racial/ethnic opportunity hoarding among those who successfully matriculate to college. As STEM fields are highly esteemed and perceived as economically prosperous, we argue that they stand out amidst potential college majors as a highly valuable resource that leverages tangible earning and status potential. National studies confirm that STEM-related occupations are viewed as more prestigious and important than social science or business-related careers and that the lifetime earnings of those with STEM degrees tend to be substantially higher than those from other fields (Arcidiacono, 2004; Hershbein & Kearney, 2014; Xie & Killewald, 2012).[1] Coupled with prevailing public discourse about the importance of STEM (National Academy of Science, 2010), it stands to reason that obtaining a STEM degree could be considered a highly valued opportunity. Indeed, Tilly argues that scientific-technical knowledge is increasingly important—"looming larger by the day" as an inequality-generating resource—contributing to a categorical distinction between scientists and nonscientists (2007, p. 252).

As such, we posit that the prevalence or overrepresentation of White students in STEM postsecondary degree attainment relative to their minority peers is a critical instance of opportunity hoarding. As noted earlier, national studies indicate that Black and Latina/o college students declare STEM majors at the same rate as their White peers (Xie, Fang, & Shauman, 2015), which suggests that they enter college with comparable levels of interest in obtaining such a degree. Yet White privilege can be both enacted and preserved if minority students exit STEM majors at comparatively higher rates and racial/ethnic gaps in persistence are greater in STEM fields than in other majors. Thus, particularly high rates of switching majors or leaving college among minority youth in STEM majors or, put differently, particularly high rates of major persistence and degree completion among White STEM majors, would provide evidence consistent with theories of opportunity hoarding.

The extant empirical literature, although limited, provides some evidence of racial/ethnic gaps in STEM degree persistence. Indeed, a handful of recent studies investigating patterns within a single university or several selected universities have found that White STEM majors are more likely to persist than their minority peers (Arcidiacono, Aucejo, & Hotz, 2016; Dickson, 2010; Price, 2010). For example, in an analysis of several public universities in Ohio, Price (2010) found that by the third year of college, 63% of White students who begin in STEM majors are still

in their chosen field of study compared to only 48% of Black students. A few national studies also report gaps in STEM persistence (Chang et al., 2014; Eagan et al., 2015; Griffith, 2010). For instance, a recent study by Eagan and colleagues (2015) found that 43% of White students who intended to major in STEM ultimately graduated with a STEM degree, compared to only 29% of Latina/o students and 22% of Black students with similar intentions. While such national studies are informative, they do not compare racial/ethnic gaps in persistence to those in non-STEM fields, making it impossible to determine whether this pattern is specific to, or at least more pronounced, in STEM fields. Moreover, despite evidence of markedly higher rates of college dropout for minority students than for White students (Snyder & Dillow, 2012), national studies examining racial/ethnic differences in exits from STEM have not typically considered exits in the form of leaving college altogether (e.g., Ferrare & Lee, 2014).[2]

Thus, stepping back, we argue that extant research on racial/ethnic gaps in STEM fields has not examined how observed disparities fit within larger patterns of inequality pervading the national postsecondary landscape. The theoretical lens of opportunity hoarding provides reasons to expect that racial/ethnic gaps in persistence may in fact be unique to and/or particularly pronounced in STEM compared to other majors, as the high social and economic value associated with STEM degrees makes them a prime location for hoarding on the part of those with privilege, namely, Whites. Conversely, it is possible that relatively higher rates of switching majors for minority versus majority youth, and in particular higher rates of leaving college without a degree, are quite consistent across different postsecondary fields. If so, then evidence of opportunity hoarding by Whites would arguably be found through the relative exclusion of minority youth from college degree attainment more generally, but not particular to certain fields.

To better understand these issues, we turn to a large-scale empirical investigation that examines patterns of departure (both switching and leaving) by race/ethnicity in both STEM and non-STEM fields. To ascertain the degree to which STEM fields may stand out, we account for an array of precollege individual characteristics (e.g., social class background) and institutional characteristics (e.g., selectivity) that are likely associated with race/ethnicity as well as persistence in STEM fields and college in general (Arcidiacono et al., 2016; Griffith, 2010). Importantly, we pay particular attention to the role of academic preparation in high school. As discussed earlier, White students have likely benefited from previous opportunity hoarding in the K–12 system (Kelly & Price, 2011; Lewis & Diamond, 2015), providing them with higher average levels of academic achievement then their minority peers, which in turn enables White students to enter college in a more academically advanced position. Indeed, some prior research points to racial/ethnic differences in academic preparation as a prominent explanation for subsequent disparities in STEM persistence (Chang et al., 2014; Price, 2010; Seymour & Hewitt, 1997). And while prior achievement gaps likely impact attainment across the postsecondary landscape, such gaps may be particularly consequential for persistence in STEM fields, whose norms prescribe that entering students have already mastered an established corpus of knowledge and acquired high levels of prerequisite skills (National Academies of Science, Engineering, and Medicine, 2016).

Thus, our analyses address the following research questions:

1. Are Black and Latina/o youth who begin college in STEM majors more likely to depart than White students, either by switching fields and earning a degree in a different major or by leaving college without a degree?
2. If so, to what extent do racial/ethnic gaps in STEM persistence remain net of other factors, particularly high school academic preparation?
3. Do racial/ethnic gaps in persistence to degree appear to be unique or more pronounced among STEM majors than in other fields (i.e., business, social sciences, or humanities)?

Data and Methods

To answer these questions, we use data from the 2004/09 Beginning Postsecondary Students Longitudinal Study (BPS: 04/09), designed and administered by the National Center of Education Statistics (NCES). BPS is a nationally representative study of postsecondary students who began college in 2003–2004 (for more details, see http://nces.ed.gov/pubs2012/2012246.pdf). Our analytic sample includes Black, Latina/o, and White students who attended a 4-year, not-for-profit, degree-granting institution. As our focus is on racial/ethnic differences in earning baccalaureate degrees, we include students who began college at a 4-year institution, and also those who started in a 2-year institution and later transfer to a 4-year institution. Additionally, as our study examines persistence patterns in STEM and non-STEM fields, our analytic sample includes students whose first declared major was in a STEM field (e.g., biological sciences, computer science, engineering, mathematics, and physical science), as well as those whose first major was in business, the humanities, or social sciences. Analyses include the panel weight (WTB000) created by NCES to account for sampling design, unequal probability of selection into the sample, and probability of attrition from the sample (Wine, Janson, & Wheeless, 2011). Missing data were replaced using multiple imputation with chained equations in Stata, which combines results from multiple datasets according to Ruben's rules (Royston, 2005).

Students' initially declared major was reported during their first year of college. For those who were initially undeclared, we used their response in the first follow-up survey instead (a dummy variable indicating late reported majors is included in multivariate analyses). As seen in Figure 1, our data reveal strong evidence of racial/ethnic similarities in choice of major. Specifically, 19% of White youth declare a STEM major, compared to 20% of Latina/o students and 18% of Black students.[3] A strong similarity also exists in the selection of non-STEM majors, particularly for White and Latina/o students, who declare majors in business, humanities, and social sciences at virtually identical rates. The major choices of Black college matriculates deviate slightly, such that the only statistically significant difference across racial/ethnic groups is found when comparing Black students' rates of

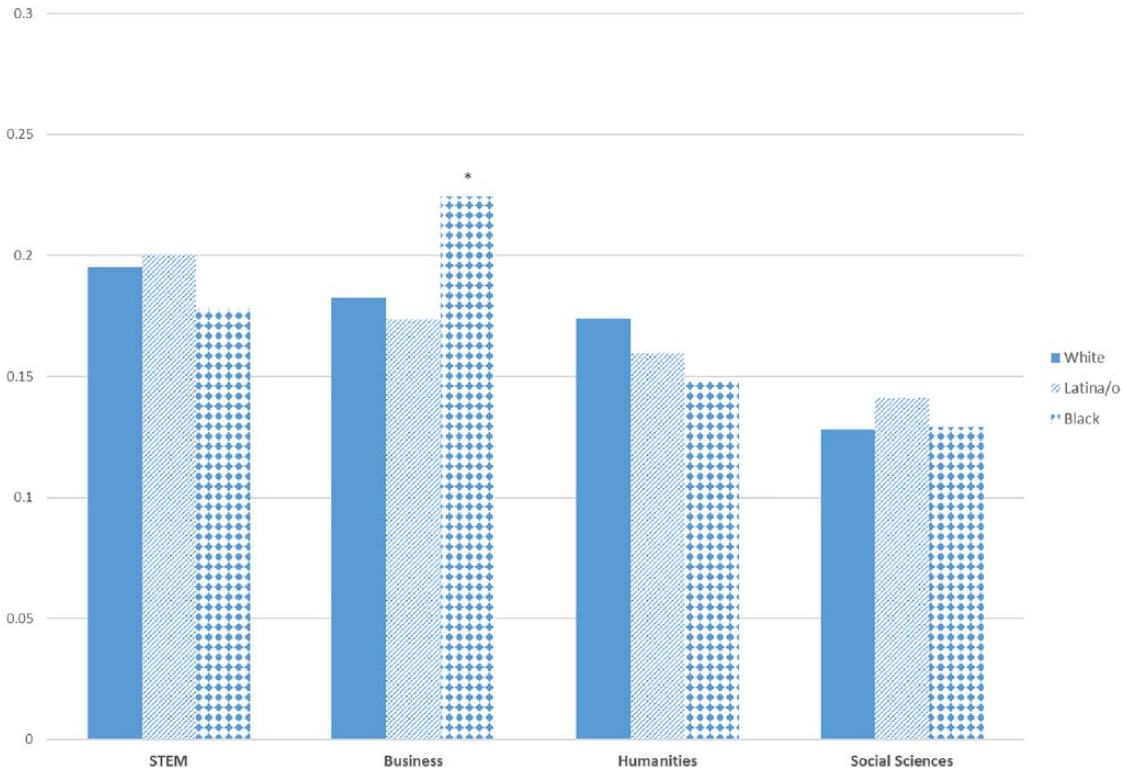

FIGURE 1. *Descriptive statistics: Choice of college major by race/ethnicity.*

Source. Data from Beginning Postsecondary Study 2004/09.

Note. Total $N = 5{,}626$. Weighted percentages of each racial/ethnic group whose first declared major was in each of the above fields. *Indicates that a significantly higher percentage of Black students chose to major in business, compared to both White and Latino students ($p < .05$).

declaring business majors, as they are significantly more likely to do so than either White or Latina/o students. Yet overall, and consistent with prior national research, patterns for choice of major are strikingly similar across racial/ethnic groups.

Dependent Variable

Our focal dependent variable is a categorical measure that distinguishes between the following three outcomes: *persisting* in the initially chosen major field and earning a degree in that field, *switching* to a college major in another field and earning a degree in that new field, and *leaving* college altogether without obtaining a degree.[4] Descriptive patterns for our dependent variable by race/ethnicity are shown in Figure 2. Beginning with those who declare a STEM major, while 58% of White students persist to earn a STEM degree, the percentage of Latina/o students (43%) and Black students (34%) who persist is significantly lower (than the percent who do not persist). Across the other columns, White students' persistence rates in non-STEM fields hover around 50%, revealing a statistically significant persistence advantage compared to both Black and Latina/o students in business, and compared to Black students in social science (although the gaps in both of these fields appear smaller than in STEM fields). Among humanities students, 50% or more of White, Black, and Latina/o students persist to earn a degree in their chosen field, with no significant differences between racial/ethnic groups.

Returning to pathways of STEM majors, we see that both Latina/o and Black students have significantly higher rates of switching (about 37% and 40%, respectively) compared to White students (29%). Latina/o STEM majors (20%) and Black STEM majors (26%) are also significantly more likely to leave school without a degree compared to White STEM majors (13%). Thus, the lower relative persistence-to-degree rates observed among minority STEM majors are the result of a greater likelihood of both switching to another field and leaving college without a degree in any field. By contrast, a review of patterns for other fields reveals that Black and Latina/o youth have comparable switching rates to White youth. The only exception is the humanities, where Black students are significantly *less* likely to switch than White students. For rates of leaving school altogether without a degree, we see a similar pattern for business and social science as we did for STEM, namely that Latina/o and Black youth have significantly higher rates of departure than their White peers. Once again, the Humanities stand in contrast, with comparable percentages of students from all groups leaving school.

In sum, these descriptive statistics provide some initial evidence of racial/ethnic differences in persisting to degree in some non-STEM fields (business and social sciences) as well as in STEM fields. Notably, for students in STEM fields, this is the

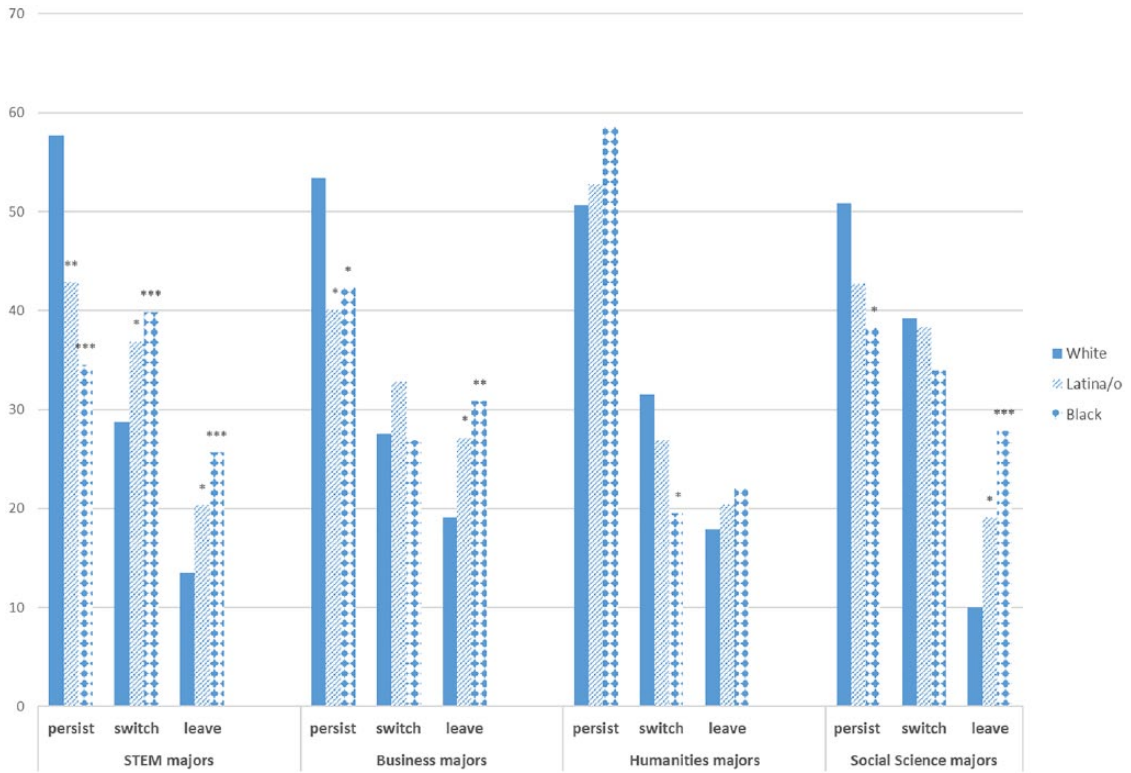

FIGURE 2. *Descriptive statistics: Persistence patterns in chosen field by race/ethnicity.*
Source. Data from Beginning Postsecondary Study 2004/09.
Note. Total $N = 5{,}626$. Figure displays the weighted percentages of each racial/ethnic group who persisted to earn a degree in that major, switched and earned a degree in a different major, and left college without a degree. Percentages for a racial/ethnic group within a given major should sum to 100%. Statistically significant differences are shown comparing each minority group to the reference group of White students. The category of persistence is compared to nonpersistence (a combined category for both switching and leaving), while the categories of switching and leaving are each compared to persistence.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

result of gaps in both rates of leaving school and rates of switching majors; whereas in the non-STEM fields mentioned, differences in persistence to degree are primarily driven by differences in rates of leaving school without a degree.

Independent Variables

Since majority and minority youth are likely to have divergent social and academic backgrounds and also likely to attend different institutions, our multivariate models control on such factors. For social background, we include measures of parental education, family income, place of birth (U.S. vs. not), and gender. We also include students' age and an indicator of working full-time or part-time (vs. not). Additional controls include transfer status and an indicator distinguishing those who declared their major after their freshman year. As research has found that institutional characteristics are related to college persistence overall, as well as persistence in STEM fields (Arcidiacono et al., 2016; Griffith 2010), we include measures for sector and selectivity, and separate indicators for whether the institution is a Historically Black College or University (HBCU) or a Hispanic Serving Institution (HSI). The coding of all variables is explained in detail in the online Appendix (see Tables A.1–A.4, which are available on the journal website, for descriptive statistics by race/ethnicity and field of study).

Finally, as we are particularly interested in the role that prior academic preparation may have in explaining disparities in persistence, our subsequent multivariate analyses also include four separate measures: SAT score, high school GPA, advanced math course-taking (pre-calculus or calculus vs. not), and science course-taking (4 years of science vs. not). Before turning to these multivariate analyses, we also explore racial/ethnic differences in these independent variables. Specifically, to ascertain whether minority STEM majors enter college with very different academic profiles than their majority peers, and how this compares to patterns in other fields, we calculated effect sizes (differences between group means divided by the pooled standard deviation) for each measure of prior academic preparation.

Figure 3 displays the effect sizes for both Black-White and Latina/o-White differences. Across the board, we see that gaps in academic performance between Latina/o students and their White peers are smaller than those observed between Black and White youth. Across majors, Black-White gaps in SAT scores are greater than those for high school GPA or math course-taking. But in general, gaps in academic preparation look quite similar across STEM, business, and social science majors, while being

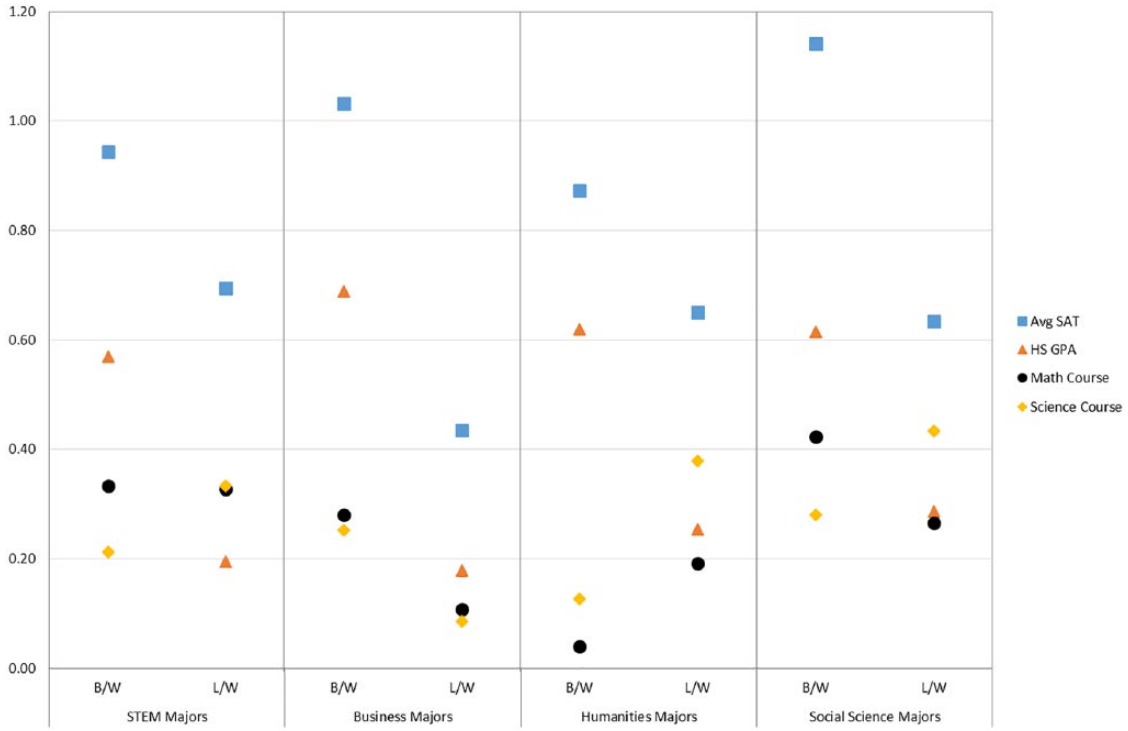

FIGURE 3. *Effect sizes of racial/ethnic differences in high school academic preparation by chosen field.*
Source. Data from Beginning Postsecondary Study 2004/09.
Note. B/W refers to differences between Black and White students, and L/W refers to differences between Latina/o and White students. Effect sizes are calculated as the difference between the two group means on a given measure, divided by the pooled standard deviation. All differences are statistically significant with the exception of B/W differences in math and science course-taking for humanities majors and L/W differences in course-taking and GPA for humanities majors.

somewhat smaller among humanities majors. For Latina/o-White comparisons, gaps in academic preparation appear very similar among STEM, humanities, and social science majors, with the smallest gaps observed among business majors. Thus, there is little evidence to suggest that STEM fields are unique in terms of their population of students from different racial/ethnic backgrounds or the disparate levels of academic preparation of these students. Given the prevalence of reduced opportunities to learn, including opportunities to both encounter and master college preparatory material, among minority youth in K–12 schools across the country compared to the opportunities available to White youth, this is perhaps not surprising.

Analytic Plan for Multivariate Analyses

To further examine racial/ethnic differences in the likelihood of switching, leaving, and persisting from initial major, we turn to multivariate models. Specifically, we estimated logistic regression models predicting the likelihood of *switching versus persisting* (Table 1) and *leaving versus persisting* (Table 2).[5] We perform separate models for students based on their initial major to show potential racial/ethnic differences in persistence patterns across fields. All models account for the clustering of students within institutions, as well as the multistage design of the BPS (Wine et al., 2011; see the online appendix [on the journal website] for more details). The baseline model includes only race/ethnicity; to ensure that observed racial/ethnic patterns are not confounded by social background or the characteristics of the institutions that students attend, in Model 2 we add the control variables mentioned earlier. Finally, in Model 3 we add measures of high school academic preparation to assess whether any racial/ethnic gaps in persistence may be explained by their inclusion. Consequently, any remaining inequality is strongly suggestive of something particular to the field itself rather than other characteristics of individuals or their institutions. All results are presented as average marginal effects, such that the race coefficients represent the percentage point difference in the likelihood of switching versus persisting (Table 1) or the likelihood of leaving versus persisting (Table 2).

Results

Switch Versus Persist

Beginning with STEM majors, in the baseline model we see that compared to their White peers, both Black and Latina/o students have significantly higher probabilities of switching out of a STEM major and completing a degree in a non-STEM field than persisting and earning a STEM degree. Specifically, the probability of a Black student switching majors rather than persisting in the major field is about 19 percentage points higher than the probability of a White student; the corresponding probability for a Latina/o student is about 13 percentage points higher than that of a White student. With the addition of social background and institutional characteristics (Model 2), the

Table 1
Predicting the Likelihood of Switching Fields Versus Persisting to Degree: Marginal Effects

	STEM Majors			Business Majors			Humanities Majors			Social Science Majors		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Black	.194****	.187***	.144**	.048	.037	−.001	−.142**	−.162**	−.180**	.034	.035	.054
	(.052)	(.061)	(.066)	(.052)	(.060)	(.065)	(.064)	(.076)	(.079)	(.070)	(.073)	(.076)
Latina/o	.126**	.098	.080	.106	.032	.024	−.045	−.083	−.102	.037	.071	.079
	(.062)	(.065)	(.067)	(.067)	(.072)	(.076)	(.062)	(.065)	(.067)	(.074)	(.081)	(.078)
Individual characteristics												
Female		.050	.055		.027	.028		.065	.056		−.156****	−.155****
		(.036)	(.037)		(.038)	(.041)		(.042)	(.044)		(.041)	(.041)
Family income		−.001	.001		−.023	−.019		−.008	−.008		−.018	−.017
		(.017)	(.017)		(.019)	(.019)		(.020)	(.021)		(.022)	(.022)
Parental education		−.014*	−.010		−.001	−.001		−.005	−.002		.014	.013
		(.008)	(.001)		(.008)	(.009)		(.009)	(.009)		(.009)	(.009)
Born outside the U.S.		−.015	−.034		−.086	−.083		.103	.097		.064	.076
		(.065)	(.066)		(.080)	(.082)		(.077)	(.076)		(.076)	(.073)
Age		.003	−.008		−.005	−.012*		.010	.008		.004	.007
		(.009)	(.009)		(.006)	(.007)		(.006)	(.007)		(.008)	(.009)
Working full-time		.141*	.113		.030	.013		.124	.122		.125	.119
		(.073)	(.074)		(.070)	(.071)		(.083)	(.085)		(.079)	(.081)
Working part-time		.057	.052		−.009	−.022		.046	.047		.071	.072
		(.034)	(.039)		(.040)	(.042)		(.041)	(.040)		(.041)	(.041)
Upward transfer		.096	.062		.049	.008		.155**	.129*		.097	.102
		(.061)	(.065)		(.052)	(.053)		(.071)	(.077)		(.074)	(.075)
Lateral transfer		.175****	.164***		.158***	.151***		.154***	.146***		.154***	.159***
		(.049)	(.050)		(.048)	(.051)		(.053)	(.053)		(.056)	(.056)
Declared major after first year		−.092*	−.091*		−.086**	−.078*		−.071	−.074		−.107**	−.103**
		(.048)	(.049)		(.042)	(.043)		(.048)	(.048)		(.044)	(.044)
Institutional characteristics												
Public school		.112**	.104**		.060	.053		.122***	.112***		.012	.020
		(.048)	(.048)		(.043)	(.044)		(.037)	(.039)		(.040)	(.040)
Historically Black college or university		−.080	−.120		−.047	−.041		−.027	−.059		−.030	−.008
		(.111)	(.116)		(.101)	(.104)		(.126)	(.124)		(.123)	(.129)
Hispanic-serving institution		−.011	−.019		.135	.108		−.113	−.104		−.155	−.136
		(.092)	(.092)		(.109)	(.106)		(.081)	(.081)		(.135)	(.133)
Very selective institution		−.023	.018		−.014	.022		.033	.063		.058	.047
		(.050)	(.051)		(.047)	(.053)		(.041)	(.042)		(.047)	(.050)
Not selective institution		.035	.021		.052	.020		.088	.074		−.029	−.029
		(.092)	(.089)		(.062)	(.066)		(.057)	(.057)		(.063)	(.063)
High school academic preparation												
SAT score			−.001*			−.001			−.001*			.001
			(.001)			(.001)			(.001)			(.001)
Cumulative GPA			−.034			−.026			.021			.014
			(.025)			(.023)			(.031)			(.032)
Precalculus or calculus			−.018			−.105**			−.053			−.108***
			(.041)			(.042)			(.039)			(.041)
Four years of science			.011			.003			.009			.019
			(.038)			(.041)			(.041)			(.039)
N		1,394			1,196			1,223			1,015	

Source. Data from Beginning Postsecondary Study 2004/09.

Note. Marginal effects are calculated from logistic regression analyses comparing the likelihood of switching majors (and earning a degree in that field) vs. persisting to earn a degree in the originally chosen field. The reference category for both working full-time and part-time is not working; the reference category for both upward and lateral transfer is no transfer; the reference category for very selective and not selective institutions is moderately selective.

*$p < .10$. **$p < .05$. ***$p < .01$. ****$p < .001$.

Table 2
Predicting the Likelihood of Leaving College Versus Persisting to Degree: Marginal Effects

	STEM Majors			Business Majors			Humanities Majors			Social Science Majors		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Black	.205****	.196***	.150**	.150***	.060	.028	.012	−.052	−.093	.217****	.175***	.111
	(.048)	(.064)	(.072)	(.053)	(.065)	(.066)	(.063)	(.071)	(.080)	(.061)	(.067)	(.072)
Latina/o	.125**	.157***	.141**	.134**	.028	.012	.018	−.027	−.054	.135**	.101	.109
	(.062)	(.059)	(.066)	(.066)	(.083)	(.084)	(.065)	(.075)	(.074)	(.060)	(.079)	(.085)
Individual characteristics												
Female		−.054	−.061		−.023	−.017		−.086	−.080*		−.078*	−.076
		(.044)	(.047)		(.040)	(.042)		(.043)	(.047)		(.044)	(.052)
Family income		−.045**	−.048**		−.088***	−.082***		−.051**	−.048**		−.042*	−.036
		(.022)	(.022)		(.022)	(.023)		(.021)	(.021)		(.025)	(.025)
Parental education		−.017**	−.011		−.003	−.002		−.017	−.012		−.016*	−.012
		(.008)	(.009)		(.010)	(.010)		(.011)	(.012)		(.009)	(.010)
Born outside the U.S.		−.107	−.142*		−.092	−.097		−.016	−.031		.017	−.009
		(.069)	(.081)		(.066)	(.068)		(.095)	(.102)		(.071)	(.074)
Age		.019****	.009		.011***	.001		.019****	.010		.001	−.009
		(.004)	(.007)		(.004)	(.005)		(.005)	(.007)		(.007)	(.074)
Working full-time		.207***	.197***		.157**	.143*		.141	.122		.154*	.135
		(.067)	(.075)		(.004)	(.081)		(.080)	(.088)		(.081)	(.089)
Working part-time		.102**	.108**		.091*	.077**		−.002	−.010		.017	.020
		(.042)	(.046)		(.047)	(.047)		(.052)	(.053)		(.052)	(.053)
Upward transfer		.107	.077		.008	−.032		.095	.018		.044	.027
		(.081)	(.086)		(.068)	(.072)		(.067)	(.075)		(.065)	(.071)
Lateral transfer		.095*	.092		.039	.034		.205****	.207****		.207****	.222****
		(.051)	(.060)		(.056)	(.056)		(.057)	(.061)		(.056)	(.058)
Declared major after first year		−.128**	−.157**		−.175***	−.161***		.060	.049		.032	.032
		(.060)	(.062)		(.053)	(.055)		(.054)	(.055)		(.049)	(.055)
Institutional characteristics												
Public school		.025	.009		.069	.069		.134***	.115**		.119**	.102*
		(.044)	(.049)		(.050)	(.052)		(.052)	(.055)		(.056)	(.059)
Historically Black college or university		−.092	−.113		−.014	−.054		.083	.052		.038	.012
		(.091)	(.109)		(.121)	(.125)		(.142)	(.151)		(.174)	(.169)
Hispanic-serving institution		−.110	−.132		.133	.140		−.097	−.065		−.268**	.296**
		(.101)	(.111)		(.089)	(.093)		(.074)	(.081)		(.109)	(.118)
Very selective institution		−.134***	−.091		−.060	−.027		−.165**	−.124*		−.092	−.024
		(.054)	(.060)		(.061)	(.063)		(.070)	(.074)		(.065)	(.069)
Not selective institution		.239****	.236****		.163***	.142**		.055	.029		.234***	.236****
		(.047)	(.052)		(.055)	(.061)		(.072)	(.075)		(.060)	(.062)
High school academic preparation												
SAT score			−.001			−.001			−.001			−.001
			(.001)			(.001)			(.001)			(.001)
Cumulative GPA			−.031			−.066**			−.012			−.040
			(.025)			(.025)			(.030)			(.027)
Precalculus or calculus			−.099*			−.054			−.138***			−.106*
			(.062)			(.050)			(.050)			(.061)
Four years of science			−.076*			.024			−.053			.006
			(.044)			(.052)			(.051)			(.053)
N		1,144			1,075			1,043			744	

Source. Data from Beginning Postsecondary Study 2004/09.

Note. Marginal effects are calculated from logistic regression analyses comparing the likelihood of leaving school without a degree vs. persisting to earn a degree in the originally chosen field. The reference category for both working full-time and part-time is not working; the reference category for both upward and lateral transfer is no transfer; the reference category for very selective and not selective institutions is moderately selective.

*$p < .10$. **$p < .05$. ***$p < .01$. ****$p < .001$.

marginal effect comparing Black students to White students is not reduced and remains significant. However, the average marginal effect for Latina/o students is reduced and no longer statistically significant; additional analyses reveal that it is the inclusion of social background measures that accounts for the difference between models. Finally, once we condition on academic preparation in high school in Model 3, the average marginal effect comparing the probability of switching for Black students compared to White students decreases to about 14 percentage points. Thus, it appears that while academic preparation does contribute to Black students' higher likelihood of switching versus persisting in STEM majors relative to their White peers, it clearly falls short of explaining this disparity.

The remaining columns present parallel results for students who enter non-STEM fields in college. Across baseline models for business and social science majors, there are no statistically significant racial/ethnic differences in the likelihood of switching majors versus persisting to earn a degree in the original field; this remains the case with the addition of other variables in Models 2 and 3. However, among students who initially declared a major in the humanities, Black students are significantly *less* likely than White students to switch fields; this disparity remains robust across subsequent models. Stepping back, the results in Table 1 reveal that higher switching rates for minority students relative to White students is a pattern that is indeed specific to STEM fields; further, a Black-White gap remains even after accounting for differences in high school academic preparation, as well as other individual and institutional characteristics. To better illustrate this disparity, we estimated average adjusted predictions from the final model, which reveal that while the probability of switching for White students in STEM majors is .35, the probability for Black students is .40.

Leave Versus Persist

Table 2 presents results for the likelihood of leaving school without a degree versus persisting and earning a degree in the chosen field (the reference category). Relative to their White peers (and again consistent with Figure 2), results reveal that Black and Latina/o STEM majors are significantly more likely to leave school than persist in their original field. Looking across the baseline models for other fields reveals some significant racial/ethnic gaps in non-STEM fields as well. Specifically, Black and Latina/o students in both business and social science majors are significantly more likely than their White peers to leave school rather than persist to earn a degree in their chosen field.

Returning to results for STEM majors, with the addition of social background and other control variables in Model 2, racial/ethnic gaps remain quite robust. Finally, with the addition of academic preparation in Model 3, the average marginal effect comparing Black and White youth decreases, but remains statistically significant and substantial in size, such that the difference in the probability of leaving school for Black versus White students decreases to about 15 percentage points compared to about 20 percentage points in previous models. Latina/o students also remain significantly more likely to leave school compared to Whites, with an average difference of about 14 percentage points.[6]

For non-STEM fields, a different pattern exists. Specifically, among students in business majors, racial/ethnic gaps in leaving school (vs. persisting to earn a business degree) for both Latina/o and Black students compared to White peers are explained in Model 2; additional analyses confirm that social background characteristics account for the different results across models. This is also the case for the Latina/o-White gap in leaving rates among students in the social sciences. For Black students in this last field, however, it is the inclusion of academic preparation measures in Model 3 that accounts for their higher relative likelihood (compared to White students) of leaving college without a degree. Thus, for non-STEM fields, racial/ethnic differences in the likelihood of leaving school versus persisting in a chosen field are fully explained, whereas substantial and significant persistence gaps that favor Whites only remain in STEM fields. Average adjusted predicted probabilities from the final model for STEM majors indicate that the probability of leaving school remains higher for both Black and Latina/o STEM majors (.33) than for their White peers (.25).

Discussion and Conclusion

Although there is much concern about the underrepresentation of minorities in STEM fields, the extant empirical literature has yet to provide a clear understanding of whether STEM fields nationwide comprise an important and unique location of racial/ethnic inequality or, instead, one of many manifestations of White privilege consistent across postsecondary fields. Using the theoretical framework of opportunity hoarding (Tilly, 1997), our study addresses this issue by examining whether these fields, which are highly valued both socially and economically, stand apart via the disproportionate exclusion of Black and Latina/o youth from degree attainment, net of an array of factors. Consistent with this theory, our results reveal that STEM fields do indeed appear to be unique from other fields.

First, regarding departures via switching majors, we note that STEM is the only field where Black and Latina/o youth are significantly more likely than their White peers to switch and earn a degree in another field. For Latina/o students, this difference is explained by social class background; however, for Black students, this disparity remains pronounced and significant even after accounting for the differences in high school academic preparation. Additionally, while minority youth in other non-STEM fields are more likely than their White peers to leave school rather than persist to earn a degree in their chosen field, our analyses reveal that these disparities are fully explained by social background and other model controls. But this is not the case for STEM fields, where substantial gaps remain. Indeed, we find these gaps the most troubling, as they reveal a comparatively high probability of exit from college specific to minority youth who enter college as STEM majors. In summary, we find evidence of White privilege in STEM degree attainment that is not mirrored in other major fields.

Although our study finds empirical evidence consistent with theories of opportunity hoarding, we cannot unpack the specific

causal mechanisms that underlie the relative hoarding of these socially and economically valuable degrees by White students. Past qualitative research makes a compelling case that STEM degree programs and college classrooms are purposively constructed as exclusionary spaces where students must essentially prove that they deserve to stay (Beasley 2011; Seymour & Hewitt, 1997). While such spaces are challenging to navigate for most students, minority students experience these spaces while subjected to specific stereotypes about their presumed inferior cognitive and mathematical ability. Put briefly, in STEM contexts, the presence of stereotype threat is likely to be very high (Beasley & Fischer, 2012; Woodcock, Hernandez, Estrada, & Schultz, 2012). Indeed, theories of opportunity hoarding point to the role of stereotypes as a key factor through which the in-group creates and maintains privilege, particularly in contemporary times when "egalitarian norms have forced boundary practices underground, to unconscious cognitive processes" (Anderson, 2010). Thus, micro-aggressions and a relative lack of support and inclusion on the part of faculty and fellow classmates (both of whom are predominantly White) likely contribute to minority students' experiences and feelings of exclusion (McGee, 2016; Seymour & Hewitt, 1997) and, as such, are strongly implicated in the hoarding of STEM degrees among White students.

Notably, compared to the results for Latina/o students, results for Black students appear more substantial in magnitude and more robust to the inclusion of covariates. While our study is unable to assess why this might be the case, it is consistent with other research finding larger educational disparities between Black and White students than between Latina/o and White students (Kao & Thompson, 2003). As discussed earlier, we also find that Black-White differences in high school academic preparation are more pronounced than Latina/o-White differences. Regarding remaining disparities in the likelihood of switching majors, research on the history and persistence of racialized bias and deficit thinking directed particularly to Blacks (and less so toward Latinas/os) speaks to the perhaps unique, socially isolated position of being Black in a college STEM classroom (Valencia, 1997). Finally, due to data limitations, our study was not able to unpack differences across fields within the larger category of STEM; the literature on gender inequality in STEM fields has called attention to the value of doing so (Xie et al., 2015), and comparative studies with new data sources focusing on race/ethnicity should surely add to this foundation.

In acknowledging the limitations of our study, we hope that future research will critically investigate the factors that may deter or block the STEM ambitions of minority students to the relative advantage of White students and, in doing so, examine the classroom cultures and related experiences of students in different STEM fields as well as other non-STEM fields. Through a comparative study of such issues, researchers (as well as educators and policymakers) can continue to gain insight into how STEM fields stand apart in their relative exclusion of minority youth and also learn whether and how some fields may construct more inclusive environments. Relatedly, in recent years, there has been a proliferation of very promising efforts to make STEM college classrooms more inclusive and more engaging for all students, for example, by using less direct instruction and incorporating more research opportunities and mentoring; however, we need a better sense of whether and how such efforts are successful in reaching minority youth in STEM fields across the country (Chang et al., 2014; Lane, 2016; National Academies of Sciences, Engineering, and Medicine, 2016).

Finally, some research posits that minority students often place a high value on using their education as a way of giving back and improving the lives of others (Beasley, 2011; Guiffrida, 2003; Seymour & Hewitt, 1997). We do not discount the possibility that as such, minority students may perceive that a sense of social responsibility is incompatible with STEM fields, shaping their decisions to depart. This explanation arguably views minority students as having more agency and actively making a choice to pursue degrees they perceive to align more closely with their priorities. But returning to the framework of opportunity hoarding, we caution that narratives dictating who belongs in STEM, as well as pervading images of STEM fields as inconsistent with the values of social justice or communal goals, are largely created and reinforced by those who have successfully hoarded access to STEM fields in the first place. Much more research is needed to fully understand the complex processes that maintain STEM fields as exclusive and racialized spaces.

NOTES

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[1]We note that earning a STEM degree is a typical prerequisite for entering a STEM occupation; and while not all students who earn STEM degrees enter STEM occupations, nevertheless their subsequent earnings are higher than those with non-STEM degrees (Xie & Killewald, 2012).

[2]For example, Ferrare and Lee's (2014) analyses did not consider students who left school without a degree (or those who transferred from a 2-year school). Chen's (2013) analyses does include "leavers"; however, it also combines all students who ever declared a STEM major into an omnibus category and does not focus on the pathways of students based on their first chosen major. Other research on this topic is further limited in its implications due to combining Black, Latina/o, and students from other backgrounds into an omnibus "underrepresented minority" category (e.g., Arcidiacono et al., 2016; Griffith, 2010), focusing only on Black/White differences (e.g., Price, 2010), or considering race differences unadjusted for measures of social class (e.g., Dickson, 2010).

[3]Weighted *N*s for STEM majors are as follows: $N = 1{,}247$ for White students; $N = 171$ for Black students; $N = 181$ for Latino/a students. See online appendix Tables A.1 through A.4 (available on the journal website) for *N*s by group for each major as well as further descriptive statistics.

[4]Switching is defined as moving across disciplinary groups such that a student who began in business and left to major in psychology is considered as switching, while a student who started in sociology and ended up in psychology is not.

[5]Estimates from multinomial logistic models were comparable to those from logistic models. See the online appendix for more details.

[6]Some reviewers wondered whether accounting for early college performance would explain remaining racial/ethnic differences in

both switching and leaving among STEM majors. Subsequent analyses including Year 1 college GPA and math course-taking revealed that racial/ethnic differences remained. See the online appendix for the results and further discussion.

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