AT THE INTERSECTION OF RELATIVE RISK AVERSION AND EFFECTIVELY MAINTAINED INEQUALITY IN STEM MAJORS: A MULTILEVEL APPROACH

by

Cayce Jamil

A thesis submitted to the faculty of
The University of North Carolina at Charlotte
in partial fulfillment of the requirements
for the degree of Master of Arts in
Sociology

Charlotte

2017

Approved by:

____
Dr. Martha Cecilia Bottia

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Dr. Roslyn Arlin Mickelson

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Dr. Yang Cao

ABSTRACT

CAYCE JAMIL. At the Intersection of Relative Risk Aversion and Effectively Maintained Inequality in STEM Majors: A Multilevel Approach.
(Under the direction of DR. MARTHA CECILIA BOTTIA & DR. ROSLYN ARLIN MICKELSON)

The underrepresentation of racial/ethnic minorities and students from low socioeconomic backgrounds in college majors that promote social mobility is problematic. Relative risk aversion theory predicts that disadvantaged students will choose college majors that promote social mobility since they are more secure educational investments. However, the theory of effectively maintained inequality predicts that privileged students, not disadvantaged students, will obtain more secure degrees. To test these theories, I utilized the NC Roots of STEM dataset to model choice of college major. The NC Roots of STEM dataset is a multivariate, longitudinal dataset that followed NC high school seniors from 2004 through 2010. This thesis utilizes a series of multilevel logit models to examine the relationship between race, SES, educational opportunities and students' interest, odds of declaration and odds of graduation with a STEM degree. The results give evidence for both theories at work within STEM majors. Disadvantaged students, particularly Black students, are more likely to have interest in STEM majors but are the least likely to graduate in these majors, once controlling for declaring a STEM major. While SES did not appear to have much difference on STEM interest and major declaration, low-SES students were significantly less likely to graduate in STEM majors. These findings give support for effectively maintained inequality within higher education.

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Introduction

To realize social equality, there is a need to increase the representation of African Americans, Hispanics, and American Indians (collectively known as underrepresented minorities (URM)), and low socioeconomic status (SES) individual's representation within higher status positions in the occupational sector in society. Social stratification is the process by which individuals are allocated into socially constrained categories based on occupation, income, education, etc… (Tumin 1953). The nature of the stratification process differs from society to society over time and the labels for stratification differ as well. Several scholars have noted that social stratification processes tend to have a stable structure where the system works to limit social mobility and preserve the social hierarchy (Mare 1981; Lucas 2001). If the social structure is organized to preserve the status quo, then disadvantaged groups therefore have unequal access to achieve success. This suggests the presence of a social injustice. Not only does this discredit the "American dream" but it also indicates that there is not equal opportunity for all people.

Income inequality has grown at a considerable rate over the last forty years (Reardon 2011). The gap between the bottom 10% of the income distribution and the top 90% has continued to widen. This gap has been directly linked to differences in educational attainment (Reardon 2011). This is somewhat surprising since there have been major reductions in costs associated with primary and secondary education in recent decades (Breen et al. 2009). Tertiary education has been found to increase chances of obtaining careers that are equally as financially-rewarding between low- and high-SES individuals (Torche 2011). Hence, a Bachelor's degree does seem to fulfill the promise of access to social mobility, regardless of the recipient's economic background (Torche

2011). However, students that could benefit the most from a Bachelor's degree- URM and low-SES students- are the least likely to obtain them (Brand & Xie 2010).

According to Gerber & Cheung (2008, 300), "educational attainment is the single most important factor shaping labor market opportunities in modern societies". However, there remains large disparities in the income and occupational status that individuals attain with the same levels of education (Gerber & Cheung 2008). For example, among Bachelor degree holders, studies that compare earnings by major groups find that engineering graduates receive the highest returns while education-related graduates receive the lowest returns (Gerber & Cheung 2008). Much of the demographical social stratification that is apparent in society, like the race wage gap, has roots that emerge while participating in the educational system (Jacobs 1996). The educational structure is embedded within the overall social structure that seeks to preserve the status quo (Batruch et al. 2017).

College attendance and choice of college major are important arenas in understanding how social stratification is maintained and social mobility is limited. For underrepresented minorities (URMs) and low-SES students, attending college is traditionally viewed as a way to boost social mobility given that the most financially-rewarding jobs in society tend to require at least a Bachelor's degree (Haveman & Smeeding 2006). However, graduation from a 4-year college does not guarantee financial success in later life (Haveman & Smeeding 2006). Students that major in certain fields, like STEM, and students that attend selective colleges have greater odds of having a higher income upon graduation (Ma & Savas 2014). For example, past research has shown that students from low-socioeconomic backgrounds receive a wage premium when they graduate from a selective college (Dale & Kruger 2002).

Past research has claimed that majors linked to high-income occupations boosted social mobility for disadvantaged students since disadvantaged students were more likely to declare majors in financial secure fields like STEM (Ma 2009). However, prior research suggests that disadvantaged students will not persist as well within these majors (Xie et al. 2016). This research will examine this gap in the literature by examining the entire college path for students. This will allow us to determine if high-income college fields act in a way to boost social mobility for disadvantaged students. Specifically, this study will determine if there is evidence that the process of high-income college major completion is socially stratified based on demographic characteristics and, therefore, is limiting the possibility of social mobility for URM and low-SES students.

This thesis contributes to previous research by analyzing students' college choice of major through a multilevel analysis of a sample of college-going North Carolina students. The goal of this investigation is to evaluate student's interest in, declaration of, and completion of a high-income major and to see how it varies by student's demographic characteristics. In this study, I also focus on the importance that unequal educational opportunities in high school and college and how these are associated with a student's choice of major. I will then examine how these, directly and indirectly, influence opportunities that are linked to social mobility. This research adds to the literature on social stratification by examining academic behavior pre-college through college graduation.

Background

I. Theoretical Background- EMI and Relative Risk Aversion

This study will primarily utilize the theory of effectively maintained inequality and the theory of relative risk aversion to understand the college-going behavior of disadvantaged students. Lucas (2001) proposed the concept of effectively maintained inequality (EMI), which describes how the educational system works to maintain the status quo regarding social hierarchies. Students from disadvantaged backgrounds face a barrage of obstacles to achieving academic success that students from privileged backgrounds do not encounter (Batruch et al. 2017). Further, EMI emphasizes that privileged families will "secure for their children some degree of advantages wherever advantages are commonly possible" (Lucas 2001:1651). Consequently, students from privileged families will be more likely to secure the best positions in the educational structure (Wells & Serna 1996). In a stratified educational system, EMI operates to allow high-SES students to have advantages wherever stratification can emerge in the structure (Lucas 2001).

Lucas (2001) has noted that there are two types of stratification within the educational system: vertical stratification and horizontal stratification that help maintain inequality. Vertical stratification refers to educational benchmarks, like years of schooling and degree attainment, which are quantifiable measurements. For example, Low-SES and URM enroll less in four-year colleges and are, therefore, stratified vertically within the education system (Lucas 2001). Horizontal stratification, on the other hand, explains distinctions between curriculum like tracking in secondary schools, college selectivity, and choice of college major (Lucas 2001). These can be understood as qualitative measurements. Lucas and Byrne (2017, 3) summed this distinction up well:

"EMI contends that socioeconomically well-off children will receive qualitative educational advantage even if quantitative outcomes are equalized or quantitative advantage is impossible." Choice of college major are understood as being stratified horizontally because majors differ substantially in terms of curriculums. Furthermore, college majors differ considerably in terms of expected economic returns and social prestige (Carnevale et al. 2015). Both vertical and horizontal stratification work to maintain inequality within society and, therefore, limit social mobility.

This study also uses relative risk aversion (RRA) theory to account for student's interest in college majors. RRA is an economic theory that posits that when an individual faces an uncertain decision, they will weigh the risks and benefits relative to the particular situation they find themselves in and will choose scenarios where there is less risk (Breen & Goldthorpe 1997). When lower-SES children attend college, RRA posits that they will be more likely to choose less financially risky majors, like STEM majors, while high-SES students will be more likely to choose riskier majors, like History or Art. The risk of a major relates to likely employment in a lucrative job upon completion of the major. Low-SES and URM students face greater barriers, like access to social capital and financial capital, to employment in lucrative jobs that pushes these students to select majors that are not as risky of an investment (Ma 2009).

Furthermore, college is a riskier endeavor for certain populations of students and RRA predicts these students will seek to minimize risk (Breen & Goldthorpe 1997). College is much more of a financially risky endeavor for low-SES students compared to high-SES students, who have more of a financial safety net. According to RRA, Low-SES students should concentrate in high-income majors like STEM (Ma 2009). Hence, RRA focuses on the motivations of the student while EMI focuses on the effects of the educational structure that students are embedded in.

Relative risk aversion theory in education argues that parents will push their children, from a social mobility perspective, to do as well as they did themselves, or better (Ma 2009). Parents seek to avoid downward mobility in their children and try to push their children up the social mobility "ladder" (Breen & Goldthorpe 1997). RRA emphasizes the influence of social network factors, like from their parents, that push their children to try to "move up the ladder", in terms of social mobility.

RRA emphasizes how environmental factors push students to try to "move up the ladder", in terms of social mobility. EMI, though, highlights how social structures work to "maintain" social stratification. By connecting the two theories, the students that should be the most interested in high-income majors (URM and low-SES students) (according to RRA) should be those that are the least likely to achieve success due to the educational structure that works to preserve the status quo (according to EMI). By intertwining these two theories, this study aims to test if social mobility has more to do with social structure than with the background of the student. This analysis will shed light on the importance of social structure in promoting or impeding social mobility.

II. Stratification in the Educational Opportunities

The odds of receiving a high school degree and/or Bachelor's degree have risen for students of different backgrounds in recent years (Katrnak et al. 2016; Lucas 2001). If one focuses on the vertical dimensions of the educational system, the fact that low-SES and URM students are more likely to achieve a postsecondary degree, compared to the past, would suggest that stratification is diminishing and social mobility should be increasing. However, if one analyses the horizontal dimensions of the educational system, from an EMI perspective, we would argue that the decrease in vertical stratification has led to a substantial increase in horizontal stratification (Lucas 2001; Katrnak et al. 2016). For example, in recent decades, there has been considerable growth in the diversification of educational trajectories among students entering the educational system (Katrnak et al. 2016). Schools offer enormous variation in terms of quality of the infrastructure, staff, teachers, curriculum, peers, etc… (Lucas 2001). The school and curriculum within the school can offer considerable variation in terms of the quality of education offered to their students.

Concerning horizontal distinctions, stratification occurs in numerous way, like via school characteristics, including school curriculums. Schools that have a higher percentage of low-SES and URM students in the US perform significantly worse on standardized tests than children who go to more integrated schools (Mickelson et al. 2013). Integrated schools perform better because they tend to have better peer influences, better teachers, and better school infrastructure (Nikischer 2013). Furthermore, within districts, teachers are more likely to leave disadvantaged schools for more advantaged schools (Goldhaber et al. 2010; Scafidi et al. 2007). Hence, disadvantaged students, like low-SES and URM students, are more likely to attend poorer quality schools, which even further disadvantages them.

Previous research highlights that low-SES and URM students are cumulatively disadvantaged. For example, in North Carolina, Clotfelter et al. (2007) found that 7th grade Black students were much more likely to have a novice teacher in math compared to 7th grade White students. Also, Goldhaber et al. (2015) examined teacher quality in schools in Washington during the 2011-2012 school year and found that in elementary, middle, and high schools, quality teachers were inequitably distributed among students that were low-SES, URM, and among students that struggled academically. Furthermore, almost every measure they used for teacher quality, including licensure exam scores, experience, and value-added estimates, were all inequitably distributing across schools. This inequitable distribution was found across classrooms, schools, and districts (Goldhaber et al. 2015).

Tracking refers to ability grouping that often takes place within particular subjects in secondary school and offers different curriculum to the different tracks of students. The curriculums can vary widely in terms of quality. Tracking is one of the most common sources of social stratification within the educational system (Mickelson & Everett 2008) because students grouped in lower tracks tend to have lower quality teachers as well as poorer curriculums (Oakes 1987). Not surprisingly, low-SES and URM students also tend to be enrolled in lower-tracked curriculums, which offer less academically rigorous courses (Lucas 2001; Oakes 1987).

In theory, tracking is based on meritocracy in that students are allocated opportunities to learn based on the individual student's ability and prior academic achievement. However, in reality, non-meritocratic factors play an integral role in influencing what track students are placed in (Mickelson & Everett 2008). For example, "recommendations of educational gatekeepers" (Mickelson & Everett 2008, 545), like teachers and guidance counselors play a direct role in deciding track placement. There are a wide range of factors, including descriptive factors of the student like their race, SES, and gender, that play a part in determining placement within tracks which stresses the non-meritocratic forces that shape student's educational paths (Mickelson & Everett 2008).

III. College Major Selection and Social Mobility

While both, college selection and major selection, are important in providing opportunities for social mobility, there is evidence that suggests that selection of college major is more important than college selection (Ma & Savas 2014). From a social mobility perspective, college major selection is arguably even more important than attaining a Bachelor's degree. In 2013, the median income for a high school graduate aged 25-59 was $36,000 compared to a median income for a Bachelor's degree holder in teaching and serving fields was $46,000 and a median income of $76,000 for STEM fields (Carnevale et al. 2015). In fact, lifetime wages vary on average more by college major than by academic achievement. For example, there is a $3.4 million life-time wage difference between the median between the lowest-paying major (early childhood education) and the median of the highest-paying major (petroleum engineers), while there is an around $1 million difference between the median of high school graduates and the median between college graduates (Carnevale et al. 2015).

Low-SES students that do not obtain a college degree are at a severe disadvantage in the labor market compared to high-SES students without a college degree. High-SES individuals without a college degree have much greater resources, including access to social and financial capital, at their disposal and a more powerful social network (Torche 2011; Brand & Xie 2010). Due to these differences, low-SES students are at a greater disadvantage in the labor market if they do not have a college degree (Torche 2011;

Brand & Xie 2010). Therefore, consistent with RRA, we would conclude that disadvantaged students will prefer paths in college that will minimize labor market risks from their Bachelor's degree (Breen & Goldthorpe 1997).

Similarly, authors have found differences of perception of obtaining a college major by students' SES (Lichtenberger & George-Jackson 2013). Low-SES students tend to view college as a way to improve their career prospects. High-SES students, on the other hand, tend to view college as a way of cultural enrichment (Lichtenberger & George-Jackson 2013). High-SES students focus on the experiences that college offers and are more attracted to college majors that they find are interesting and enriching (Ma 2009).

Understanding stratification within college majors is a complex task because there is a wide array of factors that lead students to selecting a major (Arcidiacono 2004; Arcidiacono et al. 2012; Zafar 2013; Wiswall & Zafar 2015). Research shows that students are not just attracted to majors based on the expected economic returns. They pick majors based on interest, workplace preferences, educational preferences, academic preparation, as well as personal influences (Arcidiacono 2004; Arcidiacono et al. 2012; Zafar 2013; Wiswall & Zafar 2015). Monetary premiums by college major and student ability cannot solely explain the sorting of students by college major (Arcidiacono 2004; Arcidiacono et al. 2012). In fact, Arcidiacono (2004) found that within college factors, like grades, played the largest role in student selection of college major. Similarly, other research finds that interest, not ability or economic incentives, plays the strongest role in major selection (Zafar 2013; Wiswall & Zafar 2015).

There are various factors that are pushing and pulling students into different college major pathways. In order to analyze why disadvantaged students are underrepresented in the highest-income majors, a particular field is needed for examination. There are unique factors that attract and discourage students within each major field like the academic standards, the demographic composition of the field, how the field cultivates interest, and other within college factors (Arcidiacono 2004; Arcidiacono et al. 2012; Zafar 2013; Wiswall & Zafar 2015; Xie et al. 2015). To understand social mobility within college majors, the focus needs to look at how low-SES and URM students operate within a certain high-income field rather than high income majors as a whole due to the within college differences by college field.

IV. Demographic Characteristics, Stratification in Educational Opportunities and Opportunities of Social Mobility

Low-SES students have been found to be less likely to obtain a college degree than mid- and high-SES students (Reardon 2011). Numerous factors explain why low-SES students are less likely to achieve post-secondary success. For one, investments in children’s cognitive development have increased substantially in recent decades (Reardon 2011). High-SES families invest considerably more time and resources in child development activities compared to low-SES families (Reardon 2011). Additionally, higher-SES families have greater access to a wider variety of resources, like their social network and financial capital, which further privileges already advantaged students. Differences in these resources have led to school segregation where disadvantaged students are going to poorer quality schools and receiving poorer education (Reardon 2011; Alon 2009).

As access to postsecondary education has expanded dramatically in recent decades, the demographics of students attending has also increased. There are considerably more female, minority students, and low-SES students within postsecondary education today compared to prior decades (Gerber & Cheung 2008). Again, this is a marker for vertical stratification. When examining horizontal stratification within postsecondary education, URM, low-SES, and female students disproportionately graduate in fields that are "less financially secure" in the eyes of RRA (Gerber & Cheung 2008). For example, it's commonly noted that URM, low-SES, and female students are all underrepresented in STEM fields (Holdren et al. 2013).

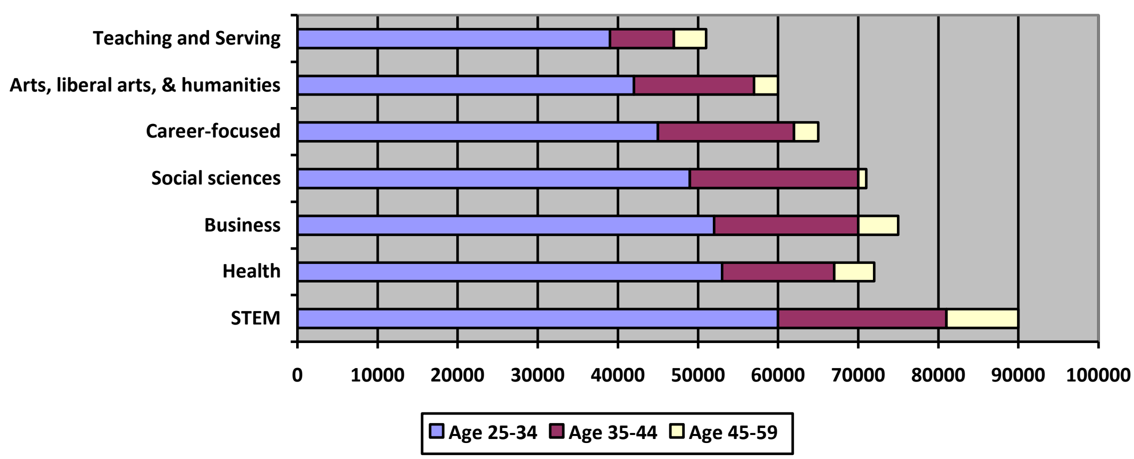
To secure the benefits from postsecondary education, students need to know how to properly navigate within the educational system. Bourdieu (1984) suggests that this ability stems from the cultural and social capital background of the student. Students from privileged backgrounds have greater resources available to them as well as superior information regarding the educational system. The "know-how" surrounding college education allows higher-SES students to have access to more lucrative and financially secure rewards upon completion of a college degree (Bourdieu 1984).

Interestingly, Hansen (2001) found that class background had substantial effects on income when students majored in "soft" fields like Sociology. Among students that majored in hard scientific and technical fields though, class background exerted a minimal effect on income after graduation. In "soft" fields, cultural and social capital may play a stronger role in acquiring higher returns, while in "hard" fields, evaluations based on merit take greater precedent (Hansen 2001; Gerber & Cheung 2008).

Similarly, minority students perform worse compared to Whites in college, even when controlling for academic background and entry qualifications (Connor et al. 2004). URM students often report a lower sense of belonging at their universities. Furthermore, they often experience "chilly" climates within their universities due to them being a smaller proportion of students (Brown et al. 2016). These hostile college environments can make minority students feel unwelcome and might work to "push" them out of these fields (Brown et al. 2016).

V. The Case of Low-SES and URM students choosing (or not) STEM Majors

V.1. Why Focus on STEM Degrees?



*Source: Georgetown University Center on Education and the Workforce analysis of U.S. Census Bureau, American Community Survey micro data, 2009-2013.

Figure 1: Median Annual Wages for College-Educated Workers by Major Group

In this study, I focus on the selection of STEM degrees as a choice of major because STEM majors have the highest economic returns in the labor market (Carnevale et al. 2015). Figure 1 presents the median annual wages and wage growth in the labor market for college-educated workers by major group and age group. The college major group with the highest median income is STEM degree holders. STEM BA holders receive the highest starting median wage and experience the greatest wage growth over the course of their career. Of the seven major groups, STEM majors undeniably provide the highest economic returns. The median income for STEM degree holders who are 25-34 years old is $9,000 higher than the median for teaching and serving degree holders who are 45-59 years old.

According to the NCES, in 2012-2013, 16.4% of all Bachelor's degrees in the US were awarded in STEM. Among White recipients of all Bachelor's degrees, 15.9% were in STEM, while among Asians, it was 29.1%. For Blacks, Hispanics, and American Indians, 11.3%, 13.6%, and 13.9% of Bachelor's degrees within their race were awarded were in STEM, respectively. Hence, among these higher-income degrees, Black, Hispanic, and American Indians remain underrepresented.

Paradoxically, even though Blacks report the smallest proportion of degrees in STEM among any racial group, Blacks report the highest levels of interest in STEM during high school (Lichtenberger & George-Jackson 2013). The disparity among Blacks between interest in STEM and degrees obtained in STEM could be an indication of presence of stratification of opportunities to learn within the educational system. The students that have the most interest in STEM should be expected to be the students that obtain the most STEM degrees. This paradox is an area that this analysis hopes to shed light on.

V.2. Important Factors that are Related to STEM Participation

The STEM literature cites math achievement in high school as a critical factor for majoring and persisting in STEM (Engberg & Wolniak 2013; Griffith 2010;

Kokkelenberg & Sinha 2010; Rohr 2012; LeBeau et al. 2012; Maltese & Tai 2011; Crisp et al. 2009; Wolniak 2015). Math achievement is usually measured as SAT or ACT math scores or by the highest math course taken during high school. The vast majority of studies find that having higher SAT & ACT math scores increases the odds of STEM persistence in college and this relationship holds true for all races, SES groups, and genders (Crisp et al. 209; Griffith 2010; LeBeau et al. 2012; Kokkelenberg & Sinha 2010; Rohr 2012).

Interest in STEM also has a significant positive relationship with STEM entrance and persistence (Ing & Nylund-Gibson 2013; Maltese & Tai 2011; Xie et al. 2015). STEM interest is important because most students who major in STEM make that decision while still in high school (Maltese & Tai 2011). Research finds that the earlier students cultivate an interest in STEM, the higher the likelihood that they will have interest in STEM majors (Sadler et al. 2012; Richardson et al. 2009; Maltese & Tai 2011). STEM interest is typically found to be related to exposure to math and science course and math and science achievement (Astin & Astin 1993; Ma 2011; Bottia et al. 2015; Lichtenberger & George-Jackson 2013; Tyson et al. 2007; Kokkelenberg & Sinha 2010). Consequently, the more children exposed to science and math, the higher the likelihood that they will have an interest in STEM majors, which translates into a higher likelihood of entering and persisting in STEM majors (Young et al. 2017).

While high school factors related to STEM success have not been studied thoroughly, there is evidence that shows that the high school's composition, in terms of race, has a significant relationship to declaring a STEM major and graduating in STEM (Bottia et al. forthcoming). Therefore, the high school context is a crucial area to examine when looking at majoring in STEM because students tend to make the decision to enter into STEM while still in high school (Maltese & Tai 2011). A meta-analysis by Mickelson et al. (2013) revealed that attending high schools with a high composition of minority students decreases math achievement, which is an important factor for accumulating STEM interest and STEM achievement (Crisp et al. 209; Griffith 2010; LeBeau et al. 2012; Kokkelenberg & Sinha 2010; Rohr 2012).

V.3 Stratification in Educational Opportunities to go into STEM

Students who attend schools with a higher SES and lower URM composition tend to offer more rigorous classes, have better quality teachers, have nicer infrastructure, higher ability peers, and offer more enriching opportunities to engage in activities that will amplify student's interests (Nikischer 2013; Mickelson et al. 2013; Bottia et al. 2017.). The few studies that have directly looked at the racial composition of high schools and STEM success have found mixed results (Bottia et al. Forthcoming; LeBeau et al. 2012; You 2013; Edmunds et al. 2015; Riegle-Crumb & Grodsky 2010). For example, LeBeau et al. (2012) did not find that high school racial composition had a significant effect on STEM participation but Bottia. et al. (Forthcoming) found that students from segregated White schools were significantly less likely to major and graduate in STEM, regardless of the race of the student. It is also worth noting, though, that the racial composition of the undergraduate student body of a university that a student attends does not appear to have a significant effect on obtaining a STEM degree (Chang et al. 2014; Sharkness et al. 2011; Griffith 2010).

Another major barrier to attaining a STEM degree encountered by students occurs during the first year when students enroll in gatekeeper courses. Gatekeeper courses control passage into an educational curriculum. Research has shown that passing gatekeeper courses is positively related to persistence in STEM (Crisp et al. 2009; Toven-Lindsey et al. 2015). Directly related, numerous studies have also found that first semester GPA is positively related to persistence in STEM (Crisp et al. 2009; Dika & D'Amico 2016). Therefore, students who initially struggle in STEM majors are more likely to switch out of these majors or drop out altogether.

V.4 SES and Selection of STEM as a Major

Several researchers have found differences in STEM participation and achievement between low-SES students and high-SES students (Miller & Kimmel 2012; Chen 2009). A common explanation of these differences is that high-SES children have greater exposure, support, and access to STEM experiences that cultivate interest and achievement in STEM fields (Archer et al. 2012; DeWitt & Archer 2015; Wang 2013; Gottfried & Williams 2013). Several studies also highlight that among students who major in STEM, high-SES are more likely to achieve a STEM degree (Chen 2009, Chen & Soldner 2014). Furthermore, low-SES students that major in STEM are disproportionally more likely to leave college all together but have the same likelihood of switching to non-STEM fields (Chen & Soldner 2014). However, several authors find that once prior academic achievement is controlled for, these disparities between SES groups largely disappears (Chen & Soldner 2014; Ma 2009; Mau 2003). It should come as no surprise then that low-SES students are largely disadvantaged in succeeding in STEM fields because they are more likely to lack the academic achievement needed in the K-12 years to be successful in STEM majors (Wolniak & Engberg 2010; Ma 2009).

Additionally, several researchers have found that low-SES students are more interested in STEM majors and are initially more likely to major in STEM compared to high-SES students (Lichtenberger & George-Jackson 2013; Ma 2009; Leppel et al. 2001). The research seems to suggest that low-SES students have more interest in STEM but may not actually commit to these majors (Bottia et al. 2017). Higher-SES students tend to be interested in majors that are financially risky like liberal arts (Simpson 2001). However, these results are contradicted by other research that has found that higher-SES students are more likely to major in STEM majors (Lee 2015; Tyler 2010; Miller & Pearson Jr. 2012; Simpson 2001).

A large barrier for low-SES STEM students is the financial capital needed to attend college (Miller & Pearson Jr. 2012). A recent study found that STEM students are more concerned about debt aversion and financial concerns compared to other students (Kruse et al. 2015). Furthermore, Fenske, Porter, & Dubrock (2000) revealed that having financial needs was a significant predictor of not persisting within STEM majors.

V.5 Race and Selection of STEM as a Major

Scholars have found that URM students have lower math achievement compared to White and Asian students (You 2013; Tyson et al. 2007; Riegle-Crumb & King 2010). These math achievement gaps play a large role in determining who participates and succeeds within STEM majors (Riegle-Crumb & King 2010; Museus et al. 2011). Lower math achievement is directly linked to lower levels of interest in math-intensive majors and careers like STEM (Miller & Kimmel 2012; Wang 2013). Typically, when prior math achievement is controlled, the effect of being URM disappears with respect to STEM success (Tyson et al 2007; You 2013; Lee 2015). Math achievement in high school therefore plays a strong role for URMs in influencing success within STEM majors.

URM students express interest in STEM at similar or higher levels as Whites (Lichtenberger & George-Jackson 2013). When controlling for prior math achievement, URM tend to be much more likely to major in STEM compared to Whites (Riegle-Crumb & King 2010; Riegle-Crumb et al. 2011). In college, URM students initially have more interest in STEM majors compared to Whites and are often more likely to enroll in these majors (Ma 2009). However, URM are still significantly less likely to persist in these majors compared to Whites (Hughes et al. 2013; Chang et al. 2014; Whalen & Shelley 2010). Some research even finds that when African-Americans major in STEM, doing so significantly decreases the likelihood that they will even graduate from a four-year university all together (Gelbgiser & Alo 2016; Chen & Soldner 2014). This discrepancy between races and persistence is likely due to two factors: lower levels of math academic preparation in high school and factors related to the college environment (Xie et al. 2015; Bottia et al. 2017).

A few studies have found that URM students are less likely to persist compared to Whites and Asians when their prior academic preparation is controlled (Figueroa et al. 2015; Xie et al. 2015). These studies find that the academic climate within postsecondary institutions can act as a barrier for success in STEM for URM students. For example, African American students often report feelings of isolation in post-secondary education (Grossman & Porche 2014; Mickelson et al. 2016). African American students also report micro-aggressions and micro-insults from their classmates which make them feel inadequate within STEM majors (Grossman & Porche 2014).

Furthermore, African-American students who report a higher sense of belonging at their university were found to be more likely to persist in STEM (Figueroa et al 2015). A larger proportion of URM attain STEM degrees within minority-serving institutions like historically Black colleges and universities (HBCUs) since these institutions tend to offer a more supportive environment for URM students (Xie et al. 2015). Other research, though, finds that Black students are less likely to choose STEM as the number of Black students in STEM at an institution increases (Griffith 2008). Thus, Black students seem to major less in STEM in supportive environments but persist better in supportive environments like HBCUs.

V.6 Previous Research on Low-SES, URM and Selection on STEM Majors

Previous research shows that race and SES interact to produce differentiated participation rates in STEM majors. For example, Trusty (2002) reported that as SES increased, URM students had considerable increases in STEM major selection, but this SES trend was not true for Whites and Asians. On the other hand, other researchers have found that higher SES URM were less likely to choose a technical major like STEM compared to low SES URM (Ma 2009), particularly for low-SES African Americans (Griffith 2008). Hence, there is some discrepancy in how race and SES interact in regard to STEM participation.

Prior research also emphasizes that low-SES, URM students are not as likely to complete STEM majors (Wolniak 2015; Hughes et al. 2013; Chang et al. 2014; Whalen & Shelley 2010). The most common factor cited for these students for leaving these majors is their lower levels of academic preparation (Chen & Soldner 2014). Even though low-SES students appear to be more attracted to the high-income field of STEM, they are not as successful within these majors (Lucas 2001; Wolniak et al. 2008).

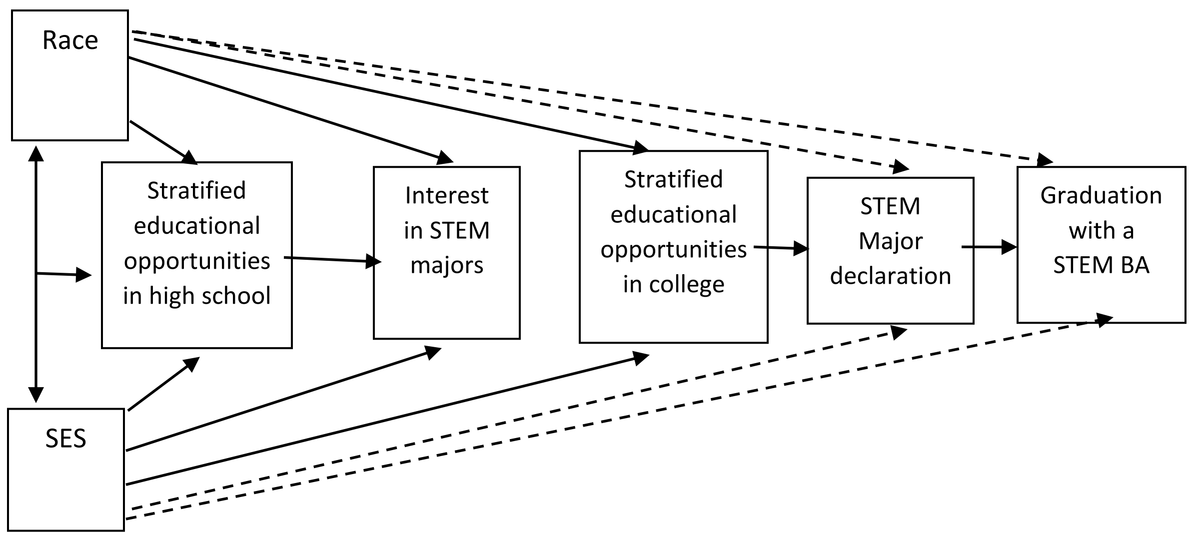


Figure 2: Integrating EMI, RRA and Interest, Selection, and Graduation in STEM

Figure 2 is a heuristic model of how the theoretical background summarized in previous research can be integrated to better explain the case of students' interest, declaration and graduation in a STEM major. The model clearly explains how the two theories could interact to help explain STEM-related outcomes. High-SES and White students, according to EMI, will receive better educational opportunities (in terms of the K-12 schools they attend, their teachers, as well as their peers at the school). Race and SES directly tie into horizontal stratification within high school. These stratification effects increase the odds that a student has been exposed to more enriching educational opportunities and that they are more likely to succeed in a postsecondary institution. Nonetheless, according to RRA, low-SES and URM students will be more attracted to high-income majors because they are more secure about making an educational investment. Also, students who attend schools with more disadvantaged peers will be more attracted to high-income majors due to a peer influences on perceptions of education.

However, according to EMI, postsecondary institutions also preserve the status quo (Lucas 2001). Race and SES determine the quality of educational opportunities in high school, which therefore influence students interest in STEM. According to RRA though, low-SES and URM students, even though the receive poorer quality of educational opportunities, will still be more likely to have interest in STEM. In college, race and SES also impact the quality of postsecondary educational opportunities. These stratified educational opportunities directly impact a student's odds of declaring a STEM major and their odds of graduating with a STEM degree.

The dotted lines from race and SES to "STEM major declaration" and "graduation with a STEM BA" represent other direct effects on these variables other than just stratified educational opportunities, which are not tested in my analysis. URM and low-SES students are known to face other barriers like a lack of financial capital, social capital, as well as discrimination that directly lower their odds of success in STEM (Xie et al 2015; Grossman & Porche 2014). The lines connecting SES and race represent the unique effects of the interactions between SES and race on STEM success.

Hypotheses

Previous studies show that low-SES and/or URM students are more attracted to higher-income majors compared to White and/or high-SES students, but they tend to have less success in them (Xie et al. 2015). This could be an indication of the presence of stratification processes that are present when analyzing choice of college major. While RRA theory suggests that low-SES and URM students will use college major selection as a way to increase their upward mobility (Breen & Goldthorpe 1997), EMI suggests low-SES and URM students will be less successful in these majors because privileged students will maintain a certain degree of advantage wherever stratification presents itself within the educational structure (Lucas 2001).

This research examines if low-SES and/or underrepresented minority (URM) students have differences in interest and participation by college major compared to high-SES and/or White students. Particularly, I examine the relationship between being low-SES and/or URM students and students' interest, participation, and completion of a degree in high-income fields (by analyzing educational benchmarks regarding STEM majors).

RRA suggests that low-SES students see college as more of an economic opportunity and would be more attracted to majors like STEM, while higher-SES students will see it is as more of a cultural experience and are interested in financially-riskier majors (Ma 2009). Related to this, if students are from a community that views college as a risker endeavor, they will also push students to choose less-risky majors. If a student views college as a risky endeavor, or other individuals in their social network view it as risky, they will be more likely to choose a financially-secure major. Based on the theory of relative risk aversion, I hypothesize:

H1: L*ow-SES students are more likely to* ***have interest*** *in high-income majors compared to high-SES students.*

H1.1***:*** *Due to differences in the educational environments low-SES students are embedded in, low-SES students will be more likely to* ***have interest*** *in high-income majors when compared to high-SES students.*

Similarly, based on RRA, URM students should be more likely to be interested in high-income fields because they face greater economic risks within society compared to Whites. These distinctions between races may push URM students towards fields that are less risky in terms of economic success. Similar to low-SES students, URM students that go to more disadvantaged schools will also be more likely to have interest in financially-secure majors compared to White students.

H2*: Underrepresented minority students are more likely to* ***have interest*** *in high-income majors compared to White students.*

H2.1***:*** *Due to differences in the educational environments URM students are embedded in, URM students will be more likely to* ***have interest*** *in high-income majors when compared to White students.*

Previous research has found that low-SES students appear to have more interest in high-income majors (Ma 2009; Leppel et al. 2002) but have paradoxically been found to enter into these majors less (Bottia et al. 2017). EMI theory would suggest that this could be a consequence of the lack of academic preparation, etc. due to exposure lower quality of educational opportunities. Relatedly, EMI suggests that disadvantaged students will experience academic barriers that work to maintain the status quo via horizontal stratification. It should be through educational opportunities that makes low-SES students less likely to declare a STEM major. Therefore, congruent with the theory of effectively maintained equality, I hypothesize that:

H3: *Low-SES students are less likely to* ***declare*** *a high-income major when compared to high-SES students.*

H3.1*: The relationship between a student's SES and* ***declaration*** *of a high-income major is mediated by differences in secondary and tertiary opportunities to learn.*

Through the lens of EMI, we would also expect Whites to maintain their stratified position compared to Blacks in the educational system. In effect, this would mean that Whites would encounter particular influences and "know-how" at the post-secondary level that push them into high-income fields like STEM. URM students, on the other hand, will lack these influences and "know-how" to turn their interests into actual declaration of a high-income major. Also, URM students will have different educational opportunities that push them out of these majors. Hence, also congruent with EMI, I hypothesize that URM students will be less likely to participate in STEM majors.

H4: *Underrepresented minority students are less likely to* ***declare*** *a high-income major when compared to White students.*

H4.1*: The relationship between a student's race and* ***declaration*** *of a high-income major is mediated by differences in secondary and tertiary opportunities to learn.*

Lastly, when looking at only the students that actually majored in STEM majors, lower SES students have been found to drop out at higher rates compared to higher SES students (Miller & Pearson Jr. 2012). EMI hypothesizes that the educational system works to maintain stratification. Low-SES students that are committed to STEM majors will still be less likely to complete these degrees (Lucas 2001). This is often because these students lack the prior academic achievement (Ma 2009), lack the cultural capital (Miller & Pearson Jr. 2012), and have more concerns surrounding finances and debt aversion (Kruse et al 2015; Fenske et al. 2000). However, EMI would also suggest that this occurs through differences in educational opportunities for low-SES students. Therefore, in line with EMI, I hypothesize that lower SES students in high paying majors are less likely to graduate compared to higher SES students.

H5: *Low-SES are less likely to* ***obtain*** *a high-income degree when compared to high-SES students.*

H5.1*:* *The relationship between a student's SES and* ***obtaining*** *a high-income degree is moderated by differences in secondary and tertiary opportunities to learn.*

Along these same lines, EMI would expect URM to have less success within high-income fields. EMI emphasizes how the system works to maintain intergenerational structural positions (Lucas 2001). URM students face a barrage of barriers within postsecondary education (Grossman & Porche 2014; Figueroa et al. 2015; Xie et al. 2015). URM students often face "chilly" climates within universities and often lack the social network of their White peers. Similar to low-SES students, URM students are also disadvantaged through their educational opportunities. Therefore, according to EMI, we would hypothesize that URM would be less likely to achieve high-income degrees compared to Whites.

H6: *Underrepresented minority students are less likely to* ***obtain*** *a high-income degree when compared to White students.*

H6.1*:* *The relationship between a student's race and* ***obtaining*** *a high-income degree is moderated by differences in secondary and tertiary opportunities to learn.*

RRA would suggest that students that are both low-SES and URM will be doubly disadvantaged and, therefore, would be more likely to seek financially secure majors. They have to overcome the risk of being low-SES and being an URM. Therefore, I hypothesize that low-SES URM students will be even more likely to have interest in high-income majors.

H7: *Students that are both low-SES and an underrepresented minority are more likely to have* ***interest*** *in a high-income degree when to compared to White, low-SES students.*

EMI predicts that financially rewarding majors will be filled by privileged students. High-SES and White students will initially be horizontally stratified into curriculums that prepare them more for high-income majors. Therefore, I hypothesize that low-SES and URM students will be less likely to major and graduate in high-income majors compared to high-SES students, even though I also hypothesize that low-SES and URM students will have more interest in these majors.

Understanding the stratification process in college majors is important because it shows how society could be failing to promote social mobility. If these hypotheses are true, then this analysis will show that underrepresented students have more interest in

STEM fields but encounter barriers within the STEM pipeline that make them less likely to commit and persist within these majors. This analysis can be understood as part of a larger investigation of how stratification in society is maintained. Individuals interested in social positions that would help them to "move up" in society are pushed away from those interests through various means. The disadvantaged individuals who do follow through with their interests then face other barriers when trying to pursue these social positions.

The purpose of this thesis is to investigate if there is, indeed, stratification based on race and SES within high income major groups at the postsecondary level by examining STEM majors. This paper will examine if there is evidence of horizontal segregation among college majors and in educational opportunities in general. In order to do so, I will examine disparities in interest in college major groups, particularly STEM, by SES and race. I will then analyze if there are differences in commitment to college major groups by SES and race. Finally, I will research how graduation rates vary by SES and race in STEM majors.

Data

This study utilizes data from the North Carolina (NC) Roots of STEM dataset. This dataset follows seniors in NC high schools in 2004 through 2010 and tracks them through public NC universities. The NC Roots of STEM dataset provides information on 19,000 college-bound students from 510 middle schools, 350 high schools and 16 University of North Carolina campuses. This dataset includes student, school, and achievement indicators that stretch from seventh grade to college graduation. The universities within North Carolina are very diverse in that there are elite universities, historically Black college and universities (HBCUs), as well as a university primarily for Native American students.

While this dataset reflects measures and indicators from the public NC high school students that graduated in 2004, the fact that it tracked students from middle school through college is very beneficial to examine college major behavior. The longitudinal nature of the dataset allows for a comprehensive examination of patterns that emerge in college major selection within higher education.

Variables

Table 1: Descriptive Statistics of Variables

Variables	Obs	Mean	Std.	Min	Max
Dependent Variables:					
STEM interest on SAT	14,536	0.182	0.386	0	1
Business interest on SAT	14,536	0.112	0.315	0	1
Health interest on SAT	14,536	0.291	0.454	0	1
Other interest on SAT	14,536	0.416	0.493	0	1
If they declared a STEM major	15,981	0.262	0.440	0	1
If they declared any other major	15,981	0.738	0.474	0	1
If they graduated in STEM	15,981	0.262	0.44	0	1
If they graduated in any field other than STEM	15,981	0.591	0.447	0	1
If they declared a major but did not graduate	15,981	0.147	0.440	0	1
Student Characteristics:					
White	21,160	0.659	0.474	0	1
Black	21,160	0.261	0.439	0	1
Asian	21,160	0.047	0.212	0	1
Other race	21,160	0.032	0.176	0	1
Low SES (based on parent edu. and if they received FRL)	15,628	0.151	0.358	0	1
Middle SES	15,628	0.313	0.464	0	1
High SES	15,628	0.536	0.499	0	1
Male	21,160	0.436	0.496	0	1
If they are a citizen	17,680	0.035	0.184	0	1
Measures of Academic Achievement:					
SAT Math score	20,419	542.975	95.653	200	800
SAT Reading score	20,419	529.278	93.579	200	800
STEM GPA Freshmen year in college	19,497	2.344	1.102	0	4.333
School Characteristics:					
If they attended a rural high school	19,589	0.341	0.474	0	1
If they attended a suburban high school	19,589	0.300	0.458	0	1
If they attended an urban high school	19,589	0.358	0.480	0	1
Measures of Educational Opportunities:					
If they took a STEM honors course in high school	17,680	0.331	0.471	0	1
Percent of the high school that is White	19,136	0.622	0.222	0.000	0.987
Percent of quality teachers at the high school	19,609	0.877	0.076	0.083	1
Percent of high school that took the SAT their Senior year	19,187	0.637	0.147	0.003	1
University Attended:					
NC A&T	21,160	0.071	0.257	0	1
ASU	21,160	0.078	0.269	0	1
UNCA	21,160	0.024	0.153	0	1
ECU	21,160	0.119	0.324	0	1
ECSU	21,160	0.019	0.136	0	1
FSU	21,160	0.026	0.159	0	1
NCCU	21,160	0.033	0.179	0	1
UNCP	21,160	0.030	0.169	0	1
NCSU	21,160	0.145	0.352	0	1
UNC	21,160	0.115	0.319	0	1
UNCC	21,160	0.096	0.294	0	1
UNCG	21,160	0.086	0.280	0	1
WCU	21,160	0.063	0.244	0	1
UNCW	21,160	0.063	0.243	0	1
WSSU	21,160	0.032	0.175	0	1

Table 1 presents the descriptive statistics for the variables used in this thesis. The variables are categorized into six different categories. The first category is the dependent variables. The rest are categories of independent variables. The second is student characteristics, followed by measures of academic achievement, then school characteristics, then measures of high school educational opportunities, and finally university attended, which is the measure for college educational opportunities.

Of the sample of 21,160 NC high school students, 66% of the students are White, while 26% are Black, 5% are Asian, and 3% are considered "other race". Due to the relatively low number of Asian, Hispanic, and Native American students in NC in 2004, the analysis primarily focuses on Africans Americans and Whites. There is also a relatively low number of non-citizen students with only 619 students in my sample. Among the SES variables, which was measured as a composite of if either of their parents has a Bachelor's degree and if they received free or reduced lunch, 15% of students fall into the low-SES category, 32% are mid-SES, and 54% are high-SES. Lastly, close to 44% of my sample are male and the other 56% are female.

Dependent Variables

Due to the need to examine a particular field, I chose to use "STEM majors" as a proxy for "high-income" majors. There are a considerable number of majors outside of STEM that are high-income. However, for the purposes of this analysis, it would be difficult to measure all high-income majors because, as mentioned, there are a wide variety of factors that push and pull students into and out of different majors. A field, where there are similar characteristics across majors, is needed for proper examination. Furthermore, some popular STEM majors, like Biology, do not necessarily translate into high-income careers, on average. Nonetheless, using the highest-income college major group as a proxy for high-income majors still gives considerable insight into EMI regarding high-income majors in general.

To determine which majors were considered high-income, I utilized research from the “Center on Education and the Workforce” (Carnevale et al. 2015). These researchers categorized college majors up into seven groups. Table 2 presents the seven major groups as well as the median yearly wage for workers aged 25-59 in 2013. This table also includes high school graduates as a category for comparison. Looking at Table 2, the three major categories that are above the median income are STEM, Health, and Business majors. STEM majors make 17% more than the closest major category and experience the greatest wage growth. Furthermore, STEM majors also have the highest median wages immediately following college (Carnevale et al. 2015**)** which emphasizes that students that are looking for lucrative career paths will likely have interest in STEM majors. Business and Health majors are tied for second in terms of expected income and experience an 8% boost in their median wages compared to social science majors (Carnevale et al. 2015).

The dependent variables are all binary in order to examine trends in the high-income field of STEM compared to all other majors. The dependent variable in the first model is interest in choice of major and was ascertained when students listed the major they were most interested in on their SAT survey. Because this measure is only available for those students that took the SAT in high school, the analytic sample I use is restricted to individuals who completed the SAT survey.

Table 2: College Major Groups by Median Yearly Wage

College Major	Median Yearly Wage of Workers with Degree Aged 25-59 in 2013
STEM	$76,000
Business	$65,000
Health	$65,000
(All majors)	$61,000
Social sciences	$60,000
Career-focused	$54,000
Arts, liberal arts, & humanities	$51,000
Teaching and serving	$46,000
High school graduate	$36,000

* Source: Georgetown University Center on Education and the Workforce analysis of U.S. Census Bureau, American Community Survey micro data, 2009-2013.

The second dependent variable is declaration of a STEM major which is measured via actual choice of major. This was indicated by whether a student ever declared a STEM major during the subsequent 5 years in college and was collected via administrative data. The third dependent variable is STEM degree completion. This was indicated by whether by the end of the 6^{th} year of college the student has received a Bachelor's degree in a STEM field and was also collected through administrative data.

Independent Variables

The STEM literature suggests a wide range of variables to control for in order to capture an accurate picture of STEM major behavior. For example, first year GPA is an important factor in pushing students out of STEM majors (Dika & D'Amico 2016). Due to this, it is important to control for an array of background and achievement variables that are related to STEM.

To test my hypotheses, I included the following measures: Race is a key independent variable in this analysis and was collected through administrative data. The options were Black, White, Asian, Hispanic, American Indian, and Other. Due to the low sample size of American Indian, Hispanic, and "Other" race students, I merged them all into an "other race" category. I also include SES as a key independent variable SES, in this analysis, is a composite variable that is measured by two dummy variables: if students received free or reduced lunch in 8^{th} grade and if at least one of their parents has a Bachelor's degree or above. Hence, there are four SES categories in my analysis. "0", the comparison category, is if they received free or reduced lunch and neither parent had a college degree. "1" is if they did not receive free or reduced lunch and neither parent had a college degree. SES was also marked "1" if they received free or reduced lunch and at least one parent had a college degree due to the low number of students that fell into this category. SES was marked "2" if they did not receive free or reduced lunch and at least one parent had a college degree. While there were four categories for SES, as mentioned, I merged the two middle categories into a "mid-SES" category.

The other key independent variables relate to educational opportunities. To account for differences in tracking, I include whether a student was enrolled in an advanced track curriculum. This is measured by if they took any honors or above STEM courses while in high school. This was measured as a binary variable which is (0) if they did not complete a STEM honors course in high school and (1) if they did complete at least one STEM honors course in high school. This allowed me to determine if advanced course-taking in high school has a significant relationship on STEM interest, major declaration, and completion. Among my sample of college bound students, about a third of the analytic sample completed a STEM honors course in high school.

Other educational variables included in these analyses examine the characteristics of the high school that the student attended. For example, due to the documented effects of high school composition on STEM declaration and graduation (Bottia et al Forthcoming), I include the racial composition of the school that the student attended. This was collected via administrative data. I also control for the percentage of the student body that took the SAT in their senior year. This is a measure of the college-going behavior of the peers at the high school that the student attended. Both of these variables test for peer effects on students. Furthermore, I include the percentage of teachers at a high school that were marked as "quality". "Quality" teachers were measured through teacher credentials and was gathered via administrative data. Teachers that were marked as "quality" hold at least a bachelor's degree and are fully licensed by the state. This variable examines the quality of the high school that a student attended.

To further measure educational opportunities at the college level, I include fixed effects for each of North Carolina's public universities. Fixed effects for each university allow me to capture institutional effects at the postsecondary level. (The list of universities can be seen in Table 1). I compare all the universities to North Carolina A&T University (NC A&T), which is a historically Black university that is known for its science program. I chose NC A&T as the comparison category due to the high amounts of URM and low-SES students that are enrolled in STEM majors at this university. The university provides an ample sample of URM and low-SES students to compare against.

As alluded to earlier, to capture how students succeed in STEM majors, there are a wide array of controls that are needed. Gender has repeatedly been found to be significant factor related to STEM participation (Tyson et al. 2007; Riegle-Crumb 2016; Wolniak 2015) and is therefore important to include in the model. A variable related to immigration is important because researchers have found that immigrant students are significantly more likely to major in STEM (Ma 2009; Wolniak 2015). Therefore, I included a binary variable that recorded if a student was a citizen (1) or not (0) and was taken from administrative data. Prior math achievement, measured by a student's SAT math score and verbal achievement was measured by their SAT verbal score are included in all models. These are all important variables because each of them has repeatedly been shown to contribute to the decision to choose a STEM major (Tyson et al. 2007; Ma 2009; Riegle-Crumb 2010; Wolniak 2015; Lichtenberger & George-Jackson 2013; Kokkelenberg & Sinha 2010; Ma 2011).

Many university level factors influence major choice and success. Past research has suggested the importance of first year GPA in STEM courses as a barrier to STEM success (Rask 2010; Dika & D'Amico 2016). To capture this, I include the student's college GPA in STEM courses during this first year of college. This measure acts as proxy to account for the academic achievement of students that initially receive when entering a STEM field. I added together the number of credits earned in STEM courses, like Calculus and Chemistry, that the students took in their first year and compared the average to the grades that the students received in STEM courses.

Also, the urbanicity of the high school attended has been found to be an important control. This variable also captures the locale of where the student lives, which can have a considerable impact on college behavior. The urbanicity of the high school will be included which is a measured as “0”, the reference category, for urban, “1” for suburban, and “2” for rural. These variables will allow me to determine the effects of their high school location on STEM success. I will also include interactions between race and SES in order to test my hypotheses and determine if they cause students to be doubly disadvantaged in their pursuit of obtaining a STEM degree.

Analytic Methods

This study utilizes a series of multilevel logit models to examine the relationship between race, SES, educational opportunities and students' interest, odds of declaration and odds of graduation in STEM. I utilize a multilevel methodology because students who attended different schools cannot be understood as independent observations. Students are nested within schools and, therefore, should be measured in this way to correctly estimate models (Raudenbush & Bryk 2002). Hence, in all models, I will nest the students within the high school they attended and therefore acknowledge for the lack of independence in these units.

The analysis is divided in two parts. In the first part I examine student interest in STEM while students were still in high school, therefore I utilize a sample of NC public high school students who took the SAT and graduated in 2004. The analytic sample for this initial analysis is 10,277 students to test hypothesis 1,2, and 7. The second part of my analysis examines NC high school students who matriculated into a 4-year public NC university and declared a major. In order to account for students that quickly dropped out or transferred, I eliminated students who never declared a college major in NC university system from these analyses. Due to this, the analytic sample for the last two analyses includes 7,240 students. The second analysis will examine the third and fourth hypotheses while the third analysis will examine the fifth and sixth hypotheses. The results in all my analyses are in odds-ratio format for ease of comparison. I also centered the continuous high-school level variables in all my analyses to facilitate interpretations.

In the first set of regression in Table 1 (model 1), I use the dependent variable "STEM interest on SAT". I initially regress "student characteristics" and high school “measures of academic achievement” (from Table 1) on the dependent variable. Next, I add school controls by adding “school characteristics”, which are the high school locale variables (model 2). To test EMI, I then include high school “measures of educational opportunities” (model 3). To check if there are unique effects by race and SES, I add interactions to the model after educational opportunities (model 4). Lastly, to see if low-SES and URM students respond differently to high school educational opportunities, which RRA suggests, I perform interactions between high school educational opportunities and SES and between high school educational opportunities and race (model 5). Due to possible collinearity problems, I chose to run each of these interactions in separate models.

In the second set of regressions in Table 4 (model 6), I utilized the dependent variable “declaring a STEM major”. I initially follow the same steps as the last analysis. I start by regressing “student characteristic” and student’s high school “measures of academic achievement” on the dependent variable (model 7). I then added school controls by adding the high school locale variables (model 8). Next, I include the high school educational opportunities to test EMI in relation to declaring a STEM major (model 9). Then, I include college-level “measures of academic achievement” by capturing how the students performed within STEM classes during their first year of college as a control. I also test EMI again by included college “educational opportunities” by adding fixed effects for the individual campuses compared to NC A&T (model 10). Lastly, I perform interactions between race and SES to test for unique interactions among them (model 11).

In the last set of regressions, I use the dependent variable “obtaining a STEM degree”. I follow the same steps as the second analysis. I start by adding “student characteristics” (model 12). I then add the high school locale variables followed by the high school “educational opportunities” (model 13). Next, I examine the college level by adding the college “measure of academic achievement”. I also add the dependent variable in the second model, “declaring a STEM major”, as an independent variable (model 14). This model examines who is more likely to switch out of a STEM major or drop out altogether after declaring. To test EMI, I then add college educational opportunities in the next model (model 15). Lastly, I add interactions between race and SES to test for unique interactions (model 16).

Results

The first model indicates that Black students, compared to Whites, appeared to be significantly more likely to have interest in STEM (1.722***). When educational opportunities and other controls are added to the model, the significant positive effect of being Black remained (1.795***). In all the models, Blacks were more likely to have interest in STEM. Neither of the other two race variables, Asian and “other race”, were significant in any model. Similarly, SES did not appear to exert any influence on the likelihood of having interest in a STEM major in any of the models in this analysis. When interactions between race and SES were added to the analysis, the interactions did not appear to be significant.

When the two school location variables, rural (1.292***) and suburban (1.215*), were added in model 2, both are significant and positive compared to urban students in interest in STEM. Across the rest of the models, this effect appears to be stable since the coefficients and the significant levels do not change much across models. Students attending a rural high school, therefore, are the most likely to have interest in STEM when compared to students who attended an urban high school. Students that attend urban high schools appear to be the least likely to have interest in STEM majors.

None of the variables included to capture educational opportunities did not appear to exert any significant influence on students’ interest when they were added to model 3. Once educational opportunities were interacted with SES and race in model 5 and 6, they did appear to be significant. When the regression includes interactions between SES and

Table 3: Multilevel Binary Logit Regressions on Interest in STEM in High School

Variables	Model 1: Student		Model 2: School		Model 3: Edu. Opp.		Model 4: Interactions		Model 5: Edu. Opp. Interactions and SES		Model 6: Edu. Opp. Interactions and Race	
Race (compared to White)												
Black	1.722	***	1.795	***	1.710	***	2.645	***	2.600	***	2.281	***
Asian	1.096		1.108		1.103		2.032		1.974		1.649	
"Other"	1.053		1.079		1.046		2.074		2.082		2.044	
SES (compared to low)												
Middle	0.919		0.928		0.961		1.069		1.132		1.041	
High	0.858		0.883		0.913		1.002		1.075		0.955	
Male	7.130	***	7.210	***	7.205	***	8.943	***	8.929	***	8.927	***
Math SAT	1.007	***	1.007	***	1.007	***	1.007	***	1.007	***	1.007	***
Reading SAT	0.997	***	0.997	***	0.997	***	0.997	***	0.997	***	0.997	***
Citizen Status	1.611		1.617		1.617		1.628		1.595		1.631	
Rural High School			1.292	***	1.363	***	1.370	***	1.374	***	1.356	***
Suburban High School			1.215	*	1.271	**	1.271	**	1.275	**	1.261	*
If they took STEM Honors					0.967		0.964		0.967		0.967	
Percent of High School that took SAT					1.000		1.000		0.993		1.005	
Percent of High School Teachers Qualified					0.823		0.803		8.220	*	0.467	
Percent of Student Body that's White					0.731		0.738		0.558		1.066	
SES X Race												
Middle X Black							0.906		0.952		0.954	
Middle X Asian							0.668		0.688		0.722	
Middle X "Other"							0.823		0.834		0.811	
High X Black							1.006		1.016		1.118	
High X Asian							0.682		0.702		0.924	
High X "Other"							0.530		0.509		0.514	
SES X Educational Opportunities												
Mid SES X % White of Student Body									1.006			
High SES X % White of Student Body									1.010			
Mid SES X % of Quality Teachers									0.022	**		
High SES X % of Quality Teachers									0.104	*		
Mid SES X % of Student Body that took SAT									1.625			
High SES X % of Student Body that took SAT									1.264			
Race X Educational Opportunities												
Black X % White of Student Body											0.989	*
Asian X % White of Student Body											0.973	**
"Other" X % White of Student Body											1.002	
Black X % Quality Teachers											4.254	
Asian X % of Quality Teachers											1.705	
"Other" X % of Quality Teachers											2.959	
Black X % of Student Body that took SAT											0.466	*
Asian X % of Student Body that took SAT											1.179	
"Other" X % of Student Body that took SAT											0.458	
Constant	0.006	***	0.005	***	0.004	***	0.003	***	0.003	***	0.003	***

N= 10,277 Asterisks represent significance at *** .1%,** 1% and * 5%. Results are presented in odds-ratio.

educational opportunities in model 5, the percent of the high school teachers that are quality appears to have a strong significant effect on interest in STEM (8.22*). Students who attend schools with more quality teachers are considerably more likely to have interest in STEM and importantly this effect is strongest for low-SES students (.022** for mid-SES and .104* for high-SES students). STEM interest of low-SES students appears to be the most positively influenced by the amount of quality teachers at their school.

Model 6 presents a regression that includes interactions between race and educational opportunities. In this case, Black students that attend high schools with more students who are White and Blacks (.989*) students who attend a school with a higher number of students that took the SAT are significantly less likely to have interest in STEM than White students who attend schools with a higher percentage of White students (.466*). There appears to be a peer-effect for STEM interest among Blacks. Asians also appear to be less likely to have interest in STEM as the amount of Whites in the student body increases (.973**). It appears that the less White students at a high school that Black and Asian students attend, the more likely these students will have interest in STEM majors.

Males, compared to females, were significantly more likely to have interest in STEM across all models (7.1***, 7.2***, 7.2***, 8.9****, 8.9***, 8.9***). This effect appears to be very strong and consistent. Math achievement, measured by SAT math scores, was, unsurprisingly, positive and significant across all models (1.007***). SAT verbal math scores though appeared to have a significant and negative effect across all models. The higher their score in the verbal section of the SAT, the less likely students were to have interest in STEM (.997***). If a student took an honors course in STEM though was not significant in any model. If the student was a citizen or not was also not significant in any model.

Table 4: Multilevel Binary Logit Multilevel Regressions on Declaring a STEM Major

Variables	Model 7: Student		Model 8: School		Model 9: Edu. Opp.		Model 10: College Edu. Opp.		Model 11: Interactions	
Race (compared to White)										
Black	1.249	**	1.285	**	1.172		0.991		0.860	
Asian	1.184		1.196		1.110		1.104		1.028	
"Other"	1.777	***	1.820	***	1.797	***	1.809	***	2.571	*
SES (compared to low)										
Middle	0.966		0.972		1.014		1.021		0.950	
High	0.947		0.963		1.008		1.008		0.944	
Male	1.666	***	1.665	***	1.655	***	1.702	***	1.662	***
Math SAT	1.003	***	1.003	***	1.003	***	1.003	***	1.003	***
Reading SAT	1.001	*	1.001	*	1.001	*	1.001	**	1.001	**
Citizen Status	0.775		0.778		0.791		0.801		0.793	
Interest in STEM	4.235	***	4.221	***	4.194	***	3.229	***	3.231	***
Interest in Business	0.549	***	0.553	***	0.544	***	0.481	***	0.480	***
Interest in Health	2.272	***	2.262	***	2.212	***	2.298	***	2.295	***
Rural High School			1.155	*	1.165		1.074		1.077	
Suburban High School			1.141		1.171		1.101		1.106	
If they took STEM Honors					1.116		1.119		1.121	
Percent of High School that took SAT					0.995	*	0.994	*	0.994	*
Percent of High School Teachers Qualified					2.071		2.776	*	2.733	*
Percent of Student Body that's White					0.537	***	0.668	*	0.658	*
Freshman STEM GPA							1.035		1.033	
University Attended:										
ASU							0.212	***	0.213	***
UNCA							1.000		1.002	
ECU							0.514	***	0.515	***
ECSU							0.867		0.872	
FSU							0.594	*	0.601	*
NCCU							0.705		0.707	
UNCP							0.683		0.687	
NCSU							1.372	*	1.380	*
UNC							0.346	***	0.347	***
UNCC							0.571	***	0.572	***
UNCG							0.416	***	0.414	***
WCU							0.413	***	0.418	***
UNCW							0.368	***	0.371	***
WSSU							0.584	*	0.579	*
SES X Race										
Middle X Black									1.269	
Middle X Asian									0.808	
Middle X "Other"									0.489	
High X Black									1.070	
High X Asian									1.114	
High X "Other"									0.743	
Constant	0.015	***	0.013	***	0.011	***	0.021	***	0.022	***

N= 7240 Asterisks represent significance at *** .1%,** 1% and * 5%. Results are presented in odds-ratio.

In the second analysis, which is presented in Table, shows the results for regressions on declaring a STEM major. In model 7 and 8, controlling for student and school location variables, show that Black students appear to be significantly more likely to major in STEM compared to White students by 1.25 odds (**). When school locale is added in model 8, Blacks are significantly more likely to major in STEM by 1.28 odds (**). When educational opportunities are accounted for in model 9 though, Black students no longer appear to be significantly more likely compared to Whites to declare a major in STEM. In the rest of the models, which include educational opportunities, Blacks remained not significantly different than Whites in majoring in STEM. Hence, the positive effect of being Black on majoring in STEM appears to work indirectly through their high school educational opportunities. The percent of the high school that took the SAT (.995*) and the percent of the student body at their high school that is White (.537***) appears to take away the positive effect of being Black on declaring a STEM major. Across all models, "other" race students were significantly more likely to major in STEM compared to Whites.

Results for declaring a STEM major are similar to the results for interest in STEM, presented in Table 3. Across all models, coming from a low-SES background is not significantly different from mid- or high-SES students with respect to declaring a STEM major. SES does not appear to impact interest or the likelihood of declaring a STEM major. SES remains not significant when SES is interreacted with race in model 11.

Of the high school educational opportunity variables, several appear to have a significant impact on majoring in STEM. When educational opportunity variables are initially added in model 9, the percent of the high school that is White and the percent of the high school that took the SAT their senior year were the only significant variables, and both had negative effects. However, the percent White of the high school had a much stronger negative effect on majoring in STEM than the percent that took the SAT in their senior year. As mentioned earlier, there appears to be a peer effect within high schools. Students who come from high schools with less White students are more likely to major in STEM. However, this could also be due to other factors. For example, schools where they have a higher percentage of White students tend to offer less rigorous curriculums that are less culturally-enriching, and therefore, narrow major interests to more traditional school subjects, like chemistry, instead of majors like art history or comparative literature (Bottia et al. Forthcoming).

When student's college achievement and educational opportunities are added in model 10, the percentage of the high school that is White (.668*) and the percent of the high school that took the SAT in their senior year (.994*) remain significant and negative while percent of quality teachers at the student's high school becomes significant and positive (2.776*). These effects of educational opportunities on declaring a STEM major remain through the rest of the models. This implies that once college educational opportunities are accounted for, having gone to a school with more quality teachers increases the odds that a student will declare a STEM major. Furthermore, when college educational opportunities are included, the percent of student body that is White decreases the odds while the percent of quality teachers appears to increase the odds of declaring a STEM major.

Consistent with the first analysis related to STEM interest, male students appear to be significantly more likely to major in STEM across all models. Men appear to have roughly 1.65 (***) the odds that they will declare a STEM major compared to female students across all models. Measures for achievement (both verbal (1.001*) and math SAT scores (1.003***)) were positively and significantly related to major in STEM. If a student completed a STEM honors course in high school, they were not significantly more like to major in STEM in all models. Unsurprisingly, having interest in STEM in high school was strongly and positively associated with the dependent variable when initially added in model 7 (4.235***).

The odds appear to slightly decrease when college educational opportunities are added in model 10 (3.229***). Having marked business interest was negatively related to the dependent variable across all models (.549***). Interest in health majors, which is related to STEM, was positively and significantly related to majoring in STEM in all models (2.272***). Among the colleges, compared to NC A&T, only attending NC State increases the odds that students will major in STEM (1.372*). The rest of the universities were not statistically significantly related or were significantly and negatively related to the dependent variable.

In model 11, none of the interactions were significant. I also ran interactions between educational opportunities and SES and between educational opportunities and race on declaring a STEM major. However, neither of these models showed any significant interaction variables. Due to this, these models are not shown.

The last analysis, presented in Table 5, shows the results of regressions on obtaining a STEM degree. In the first model, only “other” race students were the only race significantly different from White students in graduating in STEM (1.612***). This effect remains through the first two models (1.65***) but disappears once declaring a STEM major is added in model 14. Looking at the overall population of college students and controlling for high school and college achievement factors, “other” race students have 1.65 (***) the odds, compared to White students, to graduate with a STEM degree. Black and Asian students are not significantly different from Whites when analyzing the overall population of college students. However, once declaring a STEM major is controlled for in model 14, Black students have significantly less odds at .65 (**) to graduate in STEM compared to Whites.

In model 15, where college educational opportunities are added, Black students are no longer significantly different than Whites in graduating in STEM. This could be interpreted as that the negative effect of declaring a STEM major for Blacks on graduating in STEM indirectly works through their college educational opportunities. Just like in the other analyses, Asians do not appear to be significantly different in graduating in STEM compared to Whites.

Compared to low-SES students, both middle and upper SES students were not significantly different in the likelihood to graduate in STEM when controlling for pre-college and freshmen STEM GPA. Similar to Black students, once declaring a STEM major is added to the analysis in model 14, the effect of being mid- and high- SES appears to be significantly and positively related to graduating in STEM compared to low-SES students. Middle-SES students have 1.47(*) the odds while high-SES students have 1.65 the odds (**) to obtain a STEM degree. When college educational opportunities are added in model 15, being mid-SES is no longer significant but being

Table 5: Multilevel Binary Logit Regressions on Obtaining a STEM Degree

Variables	Model 12: Student		Model 13: School		Model 14: Declare		Model 15: College Edu. Opp.		Model 16: Interactions	
Race (compared to White)										
Black	1.043		0.984		0.650	**	0.765		0.596	
Asian	1.039		0.994		0.725		0.772		0.811	
"Other"	1.612	***	1.666	***	0.970		0.979		1.280	
SES (compared to low)										
Middle	1.104		1.170		1.470	*	1.379		0.931	
High	1.135		1.217		1.646	**	1.573	**	1.180	
Male	1.386	***	1.358	***	0.798		0.806		0.918	
Math SAT	1.004	***	1.004	***	1.001		1.000		1.000	
Reading SAT	1.001	*	1.001	*	1.000		1.000		1.000	
Citizen Status	1.016		1.037		2.027		2.027		1.976	
Interest in STEM	3.311	***	3.311	***	0.833		0.779		0.770	
Interest in Business	0.461	***	0.448	***	0.460	**	0.434	***	0.439	***
Interest in Health	2.049	***	2.013	***	0.881		0.872		0.857	
Rural High School			1.094		0.909		0.907		0.900	
Suburban High School			1.199		1.094		1.067		1.076	
If they took STEM Honors			1.070		0.893		0.890		0.877	
Percent of High School that took SAT			0.995		0.999		0.999		0.999	
Percent of High School Teachers Qualified			2.864	*	2.542		2.797		2.745	
Percent of Student Body that's White			0.515	***	0.695		0.691		0.702	
Freshman STEM GPA					1.702	***	1.749	***	1.741	***
Declared a STEM Major					600.454	***	604.120	***	600.582	***
University Attended:										
ASU							0.543		0.513	
UNCA							0.962		0.951	
ECU							1.510		1.453	
ECSU							0.681		0.686	
FSU							0.403	*	0.364	*
NCCU							0.737		0.689	
UNCP							1.039		0.962	
NCSU							1.617		1.545	
UNC							1.187		1.160	
UNCC							1.181		1.105	
UNCG							1.206		1.129	
WCU							1.695		1.630	
UNCW							1.538		1.500	
WSSU							1.069		1.083	
SES X Race										
Middle X Black									2.139	
Middle X Asian									1.249	
Middle X "Other"									0.741	
High X Black									1.722	
High X Asian									0.527	
High X "Other"									0.802	

N= 7240 Asterisks represent significance at *** .1%, ** 1% and * 5%. Results are presented in odds-ratio.

high-SES compared to low SES still positively and significantly increases the odds of obtaining a STEM degree by 1.57 (**). Once interactions are entered in model 16 though, SES no longer appears to be significant. Like in all other analyses, interactions between race and SES were not significant.

Of the high school educational opportunities, only two of them were significant when added to the model until declaring a STEM major is controlled for. In model 13, as the percent of teachers that are quality increases at a high school, students are considerably more likely to graduate with a STEM degree (2.864*). Once majoring in STEM is added to the model, all the high school educational opportunities are no longer significant throughout the rest of the models. Hence, having more White peers (.515***) and more quality teachers at a high school appear to increase the odds that a student will declare a STEM major.

When college educational opportunities are added in model 15, after declaring a STEM major is controlled for, only one university has a significant effect on graduating in STEM. Fayetteville State University (FSU), a historically Black university, was the only university that appeared to have any significant effect on graduating in STEM and this was a negative effect. Attending FSU appears to decrease the odds of earning a STEM degree by.403 (*). This negative significant effect on graduating in STEM from FSU appears to even increase the odds when interactions are added in model 16 (.364*).

For gender, in model 12 and 13, male students have significantly higher odds to obtain a STEM degree compared to female students by roughly 1.39 (***). However, when declaring a STEM major is controlled for, females are no longer significantly less likely than males in attaining a STEM degree. Males and females remain not significantly different in graduating in STEM when college educational opportunities are added.

SAT math and SAT verbal scores were positive and significantly related to graduating in STEM before controlling for declaring a STEM major (1.004*** and 1.001*, respectively). Once declaring a STEM major was added to the model, none of the pre-college achievement variables were significant. Hence, high school achievement indirectly affects obtaining a STEM degree by increasing the odds that a student will declare a STEM major.

While interest in STEM and health on the SAT are powerful and significant predictors of graduating in STEM (3.11*** and 2.049***), the effect appears to work indirectly through declaring a STEM major. When freshman STEM GPA is added in model 15, the effect of interest in STEM drops considerably (1.001***). When declaring a STEM major is added in model 16, interest in STEM and health lose their significance. Hence, once declaring a STEM major is added to the model, the significant effect of interest in STEM or Health on the SAT on graduating in STEM disappears. Marking interest in business on the SAT is a significant and consistent variable that reduces the likelihood of graduating in STEM throughout all the models (.46***).

Similar to the analysis of declaring a STEM major, I also ran interactions between high school educational opportunities and SES and educational opportunities interacted with race on obtaining a STEM major. However, in neither of these models were any of these interaction variables significant. Due to this, these models are not shown.

Discussion

My analysis offers mixed support for my hypotheses. Table 6 presents the results of all the hypotheses for ease of interpretation. Overall, 7 of my hypotheses were not supported, while 6 were supported. I did not find support for my first hypothesis that low-SES students are more interested in STEM majors. But, I did find that educational opportunities moderated interest in STEM by SES. However, this was not a peer effect. Low-SES students that attended schools with more quality teachers were significantly more likely to have interest in STEM compared to mid- and high-SES students at similar school contexts.

My second hypothesis, that URM students would be more interested in high-income majors was supported. This hypothesis gives support for relative risk aversion theory. Black students were around twice as likely to mark having interest in STEM on the SAT. The sub-hypothesis that attending a school with more privileged peers would decrease the odds of having interest in a STEM major was also supported. Both Blacks and Asians were significantly more likely to have interest in STEM as the percentage of the student body that is White decreased. Also, Blacks that attended high schools where less students took the SAT their senior year were significantly more likely to have interest in STEM compared to Whites.

My third hypothesis that high-SES students would be more likely to major in STEM was also not supported by the data. Mid- and high- SES students do not appear to be significantly different than low-SES students in majoring in STEM. The sub-hypothesis related to low-SES students and educational opportunities does not appear to be supported.

Table 6: Hypotheses Results

H1: Low-SES students are more likely to have interest in high-income majors.	Not supported	Low-SES students did not appear to have more interest in STEM in Table 3.
H1.1: Low-SES students that attend schools with less privileged peers are more likely to have interest in high-income majors.	Not supported	Only the educational opportunities related to quality teachers were significant in Table 3 for low-SES students.
H2: URM students are more likely to have interest in high-income majors.	Supported	Black students appeared to have higher odds of having interest in STEM majors in Table 3.
H2.1: URM students that attend schools with less privileged peers will be more likely to have interest in high-income majors.	Supported	The educational opportunities related to percentage of White students and percentage of students that took the SAT were negatively related to having interest in STEM majors in Table 3.
H3: Low-SES students are less likely to major in high-income majors.	Not supported	No SES variables were significant in Table 4.
H3.1: Poorer educational opportunities will decrease the odds that a low-SES student will major in high-income majors.	Not supported	None of the educational opportunities in Table 4 appeared to have an influence on SES as it relates to majoring in STEM.
H4: URM students are less likely to major in high-income majors.	Not supported	Black and "other race" students in Table 4 appear to be more likely to major in STEM compared to White students.
H4.1: Poorer educational opportunities will decrease the odds that an URM student will major in high-income majors.	Not supported	Poorer educational opportunities in Table 4 appeared to increase the odds that a student will major in STEM.
H5: Low-SES students are less likely to obtain a high-income degree.	Supported	Low-SES students in Table 5 appeared to be less likely to obtain a STEM degree, once declaring a STEM major was included in the model.
H5.1: Poorer educational opportunities will decrease	Supported	Educational opportunities in Table 5 appeared to moderate the odds that a

the odds that a low-SES student will obtain a high-income degree.		low-SES student would obtain a STEM degree.
H6: URM students are less likely to obtain a high-income degree.	Supported	URM students in Table 5 appeared to be less likely to obtain a STEM degree, once declaring a STEM major was included in the model.
H6.1: Poorer educational opportunities will decrease the odds that an URM student will obtain a high-income degree.	Supported	Educational opportunities in Table 5 appeared to mediate the odds that a URM student would obtain a STEM degree.
H7: Low SES, URM students have higher odds of having interest in high-income majors.	Not supported	No interaction between SES and race were significant in Table 3.

My fourth hypothesis, which is essentially the same as the third but for race, appears to have a different pattern. URM students are significantly more likely to declare a STEM major compared to Whites until high school educational opportunities are controlled for. This suggests that it is the peer effect that makes disadvantaged students more likely to declare a STEM major. High school educational opportunities still appear to have significant positive effect on majoring in STEM, even when college educational opportunities are controlled for. “Other” race students though, still appear to be significantly more likely to declare a STEM major even when high school and college educational opportunities are controlled for. This is the opposite of what I predicted which was that URM students would be less likely to declare a STEM major. These results regarding declaring a STEM major largely appear to be congruent with relative risk aversion theory.

For Black students, declaring a STEM major appears to work indirectly through the school they attend. Students that attend schools where less of the students took the SAT their senior year and fewer students are White are more likely to declare a STEM major. This gives evidence for a peer effect based on relative risk aversion theory. Black students appear to be more likely to major in STEM because they attend high schools where more of their peers are disadvantaged. “Other” race students though appear to be more likely to be more likely to declare a STEM major regardless of their educational opportunities.

My fifth hypothesis was that low-SES students would be less likely to graduate in a high-income field like STEM which was supported in my analysis. When looking at the entire student body, there does not appear to be a difference in the likelihood of obtaining a STEM degree by SES. However, once students declare a STEM major, low-SES students are significantly less likely to graduate in STEM compared to mid- and high-SES students. High-SES students were the most likely to obtain a STEM degree, followed by mid-SES students, and then low-SES students. The sub-hypothesis related to educational opportunities also appears to be supported. When college educational opportunities are added in model 15, it weakens the effect of SES on obtaining a STEM degree. Nonetheless, high-SES students are still significantly more likely to obtain a STEM degree regardless of the educational opportunities. It appears that there are barriers that emerge for low-SES students to obtain a STEM degree once they have declared a STEM major. Part of these barriers are due to the stratified college learning opportunities but not entirely. Even after controlling for the college learning opportunities, the negative effect of being low-SES remained.

Findings also lend support to my sixth hypothesis that URM students will be less likely to graduate in high-income fields. “Other” race students are significantly more likely to graduate in STEM compared to Whites. However, once declaring a STEM major is controlled for, “other” race students are not significantly different from White students. Black students though, were not significantly different from Whites in graduating in STEM when looking at the general college population. Once I control for declaring a STEM major, Black students appeared to have .65 the odds to obtain a STEM degree compared to Whites, when controlling for prior academic achievement.

When college educational opportunities are added in model 15, Black students are no longer significantly different from Whites in graduating in STEM, this finding lends support for my sub-hypothesis. This suggests that the negative effect of being Black on graduating in STEM works indirectly via educational opportunities at the college level. College educational opportunities appear to mediate the negative relationship between being Black and obtaining a STEM degree.

My last hypothesis, about the unique interaction effects between race and SES though received no support throughout any of the models. This does not give support to the idea that low-SES URM students are doubly disadvantaged and, therefore, pursue high-income majors to a greater extent.

I. Race

Black students have the results that align the best with figure 2 **(**see page 21). Black students, controlling for student and high school variables, report the highest levels of interest in STEM majors, which aligns with relative risk aversion. Furthermore, Black students that went to schools with poorer-quality peers were more likely to have interest in STEM. Compared to Whites, Blacks are also significantly more likely to declare a STEM major until high school educational opportunities are controlled for. This implies that it is largely the peers in the high school that Blacks attend that push them into STEM majors. Yet, Black students graduate in STEM at significantly lower rates than any other race, once controlling for declaring a STEM major. This closely aligns with the concepts of relative risk aversion and effectively maintained inequality. Further, this implies that it is predominately the horizontally stratified educational opportunities at the college level that are negatively impacting Black student's success in STEM majors.

As mentioned, students that attend high schools with less White students are more likely to have interest in STEM (particularly for Blacks and Asians), declare a STEM major, and obtain a STEM degree. However, when declaring a STEM major is added to the model, attending a high school with higher percent of the student body that is White is no longer significant. This implies that students that attend schools with less White students are more likely to declare a STEM major but, of those who declare a STEM major, are not more likely to obtain a STEM degree. Hence, a student with disadvantaged peers will be pushed to have more interest in financially-secure majors. However, these students may lack the skills needed for success in these majors.

These findings suggest Black students face barriers earning STEM degrees that White students do not face. Past research shows Black STEM students reported feelings of isolation, microaggressions, and feeling stereotyped within STEM majors (Grossman & Porche 2009; Brown et al. 2016). These barriers are likely part of what pushes students out of these majors. This analysis also sheds light on the opportunities to learn for disadvantaged students, which also acts as a barrier. Black students have the highest interest in STEM yet are the least likely to obtain a STEM degree, after controlling for declaring a STEM major, and this is mediated by their college educational opportunities.

II. SES

There were no significant differences in interest among students from different SES backgrounds. However, when SES is interacted with the percent of quality teachers at a high school, low-SES students become significantly more likely to have interest in STEM majors. This implies that when low-SES are taught by better teachers, they are more likely to have interest in STEM majors. Hence, when low-SES students have the academic resources to succeed, they will have more interest in high-income majors like STEM. When examining STEM major declaration though, high-SES students were no more likely to declare a STEM major across any of the models.

Looking at graduating in STEM, both middle- and high-SES students appeared to be just as likely to obtain a STEM degree when looking at the overall student body. Once declaring a STEM major is added in model 15, both middle- and high-SES students were more likely to graduate in STEM compared to low-SES students. When college educational opportunities were controlled for, the negative effect of being low-SES weakened but remained significant and negative compared to high-SES students. High-SES appear to be the most likely to graduate in STEM, even when controlling for institution and freshman STEM GPA. This emphasizes that low-SES do face horizontally stratified learning opportunities but they are also disadvantaged by other barriers. These barriers likely include access to the social and financial capital that higher SES students have at their disposal within postsecondary education environments that increases their odds of graduation (Bourdieu 1984). This gives evidence for effectively maintained inequality but not for relative risk aversion theory.

III. Educational Opportunities

Of the high school level variables, there are a few that impact STEM pathways in this analysis. As mentioned, the percentage of quality teachers at the high school becomes positive and significant for STEM major declaration after controlling for freshmen STEM GPA and remains significant across the rest of the models for STEM major declaration. Additionally, in Table 5, before controlling for declaring a STEM major, students who attended schools with high levels of quality teachers were more likely to graduate in STEM. This gives support to idea that students that are exposed to higher quality education are more likely to major in high-income majors, which supports EMI.

The percentage of the school that took the SAT their senior year had a negative significant effect. This suggests that students that attend high schools where less students are preparing to go into a four-year college are more likely to have interest in STEM majors. The percentage of the school that took the SAT and the percent of the school that are White both reflect a peer effect that is analogous relative risk aversion theory. Students that have disadvantaged peers are more likely to choose financially-secure pathways. However, none of the high school educational opportunities are significant for obtaining a STEM degree once declaring a STEM major is controlled for.

At the university level, the university educational opportunities a student experiences appears to directly impact their likelihood of obtaining a STEM degree. Once the university they attend is controlled for, the negative effect of being Black disappears and the negative effect of being low-SES diminishes. This suggests that the institution a student attends moderates, to a considerable extent, the odds that a disadvantaged student will obtain a STEM major. Furthermore, when examining graduation in STEM, only a HBCU (FSU) has a significant effect on graduation, which was negative. Students that declare a STEM major at Fayetteville State University appear to have roughly .6 the odds to obtain a STEM degree compared to students at NC A&T. This is an unexpected finding since past research has suggested the HBCUs tend to offer a more supportive environment for STEM students (Xie et al. 2015).

Conclusion

The results found in this analysis give some evidence for relative risk aversion and effectively maintained inequality within high-income majors. As RRA predicts, URM students appear to be more interested in STEM majors. Black students arguably appear to be particularly interested in these majors because they are embedded within an environment with disadvantaged peers who help to "push" them into STEM majors. However, as mentioned earlier, this may not actually be a peer effect but rather an effect of the high school curriculum. Schools with less White students tend to expose students to a smaller variety of topics and enriching opportunities, which limits their selection of a college major (Bottia et al. Forthcoming).

Low-SES students, on the other hand, appear to be more interested in these majors only when they are provided with a quality education. Apart from attending a school with a higher number of quality teachers, low-SES students do not appear to be more interested in STEM majors which is not what RRA would predict. Since low-SES students do not follow the same patterns as Black students, it is likely that this is not a RRA effect that pushes students into STEM majors. As mentioned, it is highly possible that there are other reasons that Black students are more interested in STEM majors compared to White students.

However, as EMI predicts, URM and low-SES students are both "pushed out" of the STEM pipeline, which likely promotes social mobility. Once low-SES and Black students declare a STEM major, they become significantly less likely to obtain a STEM degree. A large part of this effect is explained by the stratified opportunities to learn they encounter within postsecondary education which gives support for EMI within STEM majors. However, these stratified opportunities to learn do not fully cover the negative likelihood of obtaining a STEM degree for low-SES students. These students likely face other barriers, like access to financial capital and a lack of social capital that higher-SES students do not face (Grossman & Porche 2014; Brown et al. 2016). This is consistent with EMI that students from privileged backgrounds are also privileged within postsecondary educational institutions they attend which directly shape their career pathways (Lucas 2001).

Black students have the highest interest in STEM. However, the postsecondary environment appears to have an even stronger effect on Black students in the "STEM pipeline". Black students prefer STEM majors yet are significantly less likely to obtain them once they have declared a STEM major, even when controlling for academic performance. These results align with past research that finds that Blacks have the highest levels of interest in STEM but are the least likely to obtain a STEM degree (Lichtenberger & George-Jackson 2013).

A considerable amount of the negative effect of Black students, as well as for low-SES students, on graduating in STEM is moderated via their college educational opportunities. Low-SES and URM students appear to be more likely to be exposed to lower quality high school educational opportunities and be exposed to educational opportunities at the college level that push them out of high-income majors and preserve the status quo. While RRA may not be occurring in STEM majors, EMI appears to be operating, and the social structure appears to be much stronger than those of individual aspirations.

This analysis is significant because this the only the second time RRA and EMI have been linked together to examine college majors. In the first analysis, the researcher only looked at major declaration and concluded that RRA processes were present but EMI processes were not in high-income major groups. My analysis finds the opposite. RRA processes might be occurring for Black students in major declaration but EMI processes appear to push students out of majors that promote financial stability.

Furthermore, EMI and RRA have both been rarely used when looking at STEM majors. There is currently a considerable amount of STEM research going on but these lenses have been underutilized. This analysis clearly shows that STEM majors, as well as other high-income majors, should be examined using an EMI perspective to corroborate these findings. The schools and curriculums that disadvantaged students are enrolled in appear to be pushing these students out of socially mobile paths.

Education is typically praised as a way to boost social mobility. However, there are inherent stratification processes within the education system that work to preserve social stratification (Lucas 2001). While vertical stratification has diminished in recent decades, horizontal stratification appears to still be present and powerful, even within postsecondary education. This is particularly disturbing since students are given considerable control to choose their academic curriculum within postsecondary education, unlike in secondary education. The social structure apparently has a greater impact on preserving the status quo, no matter the aspirations of the student.

Disadvantaged students enter college and are pushed by their peers and environments to follow paths that promote social mobility. This leads these students to be more likely to declare majors that promote social mobility since they are the most “financially-secure”. Once disadvantaged students actually declare a “financially-secure” major though, the educational system pushes disadvantaged students out of these paths. The educational system is able to do so through horizontally stratified educational opportunities to learn as well as student differences in social and financial capital. Stratification within the educational system appears to still play a key role in maintaining a stratified society.

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Appendix: Correlation Matrix of Variables

	STEM dec.	Business dec.	Health dec.	Other dec.	STEM grad.	Business grad.	Health grad.	Other grad.
STEM dec.	1							
Business dec.	-0.146	1						
Health dec.	-0.1	-0.0885	1					
Other dec.	-0.6521	-0.4728	-0.3246	1				
STEM grad.	0.8111	-0.1478	-0.0986	-0.5261	1			
Business grad.	-0.1416	0.8638	-0.0811	-0.4068	-0.1393	1		
Health grad.	-0.0947	-0.085	0.8512	-0.2744	-0.0936	-0.0767	1	
Other grad.	-0.5013	-0.4015	-0.2733	0.8075	-0.6514	-0.4987	-0.3465	1
Interest in STEM	0.2427	0.0031	-0.1066	-0.1465	0.193	-0.0006	-0.0966	-0.1064
Interest in Business	-0.1106	0.3277	-0.0656	-0.098	-0.1032	0.2851	-0.0553	-0.077
Interest in Health	0.0222	-0.1104	0.2741	-0.0753	0.0251	-0.0975	0.2464	-0.0738
Interest in other	-0.1457	-0.1086	-0.1304	0.2519	-0.1131	-0.0905	-0.119	0.2047
White	0.0546	0.0294	-0.0135	-0.062	0.0798	0.061	0.0159	-0.1094
Black	-0.0881	-0.0256	0.0113	0.0864	-0.1092	-0.0579	-0.0189	0.1319
Asian	-0.0027	-0.0184	0.0041	0.0128	-0.0078	-0.0184	0.0054	0.016
Other	0.0833	0.0083	0.0028	-0.0708	0.075	0.0056	-0.001	-0.0629
Low-SES	-0.0685	-0.0268	0.0243	0.0677	-0.0868	-0.045	-0.0044	0.1002
Mid-SES	-0.0368	-0.0325	0.0274	0.0378	-0.0378	-0.0392	0.0251	0.0428
High-SES	0.0861	0.0508	-0.0441	-0.0865	0.1008	0.0707	-0.0204	-0.1155
Male	0.1506	0.0922	-0.1487	-0.1124	0.1113	0.0842	-0.1369	-0.0787
SAT Math	0.2351	0.0512	-0.0504	-0.2067	0.2345	0.0783	-0.0155	-0.2279
SAT Reading	0.1697	-0.0103	-0.0423	-0.1141	0.1797	0.0136	-0.0115	-0.1445
If Citizen	-0.0021	0.0068	0.0021	-0.0059	0.0057	0.0079	0.0075	-0.0134
STEM Honors	0.0731	0.0129	0.0153	-0.0744	0.0645	0.0214	0.0241	-0.0757
Rural Highschool	0.0029	-0.0062	0.0013	0.0006	-0.007	-0.0031	0.011	0.0034
Suburban Highschool	0.0025	-0.0047	0.0058	-0.0019	0.0099	-0.0122	0.0094	-0.0049
Urban Highschool	-0.0054	0.0111	-0.007	0.0012	-0.0024	0.0152	-0.0206	0.0012
% White High School	0.0271	0.0278	-0.0001	-0.0415	0.0401	0.0431	0.0173	-0.0674
% Teachers qualified	0.0321	0.0124	-0.0001	-0.0343	0.0412	0.0091	-0.0023	-0.0379
% take the SAT	0.025	0.0421	-0.0149	-0.0419	0.0329	0.0455	-0.0078	-0.0524
STEM Freshman GPA	0.1859	0.1194	0.0932	-0.2789	0.2089	0.143	0.1029	-0.3054
University	0.0734	0.0108	0.027	-0.0805	0.0916	0.0375	0.0327	-0.1113

	Interest in STEM	Interest in Business	Interest in Health	Interest in other	White	Black	Asian	Other
Interest in STEM	1							
Interest in Business	-0.1715	1						
Interest in Health	-0.3228	-0.2333	1					
Interest in other	-0.3918	-0.2832	-0.533	1				
White	0.0141	-0.0398	-0.0607	0.0713	1			
Black	-0.0209	0.0543	0.0344	-0.0504	-0.8364	1		
Asian	-0.0042	-0.0317	0.0273	-0.002	-0.2846	-0.1511	1	
Other	0.0208	0.0066	0.0444	-0.0629	-0.2278	-0.121	-0.0412	1
Low-SES	-0.0242	0.0155	0.0441	-0.032	-0.4133	0.4141	0.0444	0.0042
Mid-SES	-0.021	-0.0161	0.0353	-0.006	-0.0275	0.0281	0.0074	-0.0067
High-SES	0.038	0.0036	-0.0664	0.0297	0.3357	-0.337	-0.0403	0.0032
Male	0.3835	0.0627	-0.2765	-0.0887	0.0619	-0.0726	-0.0032	0.023
SAT Math	0.1903	-0.0341	-0.0658	-0.0695	0.4858	-0.5412	-0.0206	0.0993
SAT Reading	0.0606	-0.0629	-0.0416	0.0308	0.4779	-0.5127	-0.0114	0.0351
If Citizen	0.0137	0.0041	0.002	-0.0155	-0.0077	-0.0127	0.0083	0.0445
STEM Honors	0.0084	-0.0299	0.0361	-0.0216	0.133	-0.1487	0.01	0.0095
Rural Highschool	0.0189	-0.0178	0.0088	-0.0122	0.0755	-0.0717	0.0273	-0.0546
Suburban Highschool	0.001	-0.0198	0.0005	0.0114	0.039	-0.0272	-0.0066	-0.0285
Urban Highschool	-0.0207	0.0379	-0.0096	0.0015	-0.1166	0.1011	-0.0218	0.0846
% White High School	0.0158	-0.037	-0.0313	0.0405	0.508	-0.4898	-0.0904	-0.0118
% Teachers qualified	-0.0001	0.0017	-0.0007	-0.0003	0.1117	-0.0989	-0.0457	0.006
% take the SAT	0.0166	0.0288	-0.0449	0.0105	0.0785	-0.0998	-0.0296	0.0809
STEM Freshman GPA	0.0121	0.008	-0.0398	0.0227	0.2133	-0.2362	-0.0128	0.0444
University	0.0078	-0.0285	0.0596	-0.0441	0.2228	-0.2607	-0.0001	0.0666

	Low-SES	Mid-SES	High-SES	Male	SAT Math	SAT Reading	If Citizen	STEM Honors
Mid-SES	-0.3212	1						
High-SES	-0.446	-0.7043	1					
Male	-0.0597	-0.0258	0.0691	1				
SAT Math	-0.3351	-0.119	0.3637	0.2111	1			
SAT Reading	-0.3431	-0.1109	0.362	0.0766	0.7228	1		
If Citizen	-0.003	0.0047	-0.0022	-0.002	0.0053	0.0077	1	
STEM Honors	-0.0862	-0.0213	0.0848	-0.0202	0.2358	0.2274	-0.0131	1
Rural Highschool	0.027	0.0512	-0.0686	-0.0063	-0.004	-0.0182	0.0095	0.0264
Suburban Highschool	-0.0033	0.0463	-0.0413	-0.0032	-0.0181	-0.0238	-0.0062	-0.0032
Urban Highschool	-0.0248	-0.0985	0.1117	0.0097	0.0219	0.0422	-0.0038	-0.0243
% White High School	-0.2751	0.0353	0.1729	0.0357	0.3511	0.3258	0.0077	0.0531
% Teachers qualified	-0.0803	0.0087	0.052	-0.0004	0.1281	0.115	0.0078	-0.0048
% take the SAT	-0.1633	-0.1552	0.2691	0.0369	0.2051	0.2189	-0.001	-0.0216
STEM Freshman GPA	-0.141	-0.0755	0.1771	-0.0627	0.375	0.3115	0.0194	0.1273
University	-0.1486	0.0036	0.108	-0.0192	0.2949	0.269	0.0076	0.0988

	Rural Highschool	Suburban Highschool	Urban Highschool	% White High School	% Teachers qualified	% take the SAT	STEM Freshman GPA	University
Rural Highschool	1							
Suburban Highschool	-0.5104	1						
Urban Highschool	-0.5386	-0.4497	1					
% White High School	0.1845	0.1015	-0.2911	1				
% Teachers qualified	-0.0213	0.0165	0.0059	0.216	1			
% take the SAT	-0.3287	-0.1282	0.4671	0.1166	0.0558	1		
STEM Freshman GPA	0.0091	-0.0048	-0.0047	0.1595	0.0538	0.0966	1	
University	-0.0252	0.0195	0.007	0.1825	0.0189	0.0682	0.1103	1