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## Racial and gender pay disparities: The role of education

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# **Racial and Gender Pay Disparities: The Role of Education**

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**Keywords: Race, Gender, Education, Earnings, Inequality**

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## Racial and Gender Pay Disparities: The Role of Education

### **Abstract**

*We investigate whether white women, black women, and black men earn less than white men because of 1) lower educational attainment and/or 2) lower wage returns to the same levels of attainment. Using the 1979-2012 waves of the American National Longitudinal Survey of Youth (NLSY79), we examine how educational attainment and field of study impact pay. Regression decompositions show that gaps in attainment and fields explain 13 to 23 percent of the racial pay gaps, but none of the gender pay gaps. Random effects models test for race and gender differences in returns to education. Men of both races receive higher returns relative to women, while black women receive lower returns relative to all groups for master's levels. Our intersectional approach reveals that equalizing attainment would reduce racial pay gaps, whereas equalizing returns would reduce gender disparities. Black women are multiply disadvantaged by attainment gaps and lower returns relative to all groups studied.*

Keywords: Race, Gender, Education, Earnings, Inequality

### 1. INTRODUCTION

The potential for educational attainment to reduce labor market inequalities by race, ethnicity, gender, nativity, and social class of origin has long captured scholarly attention. Rich traditions of sociological research on stratification argue that education is crucial for reducing social inequality and increasing the status attainment in occupational hierarchies of successive generations of workers, particularly among more socially disadvantaged groups (Cohen and Nee, 2000; Hout, 2012; Mandel and Semyonov, 2016; O'Neill, 1990; Sewell et al., 1969; Torche 2011; Zhou, 2019). In the latter half of the 20<sup>th</sup> century, American gender and racial gaps in educational attainment dramatically narrowed. With respect to gender, women earn college degrees at higher rates than men do, with this gender attainment gap closing among blacks earlier (Cohen and Nee, 2000; DiPrete and Buchmann, 2013; McDaniel et al., 2011).<sup>1</sup> Yet, even as gender attainment gaps have closed, gender segregation by field of study persists. In part, this may be due to the desire of individuals to express affinities for socially appropriate areas of

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<sup>1</sup> We use the term “black” to refer to people of the African Diaspora who reside in the United States.

study, given their gender identities, and school environments that reinforce gender differences (Charles and Bradley, 2009; DiPrete and Buchmann, 2013). With respect to race, gaps in educational attainment have narrowed overall, but this is largely due to increased black high school completion. Racial gaps in college and post-graduate degrees persist. Racial disparities intersect with gender, as well. The race gap in bachelor's degrees is larger but declining among men, while smaller but widening among women (McDaniel et al., 2011). Because the return to education, particularly a college degree, has dramatically increased since the 1970s (Goldin and Katz 2008; Gottschalk and Danziger 2005), race and gender differences in post-secondary educational attainment and field specialization may contribute to race and gender pay gaps. One focus of our study is to investigate how much race and gender differences in the amount and field of educational attainment contribute to these pay gaps.

However, closing attainment gaps alone is insufficient for eradicating pay gaps by race and gender. The reasons for racial and gender pay gaps among those with the same level of education include differences in human capital developed in the labor market (Corcoran and Duncan, 1979; England et al., 1999; Farkas et al., 1997; Marini and Fan, 1997; O'Neill 1990; Tomaskovic-Devey et al., 2005), occupational and industrial segregation by gender and race (Blau and Kahn 2017; Grodsky and Pager, 2001; Huffman and Cohen, 2004; Kilbourne, England, and Beron, 1994; Kilbourne, England, Farkas, et al., 1994; Reid, 1998; Tomaskovic-Devey, 1993; Wright, 1978), the gendered impact of marriage and children on pay (Budig and England, 2001; Hodges and Budig, 2010; Killewald, 2013), and unmeasured differences with respect to educational quality and community effects (Crissey, 2009; Deming et al., 2016; Gaddis, 2015; Nunley et al., 2015). Another possibility, which is the second focus in this study, is that the same educational credential may be differently rewarded in the labor market based on the gender and race of the worker. Some evidence points to disadvantaged social groups receiving lower returns to earnings for the same educational attainment, but does not fully test for differences in returns by both race and gender (Ashraf, 1994; Averett and Dalessandro, 2001; Marini and Fan, 1997).

Our study examines the extent to which differences among white men, black men, white women, and black women in educational attainment and wage returns for education matter for racial and gender

pay disparities. Importantly, we model the effects of field of study, as well as level of education attained, in order to examine the role of gender and racial segregation by field of study on the gender and race pay gaps. Using the 1979-2012 waves of the NLSY79, we systematically examine: 1) how much race and gender differences in educational attainment explain gender and race pay gaps, and 2) whether there are net race and gender differences in the effects of education on earnings. In the next two sections, we provide background on gender and race differences in educational attainment and associated wages over time. We then discuss explanations for race and gender differences in the wage returns to education.

## 2. TRENDS IN EDUCATIONAL ATTAINMENT AND EARNINGS BY RACE AND GENDER

Our study examines a cohort of non-Hispanic white and black women and men born between 1958 and 1965, who largely graduated from high school during 1976-1985. In addition to complete educational attainment histories, we follow their work histories from 1979-2012. Below we review how educational attainment has changed for these groups over time, how education maps on to wage differences, and evidence suggesting differences in wage returns to education by gender and race.

### 2.1 Racial and Gender Disparities in Educational Attainment

Since the 1950s, racial and gender gaps in educational attainment have declined dramatically, while education has risen for all groups. Despite this rise in overall attainment, significant differences persist by race. Using Current Population Survey data aggregated by the National Center for Education Statistics, Figure 1 shows the rising levels of high school completion for all, and the dramatic narrowing of the black-white high school completion gap between 1940 and 2015, to a less than 6 point gap in 2015 (National Center for Educational Statistics, 2015). Gender gaps in high school completion have been negligible throughout this period. In contrast, while college attendance has increased for all, the racial gap in college completion has widened over time. Figure 1 reveals the black-white gap in secondary education degree completion widening between 1970 and 2015 to a 14.5 percentage point gap in 2015, with 36.2 percent of whites and 22.9 percent of blacks holding a college degree. Moreover, while the gender gap in college completion has closed among whites, black women's higher rate of college completion relative to black men has grown to its largest difference, at 3 percentage points in 2015.

-----FIGURE 1 ABOUT HERE -----

The college completion gap can be elaborated by examining racial and gender gaps in the level of post-secondary degree attainment. Drawing from the Current Population Survey, Figure 2 shows the highest educational attainment of a cohort of adult civilians in 2012, a year that matches our analytical sample (US Census Bureau, 2012). High school dropout rates are higher for blacks (around 15 percent) relative to whites (around 7 percent), with little gender differences within racial groups. Black men are most likely to finish their educational attainment in high school, with over 50 percent having a high school diploma or less. Black men and women are more likely to attend some college but leave without a degree, relative to whites. Women of both races are more likely to hold associate's degrees, with black men being least likely. White advantage in educational attainment is most dramatic at the bachelor's level, particularly among men. This persists at the master's level, with white women having the most, and black men the least, representation. White men dominate at the doctoral level, and are nearly twice as likely to hold doctoral degrees compared to all other groups.

-----FIGURE 2 ABOUT HERE -----

Racial differences persist in field of study. Blacks are over-represented in professional fields with clearer paths to careers, such as business, social sciences, and life sciences, and underrepresented in humanities and STEM fields, relative to whites (Ma, 2009; Siebens and Ryan, 2012; Alegria and Branch, 2015). These differences in fields can be further elaborated by attainment levels. At the associate's level, black students are concentrated in technical and life/health fields, whereas whites are more concentrated in social science and education (Ma, 2009). At the bachelor's level, black students are more concentrated in social sciences (Ma, 2009). Among men, blacks are less likely than whites and Asians to major in engineering, and black men are most likely to be undecided about a college major upon admission; among women, blacks are more likely than whites to major in social sciences and STEM (Dickson, 2010).

Gender segregation by field of study is pronounced. Women concentrate in helping and care fields, such as education, social sciences, and humanities/arts, while being under-represented in STEM fields, compared to men (England et al., 2007; Bobbitt-Zeher 2007; Ma 2009; Siebens and Ryan 2012).

Among associate's degrees, men concentrate in technical fields while women are in life sciences and health fields (Ma, 2009). At the bachelor's level, men's concentration in math and science fields is dramatic, while women are overrepresented in the social sciences (Ma, 2009). And at the doctoral level, women largely pursue educational administration, communications, psychology, sociology, English, and nursing, whereas men dominate in engineering, physics, and math (England et al., 2007).

## 2.2 Educational Attainment and Pay Gaps by Race and Gender

Do racial and gender differences in educational attainment articulate with racial and gender pay gaps? Carnevale et al. (2011) find that racial and gender disparities in lifetime earnings are larger at higher levels of educational attainment. We find a similar widening in race and gender gaps with educational attainment in Figure 2 (US Bureau of Labor Statistics, 2015). Figure 2 shows the ratio of black men's, white women's, and black women's median weekly earnings relative to those of white men by educational attainment. These wage estimates are restricted to full-time workers aged 25 and over in 2014. All groups earn significantly less than white men at every educational level. Black men's earnings ratios show a curvilinear pattern: dropouts earn 91 cents on a white man's dollar; high school graduates and those with graduate degrees earn 81 cents and those with associate's or bachelor's degrees earn only 72 to 77 cents on a white man's dollar. Black women experience the largest pay gaps when compared to white men at every level of education: among high school dropouts, black women earn 79 cents on a white man's dollar, but only 65 cents at all higher levels of education. White women earn 72 to 77 percent of white male earnings, with larger gaps for graduate degrees. The gender gap is larger among whites than among blacks, as has been documented previously (Greenman and Xie 2008). Whites' larger gender gap is consistent with the finding of larger gender gaps among high earners with the greater proportion of high earners observed among whites (Blau and Khan, 2017). It also may reflect white women's higher rates of part-time work and greater household specialization among white families relative to black families (Greenman and Xie, 2008).

What is the contribution of education to these race and gender pay gaps? Studies that decompose gender and race pay gaps find that educational attainment explains more of the race gap than the gender

gap, and this is particularly true among men. For example, Kilbourne, England, and Beron (1994) found differences in educational attainment explained 56 percent of the race pay gap among men, compared with 43.4 percent among women. In another study using the 1991 wave of the NLSY, Farkas et al. (1997) found that educational attainment explained 11 percent of the male racial pay gap, though none of the female racial pay gap. Blau and Khan (2017) show that by 2010, differences in educational attainment explain little of the gender gap, though they did not disaggregate by race. The small contribution of educational attainment to the gender pay gap reflects the fact that the gender educational gap has closed, and even reversed in recent cohorts, with women more likely to attain college degrees (Blau and Khan 2017).

Disaggregating educational attainment by field of study better explains the gender pay gap. Marini and Fan (1997) found that gender segregation in fields, combined with other forms of human capital (AFQT, GPA, parental education, experience, and self-esteem) collectively explain 14 percent of the gender pay gap (Marini and Fan, 1997). With more recent data, Bobbit-Zeher (2007) finds that if women and men had the same attainment, fields of study, standardized test scores, and degrees from similarly prestigious colleges, the gender pay gap among the college-educated would be cut in half. Similarly, Ma and Savas (2014) find that while women get the same returns from lucrative fields of study, they are under-represented in those fields. Contrary to Bobbit-Zeher (2007), they find that women reap less of a return from attending a highly selective college, in part because of women's overrepresentation among low-paying majors at those institutions (Ma and Savas, 2014). Considering race and field of study, evidence suggests that racial segregation in fields of study contributes to the lower earnings of blacks. Carnevale et al. (2016) find that blacks are overrepresented in majors that serve the community but are low-paid, such as social work, human services, and public administration, while being underrepresented in high-paying STEM degrees (i.e., pharmaceutical sciences and engineering). Together, these findings point to the importance of disaggregating field of study in analyzing race and gender pay gaps.

### 2.3 Race and Gender Differences in Returns to Education

Thus far, the evidence regarding racial and gender differences in returns to education is inconclusive, and does not consistently take an intersectional approach to consider differences by both gender and race. One strand of the literature examines the effect of education on the race gap, but rarely pays attention to gender. For example, Gottschalk and Danziger (2005), O'Neill (1990), Smith (1997), Tomaskovic-Devey et al. (2005), and Wright (1978) examine race differences, but limit their analysis to men only. These studies generally find lower returns to education for minority men. In recent analyses that include women and men to examine differences by race in returns to education find that whites of both genders have higher returns (Carnevale et al., 2011; Mandel and Semyonov, 2016). In contrast, findings for older cohorts were mixed, variously finding that black men had higher returns (Averett and Dalessandro, 2001), whites had higher returns to high school diplomas while blacks had higher returns to college degrees (Ashraf, 1994), or finding no significant race differences in returns (Corcoran and Duncan, 1979; Perna, 2005). Thus, while this literature suggests differential returns to education for blacks relative to whites, the absence of an intersectional focus makes it is less clear whether black men and black women both incur similar or disparate educational returns.

The second strand of inquiry focuses on gender differences in the returns to education, but does not consistently consider race. These studies variously find women receive higher returns for college degrees (Gottschalk and Danziger, 2005; Perna, 2005), mixed results in returns by gender and attainment (Kilbourne, England, and Beron, 1994), or no gender differences in returns to education (England, Christopher, and Reid, 1998). Decomposing gender gaps at two time-points, Blau and Khan (2017) found no difference in returns to education by gender in 1980, but found that men had higher returns in 2010, explaining 1.5% of the 2010 gender pay gap. In addition to cohort change in the gendered returns to education, several studies show that gender differences in returns to education vary by field of study: Several studies find that women's concentration in lower-paid college majors limits their returns to education relative to men (Bobbit-Zeher, 2007; Ma and Savas, 2014; Marini and Fan, 1997).

Where interactions between race and gender are examined, findings are mixed. Some studies find significant gender differences, but not race differences, in returns to education (Corcoran and Duncan,

1979; Farkas et al., 1997; Kilbourne, England and Beron, 1994; Perna, 2005). Others find evidence of race differences: Averett and Dalessandro (2001) found that black men received higher returns for BAs, but there was no race difference among women, and no race difference in the effect of two- year degrees on pay. Dale and Krueger (2011) find that college selectivity results in higher wage returns for blacks and Hispanics, relative to whites, but find no gender differences. The mixed set of findings across studies may stem from several factors, such as differences in how education is measured (as highest level or field of study), whether race and gender are jointly analyzed, included covariates (e.g., standardized test scores for cognitive skills, market-derived human capital, job characteristics, socioeconomic background, and family structure), period and age variability in the cohorts analyzed, and methodological approaches.

These studies and trends together suggest that a comprehensive analysis that considers both gender and race differences in educational attainment and returns to education could greatly illuminate the relationships between education and pay disparities. We extend the literature by taking an intersectional approach that compares four groups defined jointly by gender and race: white men, white women, black men, and black women. We consider how education, measured by highest level and highest level-within-field of specialization articulates with gender and race pay gaps. We also examine whether returns to these alternate measures of education differ among our four race-gender groups.

### 3. EXPLAINING RACE AND GENDER DISPARITIES IN THE WAGE RETURNS TO EDUCATION

While the contribution of differences in the amount of educational attainment to pay gaps is straightforward, why would the wage returns to the same amount of education vary by race or gender? In the following sections, we elaborate the mechanisms that could drive race and gender differences in returns to education. We also discuss relevant control variables included in our analysis.

#### 3.1 Race and Gender Segregation in Educational Fields of Study

Gender and racial differences in fields of study are strongly pronounced, as detailed above. Differences in fields of study are linked to occupational and industrial segregation (Marini and Fan, 1997), which leads to disparate opportunity and wage structures for whites and blacks, and women and men. Even those with more integrated fields of specialization are fighting upstream in the labor market.

As Marini and Fan (1997) show, women and men end up in occupations more gender segregated than their college majors were. Female-typed degrees lead to female-typed occupations, which tend to be underpaid relative to balanced or male-dominated occupations, all else equal (Blau and Khan 2017; Kilbourne, England, Farkas, Beron, and Weir, 1994). Regardless of the gender composition of the occupation, female-typed degrees may be devalued by employers in terms of the job-related skills they signal if those skills are thought to be more naturally endowed to women rather than acquired through education (Kilbourne, England, Farkas, et al., 1994; Steinberg, 1990). Across all occupations, Bobbitt-Zeher (2007) found that college major gender segregation and occupational segregation together counted for over one-third of the gender pay gap. With respect to race, while past research does not find that the level of racial job segregation in occupations at the national level is related to earnings (Reid 1998), other research on local labor markets finds that the segregation of black workers partially accounts for the racial gap in pay (Huffman and Cohen 2004). In particular, Wright's classic study (1978) demonstrates that the segregation of highly educated black men into academic jobs (as opposed to jobs in the private, non-academic sector) is one mechanism producing lower returns to education.

The choice of field of study may open atypical career paths for women and minorities. Gender-atypical fields of study enable some women to enter occupations atypical for their gender. Moreover, given the significantly smaller numbers of black men and women with college and graduate degrees, simply being a highly educated black worker can lead to a job placement where blacks are atypical incumbents. Both cases lead to tokenism, where an individual, marked by race and/or gender, is a rarity among their peers in the workplace. The interactional pressures tokenized workers face, including high visibility (and scrutiny), contrast from the dominant group (exaggerated differences), and assimilation (stereotyping) were established by Kanter (1977). These pressures lead to undervaluing the token's job performance and exclusion from workplace networks of power and support. Employer bias in perceptions of competence and likability for token women holding degrees from male-dominated fields of study can impact their job placement: a recent audit study reveals that high-achieving women in math fields are more penalized than moderately achieving women (*vis a vis* comparable men) in call backs for job

interviews, since their competence is viewed as orthogonal to likeability by prospective employers (Quadlin, 2018). Black women face exceptional tokenism, being underrepresented in occupations on the basis of both their race and their gender. For example, Yoder and Aniakudo (1997) show that black women professional firefighters, who passed through similar training and performance requirements as white women and men, suffer exclusion, hostility, stereotyping, lack of mentoring, and higher scrutiny from other firefighters, including black men, white women, and white men. Due to the heightened tokenism of black women in atypical occupations, we predict their returns to higher levels of education, particularly in atypical areas of study, will be significantly lower than other groups: these include graduate studies generally, and in particular, STEM and business fields.

In decomposition models, we predict that fields of study will explain more of the gender and race pay gaps compared to aggregated measures of education. Moreover, to the extent fields of study maps onto jobs, including measures of occupational segregation and industry will reduce education's contribution to gender and race pay gaps. In our longitudinal models testing for race and gender differences in the wage effects of education, we expect to find differences by field of study at the bachelor's and higher levels, with fields that are dominated by white men (business and STEM) carrying lower returns for white women and black men, and particularly for black women, due to the devaluation of their educational credentials relative to white men in these fields (Quadlin, 2018; Steinberg, 1990).

### 3.2 The Value of Education: Race and School Quality

Due to residential segregation and differential funding for public schools by race and class, public school quality varies by race and is implicated in the lower scores of blacks on measures of academic achievement and cognitive skills (Orr 2003; Rogers and Spriggs 1996, 2002). This reduced college preparation is associated with the over-representation of blacks in for-profit colleges and their relative absence in more selective institutions (Monarrez and Washington, 2020). Lacking direct information about, or valuing less, the quality of schools from which blacks hold diplomas or degrees, employers may more often question the value of educational qualifications held by black job seekers. They may assume school quality is lower for the average black applicant, compared to a white applicant, and give less

weight to educational attainment, particularly high school and associate's degrees for black workers. This could affect hiring decisions, placement within organizations, and wages offers. Indeed, audit and experimental studies find that employers interpret the same educational credentials possessed by black and white workers differently (Gaddis 2015; Nunley et al., 2015).

We include controls for basic academic skills and family resources to reduce racial heterogeneity in socio-economic background on factors that shape educational attainment and school quality. We include a measure of basic academic achievement, the Armed Forces Qualifying Test (AFQT), which was administered in the 1980 survey wave. AFQT reflects differences in resources for the acquisition of such skills, such as family socioeconomic background, nutritional deficits in childhood, poverty exposure, as well as school quality (Orr 2003; Rogers and Spriggs 1996, 2002). As such, AFQT more broadly controls for childhood resource disparities by race and class. We also include parental educational attainment, parental occupations, and number of siblings. We expect that families with more highly educated parents are more likely to have steady employment and higher earnings, which should be correlated with residence and school quality. In addition, parental education is positively correlated with parents' investments in children's educational achievement and attainment. Family size may offset these resources. These measures should net out differences in school quality, though if employers discriminate against all black workers on the basis of assumed school quality we may observe differential returns by race to high school diplomas and some college/associate's degrees.

### 3.3 Other Contributors to Race and Gender Pay Disparities

Race and gender differences in other factors that predict earnings may contribute to race and gender pay gaps, as well as influence returns to education. These factors include other human capital, job characteristics, family structure, and local economies. We consider each set of factors in turn.

Other human capital includes work experience, current job tenure, and work hours, all of which have positive wage returns in the labor market, but are held in varying amounts by gender and racial groups (Corcoran and Duncan, 1979; England et al., 1999; Farkas et al., 1997; O'Neill, 1990; Tomaskovic-Devey et al., 2005). For example, black women average greater experience relative to white

women, who are more likely than black women to lose experience and reduce work hours surrounding the birth of a child (Budig and England, 2001). Conversely, black men average less experience than white men, due to barriers to employment and having to search longer before being offered a job (Tomaskovic-Devey et al., 2005). Gender gaps in experience are larger among whites than they are among black workers. Together this suggests experience will explain more of the racial pay gap among men, and more of the gender pay gap among whites. To isolate the effects of education on pay net of these factors, we include measures of overall work experience and current job tenure in all analyses. In addition, we include measures of work hours since part-time work pays less, even on an hourly basis, than full-time work, and women, particularly white women, have higher propensities for part-time work.

Job characteristics, such as shift work or collective bargaining, contribute to gender and race pay gaps (Grodsky and Pager, 2001; Huffman and Cohen, 2004; Kilbourne, England, and Beron, 1994; Kilbourne, England, Farkas, et al., 1994; Reid, 1998; Tomaskovic-Devey, 1993; Wright, 1978). Particularly for less-educated workers, access to unionized jobs and the ability to work non-standard hours that are associated with pay premiums vary by race and gender. Collective bargaining has equalizing effects on union members' wages, raising the floor under less-educated and experienced workers while compressing wages among the highly educated and experienced (Card 2001). However, gender and racial representation in labor unions is uneven, with white men predominately populating labor unions, particularly during the period of our study (Glenn 2002). Similarly, race and gender differences persist in working non-standard hours (evenings, nights, weekends, and rotating shifts), and such shifts often carry pay premiums for less-educated workers (Presser 2003). Thus, we control for collective bargaining membership and non-standard hours in our models that include job characteristics.

Marriage, parenthood, and region of residence contribute to gender and race pay gaps, and may impact returns to education (Charles and Bradley 2009; Dickson 2010; Ma 2009; Marini and Fan 1997; Orr 2003; Rodgers and Spriggs 1996). Early childbearing lowers women's educational attainment and subsequent earnings (Fletcher and Wolfe 2009), and in the cohort we analyze, black women have a first birth at a relatively younger age than white women. Motherhood also directly impacts wages for white

women, though not for black women (Budig and England 2001). Conversely, becoming a father raises earnings among men, and more sharply for white men compared to black men, and most sharply for college educated men (Hodges and Budig 2010). Finally, geographic context (region and population density) shapes employment opportunities, educational attainment, and family formation patterns differently by race (Crissey 2009). To account for current family structure and geographic location, we include measures of marital status, number of children, region, and rural/urban residence in all models.

#### 4. DATA, MEASUREMENT, AND METHODS

##### 4.1 Data and Measures

Our data are from the 1979-2012 waves of the NLSY (National Longitudinal Survey of Youth), a national probability sample of 12,686 individuals aged 14-21 in 1979. The age of this cohort and its longitudinal data allow us to estimate the returns to education across the full career of working adults, averaging the effects of education on earnings across ages 18 to 55. Moreover, the detailed measures of employment, experience, seniority, and job characteristics offer superior human capital controls relative to other data sets, such as Census or Current Population Survey data.

Respondents were interviewed annually from 1979-1994 and biennially since. We limit the sample to non-Hispanic white and non-Hispanic black workers who are employed, at least 18 years old, and have completed their formal education. We calculate the percent female and the percent black for each detailed occupation/industry combination from 1990 Census data (U.S. Bureau of Census, 1993). For the regression decomposition, we limit the sample to the 2012 wave only. After applying restrictions above, the N for 2012 is 2,828. For the random effects analysis, we use all waves of the data. The total number of person-years is 80,267 across 7,882 individuals, averaging 14.71 waves per individual.

The NLSY79 codebook provides information on respondents with missing data: refusal (-1), don't know (-2), invalid skip (-3), valid skip (-4), and non-interview (-5). For refusal, don't know, and invalid skip, we replaced missing values with the most recently observed value. We did not replace missing values for valid skips and non-interviews. Person-years with missing values of the dependent variable (hourly wage) were dropped from the sample.

#### 4.1.1 Principal Dependent and Independent Variables

The dependent variable is the natural log of hourly wage in the respondent's current job, adjusted for inflation with the Bureau of Labor Statistics Consumer Price Index to 2012 dollars. The principal independent variable is education; different specifications of education are assessed separately. These include *highest level attained* and a detailed measure of *highest level by field of study*. We code highest level attained by using the NLSY79 variable “highest grade completed.” Following Marini and Fan (1997) and Wolpin (2005), we use the cut points of <12 grades, 12 grades, 13-15 grades, 16 grades, 17-18 grades, and 19+ grades to code levels of education.<sup>2</sup> Specifically, we code less than 12 grades completed into a category called “high school dropout,” 12 completed grades are coded as “high school diploma”, 13 to 15 grades completed (encompassing those who obtain associate degrees and those who leave college without a degree) are coded as “some college,” and 16 completed grades are coded as “bachelor’s level.” The master’s level includes those who have completed 17 or 18 grades, while those with 19 or more completed grades are coded as doctoral studies, since we do not know if graduate degrees were obtained.<sup>3</sup> Education by field of study was constructed using transcript data available in the NLSY. The source document for coding the educational variables was Appendix 4: Major Fields of Study and Subspecialties of the NLSY79 Codebook Supplement. High school contains three tracks: college preparatory, vocational, and general studies. We observed no differences in the effects of these tracks on pay disparities. For field of specialization in post-secondary education, we use five broad categories for field:

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<sup>2</sup> A measure of highest degree attained is not consistently available across all waves and contains a greater level of missing data than the highest grade completed measure. In Appendix Table A1, we compare our coding for levels using highest grade completed against the measure for highest degree attained in the 2012 wave, a wave where both measures were available. We disaggregate by gender and race. Our highest grade categories largely correspond with degree completion, though our highest grades approach captures post-secondary attainment that did not result in degree attainment, rather than assuming lower educational attainment as the highest degree variable does. For example, Table A1 shows that more respondents attend doctoral/professional studies (19 or more grades completed) than finish a degree. In our data, this gap is larger for whites (5.2% of white women and 5.8% of white men complete grade 19 or more, but only 0.9% and 2.2% complete the degree, respectively) than it is for blacks (2.8% of black women and 1/8% of black men complete grade 19 or more, but only 0.7% and 0.6% complete these degrees, respectively). More white men complete these degrees than any other group.

<sup>3</sup> Non-completion of degrees is more common among minority students, relative to whites (Bradley and Renzulli, 2011; Sowell et al, 2015). Thus, racial differences in returns to highest grade categories may in part result from differences in completion of degrees.

STEM, social sciences, business, legal and health studies, and humanities. We found no differences in the effects of fields on earnings for those respondents with fewer than 16 grades completed. Thus, we do not analyze fields of study for those with “some college.”

Thus, our models include fields of specialization for bachelor’s, master’s, and doctoral levels. STEM fields include Agricultural and Natural Resources, Biological Sciences, Computer and Information Systems, Engineering, Mathematics and Physical Sciences. Social sciences include Architecture and Environmental Design, Communications, Education, Library Science, Psychology and Social Sciences. Business includes Business and Management fields. Legal and health studies are coded as Health Professions and Law. Lastly, humanities include General Studies, Area Studies, Fine and Applied Arts, Foreign Languages, Home Economics, Letters, Military Sciences, Public Affairs and Science, Theology and Interdisciplinary Studies.

#### *4.1.2 Control Variables*

We include an array of job, occupational, and industrial characteristics: whether the job includes non-standard hours (rotating schedules, on-call, night shift, etc.), whether wages are set by collective bargaining agreements, and whether the respondent’s occupation is professional/managerial versus other occupations. To examine the impact of race and gender segregation, we include measures for the percent female and the percent black in respondents' detailed census occupation by detailed census industry cells. We also include variables to control for eleven industrial sectors.

In addition to education, other human capital variables include AFQT, years of total work experience and years of current job seniority. Total work experience includes seniority in one's present workplace. Individual labor supply measures are usual weekly work hours and number of jobs ever held.<sup>4</sup> Pooled models testing for race and gender differences in coefficients include an interaction between race and AFQT to capture early education differences (such as school quality).

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<sup>4</sup> Average hourly wage rates in part-time jobs are lower than hourly wage rates for full-time jobs in the U.S. (Bardasi and Gornick 2008). Thus, we include a control for work hours.

Measures of family socio-economic background include the respondent's parents' education and number of siblings. Parent's education was measured when the respondent was aged 14 years. In the case of a single-parent household, we used the present parent's occupation and education. In two-parent households, we averaged the parents' highest grades and occupational prestige scores. Current family structure includes the respondent's number of children living in the household and marital status. Controls for demographic characteristics include whether the respondent lives in a rural or urban area (rural is reference category), and region of residence (dummy variables for south, northeast, and north central, with west being the reference category).

#### 4.2 Methodology and Analytical Plan

Our analyses proceed in three stages. First, we present descriptive statistics from the 2012 wave for all variables separately by racial group and gender. We use t-tests with means and chi-square with proportions to test for significant differences between groups. Second, to answer the question of whether closing the race and gender educational attainment gaps would reduce race and gender pay gaps, we use the 2012 wave and estimate detailed Blinder-Oaxaca regression decompositions with pooled slopes to decompose race and gender pay gaps (Jann 2008). To address the identification problem inherent in decompositions with categorical variables (wherein the results for the detailed decomposition depend on the reference category used for categorical variables), we use the deviation contrast normalization approach established by Yun (2005). Regression decomposition identifies how much group mean differences in the predictor variables contribute to the pay gaps between two groups.<sup>5</sup> In other words, the means decomposition tells us how much of the race (gender) gap would be explained if blacks (women) had the same means as whites (men). While coefficient differences can also be decomposed, we use random effects models on waves of the data spanning 1979-2012 in order to have sufficient power to detect intersectional differences in the returns to levels of education *within* field of study. For example,

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<sup>5</sup> The pooled slopes method assigns the interaction component between endowments and coefficients to the endowments portion of the decomposition.

in the 2012 wave of data there are too few black women with graduate studies in the physical sciences to reliably estimate its wage return.<sup>6</sup> In the regression decomposition, we address this limitation of small N's in the highest attainment levels within fields of degree by alternately pooling across fields and across levels in separate models. Thus, we present decompositions for post-secondary attainment levels across all fields in Model A, and for fields of study across all post-secondary attainment levels in Model B. Random effects models, the third stage of our analysis, improve upon standard OLS regression by estimating random intercepts that account for the non-independence of observations over time and allow us to capture both within- and between-individual variation for both time-varying and time-invariant characteristics of individuals. Random effects models assume that the error term is not correlated with the predictors; this allows for the inclusion of time-invariant variables as explanatory variables. By allowing for simultaneous estimation of both time-varying and invariant characteristics, random effects models are appropriate for our analyses as other estimation methods for panel data, such as fixed effects models, are limited to individuals who make transitions during the survey period; consequently, those who have fewer educational transitions, particularly less-educated workers, during the full survey period would be excluded from the analysis. For workers who delay employment until after their school completion, values on education do not change over their observed years. This is particularly true of less-educated workers, such as those with high school or less, who are less likely to hold a job prior to education completion, relative to workers who continue on to post-secondary education. Because education is largely time-invariant after some respondents reach their middle-twenties, we treat education as a time-invariant predictor and restrict our sample to post educational

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<sup>6</sup> We used the *xtreg, re* command in Stata 16 for random-effects models. This fits a GLS estimator that produces a matrix-weighted average of the between and within results: [www.stata.com/manuals13/xtxtreg.pdf](http://www.stata.com/manuals13/xtxtreg.pdf). Alternative specifications, including *xtreg, mle*, and *mixed, rml*, provide the maximized likelihood and the restricted maximum likelihood of the random-intercept models, respectively, and both approaches hold more stringent assumptions about the shape of the error term. Though these different specifications estimate similar models, they can produce different estimates [www.stata.com/support/faqs/statistics/xtreg-mle-versus-gmm](http://www.stata.com/support/faqs/statistics/xtreg-mle-versus-gmm). However, the results from alternative specifications using these options produced robustly similar coefficients and standard errors. We thus present the models with the fewest assumptions about the error term (full results available on request).

completion person-years. We run separate models for black men, black women, white men, and white women. Models include education and other human capital, family structure, and demographic indicators, AFQT, and job and industry characteristics measures (see Table 3). Models also include N-1 year dummies for each survey wave to fix effects across time. We use z-tests for significance to test whether coefficients differ by race and gender.

## 5. RESULTS

### 5.1 Descriptive Analysis

Table 1 presents descriptive statistics from the 2012 survey wave for all variables, by race and gender, with significance tests for group differences between every bivariate comparison of the four groups denoted. Our dependent variable, hourly earnings, shows significant race and gender differences. White men have the significantly highest mean hourly rate at \$30.97, followed by black men (\$21.33) and white women (\$21.20), with black women having the significantly lowest rate at \$17.37. This renders the overall racial pay gap among men as 0.69 and 0.82 among women. The overall gender gap is 0.68 among whites and 0.81 among blacks. In results not shown, we analyzed gender and race gaps in pay for the full set of person-years used in the random effects model. Gender and race gaps are smallest among those with doctoral studies, though white men still average, significantly, the highest earnings.

It is important to note that, given the baseline race and gender pay gaps among high-school dropouts, even equivalent returns to educational attainment across race and gender categories will not close the gender and race pay gaps: equivalent returns to education will merely replicate the disparities found among the least educated. Moreover, lower returns to educational attainment for these groups will serve to widen the racial and gender pay gaps at higher levels of education.

-----TABLE 1 ABOUT HERE -----

Focusing on educational measures first we find all groups average around 13 to 14 grades completed (indicating some post-secondary education), with white women averaging the highest attainment, followed by white men, black women, and black men. Black men are most likely, and white women are least likely, to be high school dropouts. In our sample, one-half of black men complete their

education with the high school diploma, compared with about 37-41 percent of women and white men. Black women are more likely to attend some college, either gaining an associate's degree or exiting with no degree. Blacks are less likely to complete 16 grades or pursue graduate studies relative to whites, while white men are most likely to pursue doctoral studies and white women are most likely to attain the master's level. Examining field of study shows that black and white women are concentrating in the same leading fields at each level of educational attainment, though black women are more often found in legal/health studies and white women in humanities. Similar leading fields are business and social sciences. Among men, there is greater racial disparity in field of study. At the bachelor's level, white men are more concentrated in STEM and business, whereas black men are more often found in the social sciences, as well as business. At the doctoral level, natural and social sciences are the leading areas for white men, while humanities and business lead for black men.

Turning to other human capital, the difference in AFQT by race is dramatic, with the mean score for whites around the 56-59<sup>th</sup> percentiles and the mean score for blacks at the 26<sup>th</sup> percentile, consistent with past research. White men have greater job tenure, more experience, and work longer hours than other groups. Black women are more likely to work irregular shifts, and black men and women are more likely to be union members and less likely to hold professional or managerial occupations, relative to whites. In regard to industry, black men are more likely to be in personal and professional services, relative to white men, while black women are more often found in public administration and transportation/public utilities, compared to white women. Women are concentrated in service industries, whereas men are more often found in manufacturing, trade, and construction.

In terms of family background, whites tend to have more highly educated parents and fewer siblings, suggesting greater family resources to invest in their education. With respect to current family structure and demographic characteristics, blacks are less likely to be married, particularly black women, who also live with more children on average, compared to whites. Blacks are more likely to live in urban areas and in the southern region, while whites are more concentrated in the northcentral region.

## 5.2 Decomposing Differences in Educational Attainment and Other Factors by Race and Gender

How much of the within-race gender pay gaps and the within-gender race pay gaps can be attributed to differing on qualifications and pay-related characteristics observed among men and women, blacks and whites? To examine compositional effects on the pay gaps Table 2 presents a set of regression decompositions of the 2012 wave. We estimate the impact of gender and race differences in educational attainment on four wage gaps: the male race gap, the female race gap, the white gender gap, and the black gender gap. Table 2 shows how much gender and race differences in mean scores on each independent variable contribute to the race (and gender) difference in mean wages, net of covariates.

-----TABLE 2 ABOUT HERE-----

Panel 1 and Panel 3 show the effects of two different specifications of education (measured as highest level attained and field of study) on the wage gap in hourly earnings, controlling for socioeconomic background, AFQT, family structure, demographic characteristics, and other human capital measures as detailed in Table 1. Panels 2 and 4 add job characteristics and industrial sector to the predictors included in Panels 1 and 3. These variables are detailed in Table 1. Presenting the findings in this manner allows us to see how mean differences in education contribute to gender and race pay gaps, and, further, how this is moderated by the inclusion of occupational and industrial segregation.

Looking first at the racial gap decompositions in the human capital model of Table 2, Panel 1, Model A, we find that racial differences in educational attainment contribute significantly to the racial pay gaps, and more strongly so among women. The contribution of education to the racial pay gaps is somewhat lessened when we include measures of job characteristics and industry in the full model. Focusing on the full model we find that, among women, closing gaps in post-secondary education matter most for the racial pay gap: Equalizing attainment would close women's racial pay gap by 19 percent in the full model. If black women had white women's levels of some college, bachelor's, or doctoral studies, the racial pay gap among women would close by 4, 2, and 7 percent, respectively. Among men, equalizing educational attainment by race would close the overall racial pay gap by 15 percent in the full model. Lowering black men's high school dropout rates would reduce the racial pay gap by 3 percent.

Equalizing black men's rates of bachelor's, master's, and doctoral studies would close the racial pay gap by 2, 2, and 3 percent, respectively. Model B disaggregates post-secondary education into field of study. Here we collapse across the post-secondary levels and show how field specialization across levels contributes to the pay gaps. Disaggregating by field of study lowers the racial pay gap more among men, relative to women. This analysis shows that if black men had white men's representation in STEM, business, or legal/medical studies, the racial pay gap would close by 2, 1, and 3 percent, respectively. In this analysis, closing the racial attainment gap at lower levels of education explains more of men's racial pay gap. Among women, field of study differences do not contribute to the racial pay gap, suggesting that women are less segregated by race in terms of fields of study. Indeed, the percentage of the gap explained by field of education is smaller (13 percent) than by level of education (19 percent) among women. In contrast, while differences in levels of education explain 15 percent of the male racial pay gap, differences in fields of study explain 17 percent. Differences in family background, current family structure, and demographic characteristics collectively explain 21 percent of the male race gap, while other human capital differences explain 17 percent of the male race gap among men. Comparatively, background factors matter less among women, though closing human capital gaps would explain 15 percent of women's racial pay gap. In detailed results not shown, human capital measures of job tenure and experience account for 14 percent of the male race pay gap, whereas race differences in experience account for 23 percent of the female race pay gap. Moreover, race differences in AFQT scores account for 27 to 57 percent of the race gap for men and women, respectively. This suggests that unmeasured race differences in basic skills, school quality, and community contexts matter for the racial pay gap.

Turning to job and industry characteristics, together these explain 27 percent of the male race gap and 21 percent of the female race gap; most of this contribution is driven by differences in job characteristics, whereas industry accounts for a small part of the male race gap and none of the female race gap. In detailed results not shown, occupational racial segregation accounts for 15 percent of the male racial pay gap and 24 percent of the female racial pay gap. Consistent with our expectations, the inclusion of job and industry characteristics somewhat diminishes the contributions of education (in every

specification) to explaining the racial pay gaps among men and women. This suggests that differential job placement of blacks and whites, even when highly educated, in occupational structures contributes to race gaps in pay. Differences in AFQT, human capital, job characteristics, and industrial sector, while accounting for about 89 percent of the male race gap and 79 percent of the female race gap, do not eliminate the continued importance of education in accounting for racial pay gaps. Even in the fully saturated model, if blacks had whites' educational attainment, the racial pay gap would shrink by 15 to 19 percent overall, for men and women, respectively.

Turning to the gender decompositions, we find no evidence that educational attainment differences between women and men explain the gender gaps within either race. Indeed, if women had the same educational attainment as men of their racial group, the gender pay gap would widen, particularly among blacks. The only exception to this is with respect to field of study among whites. White women's lower representation in STEM and business accounts for 4 and 2 percent of the white gender gap, respectively, and these are only slightly reduced in the full model. Black women's higher representation in medical/legal fields buffer them from experiencing a larger gender pay gap; if they had black men's rates of attainment in these fields the gender pay gap would expand by 8 percent among blacks.

Similarly, SES and family structure do not explain the gender gap among whites, though they account for 13 percent of the gap among blacks. The biggest contributors to the gender pay gap are differences in non-education human capital measures (experience and work hours), which collectively account for around 30 percent of the gender gap among blacks and whites in the full model. Finally, while job characteristics and industry contribute less to the gender pay gap, among whites gender occupational segregation accounts for 12 percent of the white gender pay gap, whereas among blacks, women's overrepresentation in professional services accounts for 17 percent of the black gender pay gap.

Our finding that differences in educational attainment explain more of the racial pay gap than the gender pay gap is consistent with earlier work (Farkas et al., 1997; Kilbourne, England, and Beron, 1994). However, in contrast to those studies, we find that educational attainment explains somewhat more of the racial pay gap among women, whereas segregation by field of study explains somewhat more of the racial

pay gap among men. The location of the race gap in educational attainment matters: closing the race gap in high school completion among men, and closing the race gap in post-graduate studies among women, would have the largest impacts on closing the racial gaps in pay. Among men, blacks' lower attainment of STEM and business fields together explains about 5 to 6 percent of the racial pay gap, collectively. But there is no evidence of segregation by field of study contributing to the racial pay gap among women. Taken together, these findings show that racial and gender differences in attainment partly explain racial pay gaps, but not the gender gaps. We next turn to a random effects analysis and longitudinal data to test differences in returns to educational attainment and fields of study.

### 5.3 Testing for Differences in Returns to Education by Gender and Race

Table 3 shows whether wage returns to the same educational credentials vary by race and gender. This table shows the effects of education—measured alternately as highest level and highest level-by-field of study—from random effects models on person-years restricted to post-educational completion. Here, educational indicators are time-invariant. These models are estimated separately for white men, black men, white women, and black women. Significant differences in coefficients were tested using a z-score test for independent samples between all race-gender groups, using the partial slopes and standard errors from the separate models. Significant differences are noted in the last 6 columns of the table. We replicate the full model (Panels 2 and 4 in Table 2), which includes all control variables listed in Table 1.

As in Table 2, Model A shows the effect of highest education level attained (high school diploma, some college, BA, MA, and doctoral studies, with high school dropouts as the reference category) on logged wage. Whereas these results were condensed in Table 2, here Model B shows the effect of highest level within academic field on logged wage. In our discussion below, we exponentiate coefficients to transform them into percentage effects on wage, following the formula:  $(\exp(b)-1)*100$ .

-----TABLE 3 ABOUT HERE -----

Findings in Table 3 show male advantage in the returns to education—where men of both races receive higher returns to levels and fields of education – and few differences in returns by race among men. Among women, however, we see racial disadvantage in returns: while women of both races generally

receive lower returns to education compared to men, black women additionally receive lower returns relative to white women. We explain these patterns in detail, next.

Model A presents the net returns to education separate for the four race-gender groups under study, where high school dropouts constitute the reference group. Starting with returns to a high school diploma, findings reveal that white men receive the greatest returns from high school completion (9 percent), and this is significantly higher relative to black men and white women who do not receive a significant return from attaining a diploma, though black women receive a 7 percent return. Compared to men, white women receive lower returns to education at some college, bachelor's and master's levels of study, though similar returns for doctoral studies. Black women similarly receive lower returns relative to all men for bachelor's and master's levels of attainment. To illustrate, while men, relative to high school dropouts, receive returns of about 43 percent, 54 percent, and 62 percent for bachelor's, master's, and doctoral levels, women's returns are about 31 percent, 23 to 31 percent, and 50 percent, respectively. Notably, black women receive the lowest returns (23 percent) to the master's level relative to white women (31 percent) and all men (54 percent). Importantly, these higher returns exacerbate the baseline advantage in wages held by white men among high school dropouts and contribute to the gender and race pay gaps.

In Model B we investigate whether returns to education vary by field of study, as well as level of attainment. Again, we observe few differences among men by race in returns. Gender differences predominate here, though we see some differences by race in returns by field of study among women. At the bachelor's level, relative to white men, white women receive lower returns for business fields (white women's return is 33 compared to white men at 47 percent) and in humanities (19 compared to 31 percent). For bachelor's studies in social sciences, black men receive the highest returns at 35 percent, compared to 26 percent for white men, 22 percent for black women, and 12 percent for white women. This is the only bachelor's field where black women compare favorably to white women, though black women still receive lower returns relative to men.

At the master's level, women receive lower returns relative to men, and, in addition, black women receive lower returns relative to white women. For master's studies in STEM, black men receive the highest return at 76 percent, followed by white men at 55 percent, white women at 43 percent, and black women at 4 percent return. Black women are significantly lower than all other groups in returns to master's in STEM. For MBA's, all men and white women receive returns of 53 to 63 percent, compared to black women's return of 31 percent, which is significantly lower than that of all men and white women. At the master's level, white women fare significantly worse in the field of social sciences, with a 16 percent return, compared to black men at 34 percent, white men at 26 percent, and black women at 24 percent. Black women receive a lower return to master's specializations in legal and health fields (43 percent), relative to white men (55 percent). Finally, women receive lower returns to master's studies in humanities, with men earning a 34 to 37 percent return, compared to white women (20 percent) and a negative nonsignificant return for black women.

At the doctoral level, white men receive the highest returns for social science studies with a 49 percent return, compared to black women at 35 percent, white women at 20 percent, and a nonsignificant return for black men. White women earn the highest returns for doctoral studies in business, with a 76 percent return, compared to 66 percent for white men, 55 percent for black men, and a nonsignificant 12 percent return for black women. These lower returns for black men and black women might reflect lower completion rates of doctoral degrees (Wolpin 2015), however, we do not consistently find that black women and men receive lower returns for doctoral studies, as we will see next. For doctoral studies in STEM, black men receive the highest return (124 percent) relative to white women (46 percent), white men (40 percent), and black women, who are too few in this field to estimate a return. Along with black women, black men and white women are underrepresented in STEM doctoral programs, despite commanding a high return to this field of study. In doctoral studies in law and medicine, the returns among the four groups are not significantly different, but are large and significant for all groups. Finally, for doctoral studies in the humanities, only black women receive a significant return, at 36 percent, compared to other groups whose returns are nonsignificant.

Taken together, these findings for disparities in the returns to education show that while black men fare worse than white men at lower levels of education, receiving lower returns to high school completion, women persistently receive lower returns relative to men to their educational attainment at the bachelor's and master's levels, with black women frequently receiving the lowest returns to the master's level. At the doctoral level, perhaps because of their rarity in some fields, white women, black men, and more rarely, black women, have the highest returns to varying fields. Generally, while increasing educational attainment raises wages, due to the differential returns, particularly at bachelor's and master's levels, educational attainment does not help to close the baseline gender and racial pay gaps. Strikingly for black women, outside of social sciences and the humanities, greater educational attainment does not net them comparable wage increases, relative to all other groups. Indeed, all else equal, they experience greater wage disparities relative to their white and male peers, than those experienced by less educated black women. This means that while educational attainment raises black women's pay, it raises white men's, white women's, and black men's pay even more, and creates greater disparities between black women and all other groups at higher levels of education.

## 6. DISCUSSION

The potential impact of a college degree on equalizing opportunities for marginalized groups' economic success is high, as Torche (2011:764) states, "a college degree fulfills the promise of meritocracy—it offers equal opportunity for economic success regardless of the advantages of origins." But this promise is unfulfilled if the wage returns to the same educational attainment, such as a college degree, differ by markers of social inequality, such as gender and race. The intersectional approach of this study reveals dramatic differences in the role education plays in pay disparities between black men, black women, white men, and white women. Our models show that there is not one race story or one gender story, rather the intersecting identities of race and gender relate in unique ways to educational attainment and pay. Our discussion unpacks these multiple differences.

Our first research question focused on whether equalizing educational attainment by race and gender would significantly reduce racial pay gaps among women and men and gender pay gaps among

blacks and whites. Our findings reveal that closing the attainment gap matters more for closing racial pay gaps than for reducing gender pay gaps. Our decomposition findings show that if black men had the same educational attainment as white men, particularly in high school completion and in post-secondary degrees and in the fields of STEM, business, and legal/medical studies, the male racial pay gap would close by 15 to 20 percent. Introducing occupational and industrial segregation measures slightly reduces mean differences in educational attainment to the male race gap.

The race story among women is similar: if black women had white women's educational attainment, the female racial gap would close by 18 to 23 percent. Most of this is driven by black women's lower rates of college and graduate studies. Similar to men, adding occupational and industrial characteristics explains some of the impact of education on the race gap among women: this indicates that educational attainment differences may lead to dissimilar occupations for blacks and whites. But the resilience of significant effects for education in the fully specified model suggests that blacks' lower attainment may suppress their career advancement within occupations and industries. Thus, closing the racial attainment gap would reduce the racial pay gap among men and women.

Unlike education's contribution to the racial pay gaps, overall attainment differences explain none of the gender pay gaps among blacks or whites. When we disaggregate education by field of study, we see that field matters for the gender gap among whites. White women's underrepresentation in STEM and business, relative to white men, explains 4 to 6 percent of the white gender gap. In contrast, disaggregating by field of study explains none of the gender gap among blacks. This suggests that raising educational attainment generally for women will not impact gender pay gaps. However, increasing the number of women in STEM and business fields will help close the gender gap among whites.

Our second major research question was whether our race-gender groups received the same returns to the same educational attainment. Given the baseline race and gender pay gaps among high-school dropouts, any finding of equivalent returns to educational attainment across race and gender categories will not be enough to close the gender and race pay gaps; equivalent returns will merely replicate these baseline disparities. In addition, lower returns to educational attainment for women or

black men will widen baseline racial and gender pay gaps. Our intersectional approach reveals striking findings in the wage returns to education: we find persistently lower returns to educational attainment for women relative to men. Moreover, while we find equivalent returns by race among men, black women consistently receive the lowest returns to education in every specification of the model relative to white men, white women and, to a lesser extent, relative to black men. With other human capital, AFQT, socioeconomic background, region, and current family structure controlled, these factors cannot explain women's, particularly black women's, lower wage returns.

White women receive lower returns relative to white men, and often black men, to every level of education except doctoral studies. These lower returns are found in more female-dominated fields of humanities and social science, as well as male-dominated fields of business and STEM. This indicates that the gender wage gap among whites grows at higher levels of education. Moreover, black women receive lower returns than do white and black men at the bachelor's level, and lower returns to the master's level relative to all men and white women. Black women's disparities in wage returns are found in STEM, business, humanities, and social science. This indicates that the wage disparities between black women and other groups grow with educational attainment; even as education raises wages generally, it pays less well for black women. Importantly, these effects are net of occupation and industry, showing that black women's lower returns to education do not result from segregation into lower-earning jobs. Rather, black women are underpaid for their educational attainment even when they occupy the same occupations and industries as other groups.

Black women's lower returns to high educational attainment, particularly to graduate studies, may result from a combination of organizational racism (Acker, 2011) and tokenism (Kanter, 1977). Black women in any organization confront racially and gender-biased assumptions from supervisors and co-workers around their suitability for jobs, promotions, and responsibility (Acker, 2011). Highly-educated black women in professional occupations may face heightened implicit bias because they are numerically rare. Being a token in terms of gender, race, and level of education, along with confronting racism and sexism that are institutionalized in the workplace, may prevent black women from accessing the

mentorship, sponsorship, and professional development needed to advance their careers and realize the wage returns for educational investments (Sesko and Biernat, 2010; Watkins et al., 2019; Yoder and Aniakudo, 1997). The triple jeopardy highly educated black women face in terms of tokenism is rarely studied. As Watkins et al. (2019) point out, “there is a relative absence of research that acknowledges the implications of being a token for those who identify with more than one token group” (p. 358). Research on workplace processes using large samples of black women who are highly educated would greatly illuminate why they are not receiving the same payoffs for their education in terms of wages.

A limitation of our study is that we lack data on workplace composition, workplace interactions, and employer behaviors. Because of this, we cannot measure or test for tokenism, bias, or discrimination. However, a recent study offers support for the triple jeopardy faced by highly educated black women in securing high paying positions. In a study sponsored by McKinsey & Co. and LeanIn.org, Rachel Thomas and collaborators surveyed over 68,500 employees in 329 companies and found strong evidence of a leaky pipeline for black women moving up corporate ladders (Thomas et al., 2019). Their data showed that for every 100 men hired in entry-level roles who are subsequently promoted to mid-level management, only 72 women are so promoted, and this number falls to 58 for black women. This disparity gets worse up the corporate ladder. White men’s representation grows from 35 percent of entry-level employees, to 51 percent of senior management, to 68 percent of C-suite leaders. Compared to this, white women’s proportions are 30 percent, 26 percent, and 18 percent, men of color are 16 percent, 14 percent, and 10 percent, while women of color are 18 percent, 9 percent, and 4 percent (Thomas et al., 2019). Thomas et al. (2019) describe this career ladder for black women as containing a “broken rung,” and their data point to unwelcoming workplace climates, lack of sponsorship, and being overlooked for promotions and opportunities as key contributors to black women’s lower advancement. Their data show that black women’s performance may be undervalued: black women report high rates of having their competence questioned, being disrespected, and experiencing microaggressions, relative to all other groups studied. Thus, black women’s treatment in the workplace, particularly when they are tokens, may be preventing them from realizing the wage gains to educational attainment.

Turning education's returns for other groups, some evidence indicates lower returns for black men and white women. Compared to white men, black men receive lower returns to high school completion. White men's higher returns for high school diplomas are not explained by their stronger job characteristics, gender and racial occupational segregation, or industrial sector. Our findings are consistent with employers devaluing high school diplomas held by black men and reveal a more robust labor market for less-educated white men. At the doctoral level, black men receive higher returns to STEM fields, though their rates of attainment are very low. In contrast, they receive lower returns relative to white women for doctoral studies in social sciences, which is a more common field among black men. Receiving similar wage returns to educational credentials does not imply that education is narrowing wage disparities between white men and black men. Importantly, because returns to education are relative to the wages of those not graduating from high school *within the same gender-race group*, the absence of differences in the rates of returns indicate that the race gap in pay in comparison to white men who are high school dropouts is replicated among men at higher levels of education.

To conclude, we find that while the racial and gender gaps in education are closing overall, the relative lack of women and minority men in STEM fields contributes to gender and racial pay gaps. Moreover, racial and gender differences in the effects of education on wages are significant and highlight the differential payoff black women receive on their educational investments. There are several policy implications of our study. First, diversifying educational fields of study by recruiting and supporting women and minorities, particularly in STEM fields, will reduce the gender and racial pay gaps. But the findings for black women show that even those with graduate studies do not realize the wage gains for their educational attainment. This suggests that increasing diversity in the highly educated workforce must be accompanied by disrupting implicit bias in workplaces. In order for highly educated minorities, particularly black women, to receive wages commensurate with their education, unconscious bias in hiring, project assignments, and promotions should be examined. Related to this, employer efforts to increase mentorship and sponsorship of black women may support them in successfully navigating an

unequal playing field. Future studies of black women's returns to education with measures for workplace diversity, equity and inclusion initiatives are needed to inform these policy implications.

## References

- Acker, J., 2011. Theorizing Gender, Race, and Class in Organizations. In: Jeane, E. L., Knights, D., Martin, P.Y. (Ed.), *Handbook of Gender, Work, and Organizations*, John Wiley and Sons, West Sussex, UK, pp. 65-80
- Alegria, S., Branch, E. H., 2015. Causes and Consequences of Inequality in the STEM: Diversity and its Discontents. *International Journal of Gender, Science and Technology* 7, 321-342.
- Ashraf, J., 1994. Differences in Returns to Education: An Analysis by Race. *American Journal of Economics and Sociology* 53, 281–290.
- Averett, S., Dalessandro, S., 2001. Racial and gender differences in the returns to 2-year and 4-year degrees. *Education Economics* 9, 281-292.
- Bardasi, E., Gornick, J., 2008. Working for Less? Women’s Part-time Wage Penalties Across Countries. *Feminist Economics* 14, 37-72.
- Blau, F., Kahn, L., 2017. The Gender Wage Gap: Extent, Trends, and Explanations. *Journal of Economic Literature* 55, 789-865.
- Bobbitt-Zeher, D., 2007. The Gender Income Gap and the Role of Education. *Sociology of Education* 80, 1-22.
- Bradley, C. L., Renzulli, L. A., 2011. The Complexity of Non-Completion: Being Pushed or Pulled to Drop Out of High School. *Social Forces* 90(2), 521-545.
- Budig, M. J., England, P., 2001. The Wage Penalty for Motherhood. *American Sociological Review* 66, 204-225
- Card, D., 2001. Unions and Wage Inequality in the US. *Industrial and Labor Relations Review* 54, 296-315.
- Carnevale, A. P., Fasules, M. L., Porter, A., Landis-Santos, J., 2016. *African Americans: College Majors and Earnings*. Center on Education and the Workforce, Washington, DC.

- Carnevale, A. P., Stephen R. J., Cheah, B., 2011. The College Payoff: Education, Occupations, Lifetime Earnings. Center on Education and the Workforce, Washington, DC.
- Charles, M., Bradley, K., 2002. Equal but Separate? A Cross-National Study of Sex Segregation in Higher Education. *American Sociological Review* 67(4):573-599.
- . 2009. Indulging Our Gendered Selves? Sex Segregation by Field of Study in 44 Countries. *American Journal of Sociology* 114, 924-76.
- Cohen, C. J., Nee, C.E., 2000. Educational Attainment and Sex Differentials in African American Communities. *American Behavioral Scientist* 4, 1159-1206.
- Corcoran, M., Duncan, G.J., 1979. Work History, Labor Force Attachment, and Earnings Differences Between the Races and Sexes. *Journal of Human Resources* 14, 3-20.
- Crissey, S. R., 2009. Educational Attainment in the United States: 2007. US Census Bureau P20-560. Government Printing Office, Washington, D.
- Dale, S., Krueger, A. B., 2011. Estimating the Return to College Selectivity over the Career Using Administrative Earnings Data. NBER Working Paper 17159.
- Deming, D. J., Cohodes, S., Jennings, J., Jencks, C., 2016. School Accountability, Postsecondary Attainment, and Earnings. *The Review of Economics and Statistics* 98(5):848-62.
- Dickson, L., 2010. Race and Gender Differences in College Major Choice. *The Annals of the American Academy of Political and Social Science* 627, 108-124.
- DiPrete, T. A., Buchmann, C., 2013. The Rise of Women: The Growing Gender Gap in Education and What It Means for American Schools. New York: Russell Sage Foundation.
- England, P., Allison, Paul, Li, S., Mark, N., Thompson, Budig, M.J., Sun, H., 2007. Why Are Some Academic Fields Tipping toward Female? The Sex Composition of U.S. Fields of Doctoral Degree Receipt, 1971-2002. *Sociology of Education* 80(1): 23-42.
- England, P., Christopher, K., Reid, L., 1999. Gender, Race, Ethnicity, and Wages. In *Latinas and African American Women at Work: Race, Gender, and Economic Inequality*, Irene Browne, editor. New York: Russell Sage Foundation.

- Farkas, G., England, P., Vicknair, K., Kilbourne, B.S., 1997. Cognitive Skill, Skill Demands of Jobs, and Earnings among Young European American, African American, and Mexican American Workers. *Social Forces* 75, 913-40.
- Fletcher, J. M., Wolfe, B. L., 2009. Education and Labor Market Consequences of Teenage Childbearing: Evidence Using the Timing of Pregnancy Outcomes and Community Fixed Effects. *Journal of Human Resources* 44, 303-325.
- Gaddis, M. S., 2015. Discrimination in the Credential Society: An Audit Study of Race and College Selectivity in the Labor Market. *Social Forces* 93, 1451-79.
- Glenn, E. N., 2002. *Unequal Freedom: How Race and Gender Shaped American Citizenship and Labor*. Harvard University Press, Cambridge.
- Goldin, C., Katz, L., 2008. *The Race Between Education and Technology*. Belknap Press, Cambridge.
- Gottschalk, P., Danziger, S., 2005. Inequality of wage rates, earnings and family income in the United States, 1975–2002. *Review of Income and Wealth* 51, 231-254.
- Greenman, E. and Xie, Y., 2008. Double Jeopardy? The Interaction of Gender and Race on Earnings in the United States. *Social Forces* 86, 1217-1244.
- Grotsky, E., and Pager, D., 2001. The Structure of Disadvantage: Individual and Occupational Determinants of the Black-White Wage Gap. *American Sociological Review* 66, 542-67.
- Hodges, M., and Budig, M.J., 2010. Who Gets the Daddy Bonus? Organizational Hegemonic Masculinity and the Impact of Fatherhood on Earnings. *Gender & Society*, 24, 717-745.
- Hout, M., 2012. Social and Economic Returns to College Education in the United States. *Annual Review of Sociology* 38, 379-400.
- Huffman, M. L., Cohen, P. N., 2004. Racial Wage Inequality: Job Segregation and Devaluation across U.S. Labor Markets. *American Journal of Sociology* 109, 902-36.
- Jann, B., 2008. The Blinder-Oaxaca Decomposition for Linear Regression Models. *The Stata Journal*, 8, 453-79.
- Kanter, R.M., 1977. *Men and Women of the Corporation*. Basic Books, New York.

- Kena, G., Hussar, W., McFarland, J., de Brey, C., Musu-Gillette, L., Wang, X., Dunlop Velez, E., 2016. The Condition of Education 2016 (NCES 2016-144). Educational Attainment of Young Adults. U.S. Department of Education, National Center for Education Statistics. Government Printing Office, Washington, DC. Available at: <https://nces.ed.gov/fastfacts/display.asp?id=27>
- Kilbourne, B., England, P., Beron, K., 1994. Effects of Individual, Occupational, and Industrial Characteristics on Earnings: Intersections of Race and Gender. *Social Forces* 72, 1149-1176.
- Kilbourne, B., England, P., Farkas, G., Beron, K., Weir, D., 1994. Returns to Skill, Compensating Differentials, and Gender Bias: Effects of Occupational Characteristics on the Wages of White Women and Men. *American Sociological Review* 100, 689-719.
- Killewald, A., 2013. A Reconsideration of the Fatherhood Premium: Marriage, Coresidence, Biology, and Fathers' Wages. *American Sociological Review* 78, 96-116.
- Mandel, H., Semyonov, M., 2016. Going Back in Time? Gender Differences in Trends and Sources of the Racial Pay Gap, 1970-2010. *American Sociological Review* 81, 1039-68.
- Marini, M. M., Fan, P.L., 1997. The Gender Gap in Earnings at Career Entry. *American Sociological Review* 62, 588-604.
- Ma, Y., 2009. Family socioeconomic status, parental involvement, and college major choices—gender, race/ethnic, and nativity patterns. *Sociological Perspectives* 52, 211-34.
- Ma, Y., Savas, G., 2014. Which is more consequential: Fields of study or institutional selectivity? *The Review of Higher Education* 37, 221-47.
- McDaniel, A., DiPrete, T. A., Buchmann, C., Shwed, U., 2011. The black gender gap in educational attainment: Historical trends and racial comparisons. *Demography* 48, 889-914.
- Monarrez, T., Washington, K., 2020. Racial and Ethnic Representation in Postsecondary Education. Urban Institute Center of Education Data and Policy, Washington, D.C.
- National Center for Education Statistics (NCES). 2015. Table 104.10. Rates of high school completion and bachelor's degree attainment among persons age 25 and over, by race/ethnicity and sex: Selected years, 1910 through 2015.

- Nunley, J. M., Pugh, A., Romero, N., Seals, R. A., 2015. Racial Discrimination in the Labor Market for Recent College Graduates: Evidence from a Field Experiment. *B.E. Journal of Economic Analysis & Policy* 15, 1093-125.
- O'Neill, J., 1990. The Role of Human Capital in Earnings Differences Between Black and White Men. *Journal of Economic Perspectives* 4,25-45.
- Orr, A. J., 2003. Black-White Differences in Achievement: The Importance of Wealth. *Sociology of Education* 76, 281-304.
- Perna, L. W., 2005. The Benefits of Higher Education: Sex, Racial/Ethnic, and Socioeconomic Group Differences. *The Review of Higher Education* 29, 23-52.
- Presser, H. B., 2003. Race-Ethnic and Gender Differences in Nonstandard Work Shifts. *Work and Occupations* 30, 412-39.
- Quadlin, N., 2018. The Mark of a Woman's Record: Gender and Academic Performance in Hiring. *American Sociological Review* 83, 331-60.
- Reid, L. L., 1998. Devaluing Women and Minorities: The Effects of Race/Ethnic and Sex Composition of Occupations on Wage Levels. *Work and Occupations* 25, 511-36.
- Rodgers, W.M., Spriggs, W.E., 1996. What Does the AFQT Really Measure: Race, Wages, Schooling, and the AFQT Score. *Review of Black Political Economy* 24, 13-45.
- , 2002. Accounting for the Racial Gap in AFQT Scores: Comment on Nan L. Maxwell, The Effect on Black-White Wage Differences of Differences in the Quantity and Quality of Education. *Industrial and Labor Relations Review* 55, 533-41.
- Sesko, A. K., Biernat, M., 2010. Prototypes of Race and Gender: The Invisibility of Black Women. *Journal of Experimental Social Psychology* 46, 356-360.
- Sewell, W. H., Archibald H. O., Portes, A., 1969. The Educational and Early Occupational Attainment Process. *American Sociological Review* 34, 82-92.
- Siebens, J., Ryan, C. L., 2012. Field of Bachelor's Degree in the United States: 2009. *American Community Survey Reports, ACS-18*. US Census Bureau, Washington, DC.

- Smith, R. A., 1997. Race, Income, and Authority at Work: A Cross-Temporal Analysis of Black and White Men. *Social Problems* 44, 19-37.
- Sowell, R., Allum, J., and Okahana, H., 2015. Doctoral Initiative on Minority Attrition and Completion. Washington, DC: Council of Graduate Schools.
- Steinberg, R. J., 1990. Social Construction of Skill: Gender, Power, and Comparable Worth. *Work and Occupations* 17, 449-482.
- Thomas, R., Cooper, M., Konar, E., Bohrer, A., Mohsenin, A., Yee, L., Krivkovich, A., Starikova, Huang, J., Sanoschi, D., 2019. Women in the Workplace 2019. A report from McKinsey and Company and LeanIn.Org. Available at: <https://www.mckinsey.com/featured-insights/gender-equality/women-in-the-workplace-2019#>.
- Tomaskovic-Devey, D., Thomas, M., Johnson, K., 2005. Race and the Accumulation of Human Capital Across the Career: A Theoretical Model and Fixed-Effects Application. *American Journal of Sociology* 111, 58-89.
- Tomaskovic-Devy, D., 1993. The Gender and Race Composition of Jobs and the Male/ Female, White/Black Pay Gaps. *Social Forces* 72, 45-76.
- Torche, F., 2011. Is a College Degree Still the Great Equalizer? Intergenerational Mobility Across Levels of Schooling in the United States. *American Journal of Sociology* 117,763-807.
- U.S. Bureau of the Census. 2012. Table 3. Detailed Years of School Completed by People 25 Years and Over by Sex, Age Groups, Race, and Hispanic Origin: 2012. Current Population Survey, 2012 Annual Social and Economic Supplement. Government Printing Office, Washington, DC.
- U.S. Bureau of the Census. 1993. 1990 Census of the Population Supplementary Reports: Detailed Occupation and Other Characteristics from the EEO File for the United States. Government Printing Office, Washington, DC.
- US Bureau of Labor Statistics. 2015. Usual Weekly Earnings of Wage and Salary Workers Fourth Quarter 2014. Government Printing Office, Washington, DC. USDL-15-0071. Available at: [https://www.bls.gov/news.release/archives/wkyeng\\_01222016.pdf](https://www.bls.gov/news.release/archives/wkyeng_01222016.pdf)

- Watkins, M. B., Simmons, A., Umphress, E., 2019. It's Not Black and White: Toward a Contingency Perspective on the Consequences of Being a Token. *Academy of Management Perspectives* 33, 334-365.
- Wolpin, K., 2005. Education data in the NLSY79: a Premiere Research Tool. *Monthly Labor Review*, February, 15-20.
- Wright, E. O., 1978. Race, Class, and Income Inequality. *American Journal of Sociology* 83, 1368-1397.
- Yoder, J., Aniakudo, P., 1997. 'Outsider Within' the Firehouse: Subordination and Difference in the Social Interactions of African American Women Firefighters. *Gender & Society* 11, 324-341.
- Yun, M. S. 2005. A simple Solution to the Identification Problem in Detailed Wage Decompositions. *Economic Inquiry* 43: 766-772.
- Zhou, X., 2019. Equalization or Selection? Reassessing the 'Meritocratic Power' of a College Degree in Intergenerational Income Mobility. *American Sociological Review* 84, 459-85.

**Table 1. Means, Proportions, Standard Errors, and Significance Tests, 2012 Wave, Weighted**

	White Men N=893	Black Men N=377	White Women N=990	Black Women N=540	Significance Tests					
					Relative to ...White Men			...White Women		...Black Men
					Black Men	White Women	Black Women	Black Men	Black Women	Black Women
Number of Person-years										
<b>Dependent Variable</b>										
Log Wage	3.27	2.88	2.88	2.70	***	***	***		***	***
Hourly Wage (Overall)	\$30.97	\$21.33	\$21.20	\$17.37	***	***	***		***	***
<b>Education</b>										
Highest Grade	14.03	13.23	14.21	13.64	***		***	***	***	**
<u>Level</u>										
High School Dropout	3.6%	6.6%	2.7%	4.4%	*			***		
High School Graduate	41.0%	50.0%	37.3%	38.1%	**			***		***
Some College	21.2%	24.2%	25.2%	35.9%		*	***		***	***
Bachelor's Level	18.7%	13.2%	16.8%	11.9%	*		***		**	
Master's Level	9.3%	4.4%	12.5%	7.6%	**	*		***	**	*
Doctoral Level	6.2%	1.7%	5.6%	2.1%	***		***	**	**	
<u>Level and Major</u>										
BA: STEM	6.2%	2.2%	2.4%	1.7%	**	***	***			
BA: Social Sciences	3.5%	5.0%	3.9%	2.5%						
BA: Business	6.8%	4.9%	5.1%	3.9%			*			
BA: Law/Health	0.4%	0.4%	2.4%	2.6%		***	***		*	
BA: Humanities	1.8%	0.8%	3.0%	1.3%				**		
MS: STEM	2.4%	1.0%	1.0%	0.9%		*				
MA: Social Sciences	2.0%	1.0%	5.8%	2.5%		***		***	**	
MA: Business	4.1%	1.7%	2.4%	2.0%	*	*	*			
MA: Law/Health	0.1%	<0.1%	1.9%	1.2%		***	*			*
MA: Humanities	0.7%	0.6%	1.3%	1.0%						
PhD: STEM	0.7%	<0.1%	0.6%	<0.1%	*			*		
PhD: Social Sciences	2.1%	0.2%	2.4%	1.3%	***			***		*
PhD: Business	1.1%	0.6%	0.8%	0.2%			*			
JD/MD	2.0%	<0.1%	1.4%	0.6%						
PhD: Humanities	0.3%	0.9%	0.4%	<0.1%						
<b>Human Capital</b>										
AFQT	59.17	25.85	56.04	25.69	***	**	***	***	***	
Job Tenure	12.24	10.37	10.53	10.44	***	***	***			
Work Experience	30.43	27.40	27.63	25.43	***	***	***		***	***

	White Men N=893	Black Men N=377	White Women N=990	Black Women N=540	Significance Tests					
					Relative to ...White Men			...White Women		...Black Men
					Black Men	White Women	Black Women	Black Men	Black Women	Black Women
Number of Person-years					***	***	***	***	*	***
Usual Work Hours	44.07	41.96	36.77	38.31						
# of Jobs Ever Held	1.37	1.39	1.40	1.34						
<b>Job Characteristics</b>										
Irregular Shift	8.9%	9.3%	9.1%	11.5%						
Union Member	9.0%	12.2%	6.7%	12.3%				**	**	
% Female in Occ*Ind Cell	33.7%	33.7%	66.5%	66.7%		***	***	***		***
% Black in Occ*Ind Cell	23.9%	33.4%	25.4%	32.4%	***	**	***	***	***	
Professional/Manager	36.7%	21.1%	33.3%	25.2%	***		***	***	***	
<b>Industry</b>										
Extractive Industries	3.0%	1.3%	0.5%	<0.1%		***	*			***
Construction	10.6%	8.4%	1.9%	0.6%		***	***	***	*	***
Manufacturing	22.4%	17.6%	8.5%	8.5%		***	***	***		***
Transportation & Other Utilities	11.5%	15.1%	5.6%	9.5%		***		***	**	*
Retail & Wholesale Trade	13.3%	8.8%	11.6%	9.2%	*		*			
Financial Services	5.8%	4.2%	8.4%	6.6%		*		**		
Business Services	6.2%	4.1%	5.1%	2.6%			**		*	
Personal Services	5.5%	9.5%	8.0%	9.6%	*		**			
Entertainment	1.2%	2.0%	1.9%	0.7%						
Professional Services	13.6%	21.1%	42.5%	42.4%	*	***	***	***		***
Public Administration	6.9%	7.9%	6.2%	10.5%			**		**	
<b>Family &amp; Demographics</b>										
Currently Married	72.3%	56.7%	68.5%	36.7%	***		***	***	***	***
# of Children	1.65	1.87	1.74	1.92	**		***		**	
Age	50.76	50.70	50.70	50.77						
Number of Siblings	2.92	4.37	2.97	4.60	***		***	***	***	
Parent's Education	12.26	10.85	12.04	10.61	***	*	***	***	***	
Urban Residence	71.5%	88.2%	69.0%	89.4%	***		***	***	***	
Region: NE	17.1%	13.1%	18.7%	13.4%				**	**	
Region: NC	35.5%	17.1%	34.5%	18.3%	***		***	***	***	
Region: South	31.2%	62.8%	31.7%	62.6%	***		***	***	***	

Notes: N= 2,828. \*\*\* is p < .001, \*\* is p < .01, and \* is p < .05, two-tailed tests.

**Table 2. Percentage of the Race and Gender Wage Gaps Explained, from Decomposition Models of Education and Control Variables on Ln Earnings, By Race and Gender (2012)**

	Panel 1		Panel 2		Panel 3		Panel 4	
	Race Gap Decomposition, Human Capital Model		Race Gap Decomposition, Full Model		Gender Gap Decomposition, Human Capital Model		Gender Gap Decomposition, Full Model	
	Men N=1270	Women N=1530	Men N=1270	Women N=1530	White N=1883	Black N=917	White N=1883	Black N=917
<b>MODEL A</b>								
HS Dropout	3.61 *	3.27 +	3.35 *	2.61 +	-1.09	-3.72	-0.97	-2.82
HS Diploma	4.67 *	1.49	4.00 *	1.31	-2.08	-11.56 **	-1.79	-9.16 *
Some College	0.68	5.13 **	0.53	4.28 *	0.82 +	3.78	0.53	3.68
BA / BS	2.79 **	2.66 *	1.95 *	1.78 +	0.77	-0.07	0.61	-0.04
MA / MS	2.74 *	3.07 *	2.12 *	2.11	-1.59 *	-2.33	-1.28 *	-1.67
Doctoral Studies	2.53 **	7.41 ***	2.86 **	6.73 **	0.47	-0.35	0.42	-0.38
<i>Sum of Levels</i>	<i>17.03 ***</i>	<i>23.03 ***</i>	<i>14.81 ***</i>	<i>18.81 ***</i>	<i>-2.70</i>	<i>-14.26 *</i>	<i>-0.97</i>	<i>-2.82</i>
<b>MODEL B</b>								
HS Dropout	4.40 *	3.56 +	4.03 *	2.65 +	-1.19	-4.79 +	-1.03	-3.56
HS Diploma	6.04 *	1.68	5.27 *	1.34	-2.47 +	-14.55 **	-2.05 +	-11.27 **
Some College	1.20	6.52 **	1.03	4.77 *	1.27 +	6.61 *	0.87 +	5.82 *
BA+ STEM	3.15 **	2.02	2.05 *	1.46	3.53 ***	1.45	2.73 ***	0.98
BA+ Social Science	-0.04	-1.26	-0.07	-1.59	0.30	0.05	0.56	0.04
BA+ Business	2.29 *	2.70	1.23 *	1.64	2.29 *	0.65	1.64 *	0.14
BA+ Legal/Medical	3.24 ***	3.44	3.43 ***	3.51	-3.69 ***	-6.26 *	-3.77 ***	-7.58 *
BA+ Humanities	-0.05	-1.16	-0.02	-1.25	0.27	-0.12	0.30	-0.09
<i>Sum of Fields</i>	<i>20.22 ***</i>	<i>17.49 **</i>	<i>16.96 ***</i>	<i>12.53 **</i>	<i>0.31</i>	<i>-16.95 *</i>	<i>-0.74</i>	<i>-15.52 **</i>
<b>ALL MODELS</b>								
SES, Family, Region	21.13 ***	10.41	20.59 ***	6.82	1.96	12.92 *	2.07	13.27 *
Other Human Capital	18.78 ***	18.55 *	16.65 ***	14.87 *	35.13 ***	38.28 ***	29.29 ***	30.75 **
AFQT	35.58 ***	67.00 ***	27.18 ***	57.43 ***	2.35 +	1.53	1.88 +	1.17
Job Characteristics			20.27 ***	26.12 ***			15.33 ***	3.61
Industry			6.24 **	-5.42			6.80 *	9.16

Notes: \*\*\* is p < .001, \*\* is p < .01, and \* is p < .05 two-tailed tests. All categorical variables are normalized and pooled slopes are used.

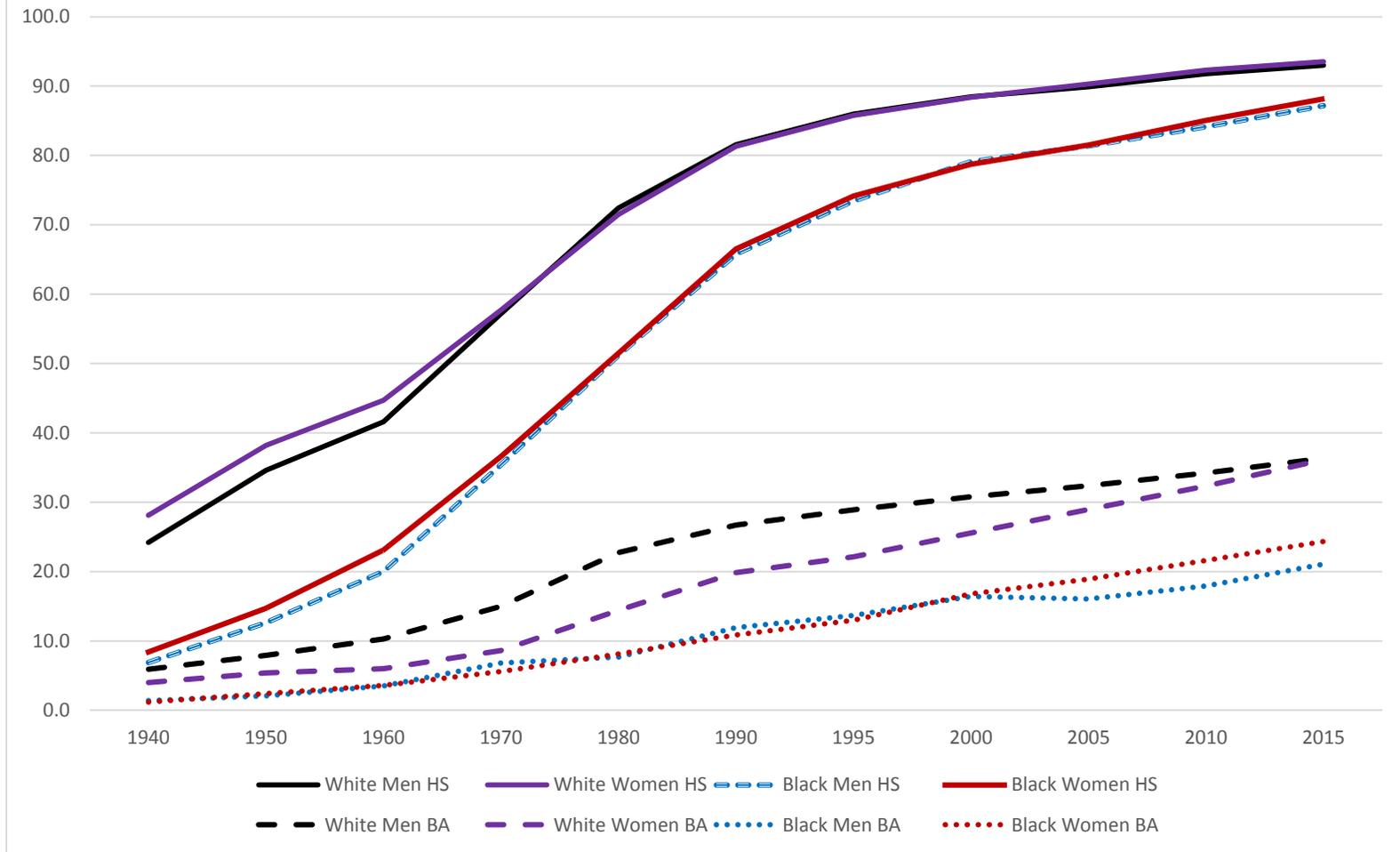
**Table 3. Coefficients and Standard Errors from Random Effects Models Regressing Alternate Specifications of Education and All Control Variables on Ln Earnings, Separate Models with Significance Tests for Differences by Gender and Race**

								Significance Tests				
	White Men		Black Men		White Women	Black Women	Relative to White Men			Relative to White Women	Relative to Black Men	
							Black Men	White Women	Black Women	Black Men	Black Women	Black Women
<b>MODEL A</b>												
HS Diploma	0.087	***	0.031		0.021		0.068	*	**	***		
	(0.022)		(0.029)		(0.027)		(0.039)					
Some College	0.198	***	0.159	***	0.116	***	0.16	***		***	**	
	(0.027)		(0.034)		(0.030)		(0.042)					
BA / BS	0.365	***	0.351	***	0.252	***	0.285	***		***	*	***
	(0.031)		(0.045)		(0.034)		(0.049)					
MA / MS	0.431	***	0.435	***	0.272	***	0.208	***		***	***	***
	(0.037)		(0.061)		(0.038)		(0.059)					
Doctoral Studies	0.481	***	0.482	***	0.408	***	0.416	***				
	(0.042)		(0.086)		(0.048)		(0.078)					
<b>MODEL B</b>												
HS Diploma	0.061	***	0.012		0.011		0.065	*	**	***		*
	(0.021)		(0.028)		(0.025)		(0.038)					
Some College	0.166	***	0.137	***	0.106	***	0.158	***		***		
	(0.025)		(0.034)		(0.029)		(0.041)					
BA STEM	0.339	***	0.345	***	0.320	***	0.293	***				
	(0.035)		(0.066)		(0.047)		(0.074)					
BA Social Science	0.228	***	0.303	***	0.109	***	0.200	***		***	*	***
	(0.039)		(0.055)		(0.037)		(0.056)					
BA Business	0.387	***	0.349	***	0.282	***	0.318	***		***		
	(0.034)		(0.060)		(0.038)		(0.057)					
BA Legal/Health	0.438	***	0.43	***	0.446	***	0.392	***				
	(0.075)		(0.100)		(0.046)		(0.066)					
BA Humanities	0.27	***	0.243	**	0.172	***	0.240	**		***		
	(0.046)		(0.078)		(0.042)		(0.087)					
MA STEM	0.44	***	0.566	***	0.357	***	0.043			*	***	***
	(0.052)		(0.100)		(0.065)		(0.098)					

									Significance Tests		
					Relative to White Men			Relative to White Women		Relative to Black Men	
	White Men	Black Men	White Women	Black Women	Black Men	White Women	Black Women	Black Men	Black Women	Black Women	
MA Social Science	0.228 *** (0.049)	0.29 *** (0.083)	0.146 *** (0.041)	0.215 ** (0.068)		**		*			
MA Business	0.486 *** (0.045)	0.428 *** (0.089)	0.462 *** (0.061)	0.272 *** (0.080)			**		***	***	
MA Legal/Health	0.437 *** (0.097)	0.458 *** (0.132)	0.427 *** (0.057)	0.36 *** (0.090)			*				
MA Humanities	0.289 *** (0.063)	0.315 ** (0.117)	0.184 *** (0.066)	-0.066 (0.104)		***	***		**	***	
PhD: STEM	0.333 *** (0.080)	0.808 *** (0.205)	0.375 *** (0.107)	N/A	*			*			
PhD: Social Science	0.398 *** (0.059)	0.133 (0.157)	0.178 *** (0.064)	0.303 ** (0.096)		***					
PhD: Business	0.507 *** (0.098)	0.439 ** (0.136)	0.565 *** (0.100)	0.111 (0.207)		**	*		*	*	
JD/MD	0.548 *** (0.054)	0.892 * (0.429)	0.583 *** (0.063)	0.689 *** (0.117)							
PhD: Humanities	0.111 (0.091)	0.059 (0.145)	0.216 (0.132)	0.310 *** (0.152)				**		***	

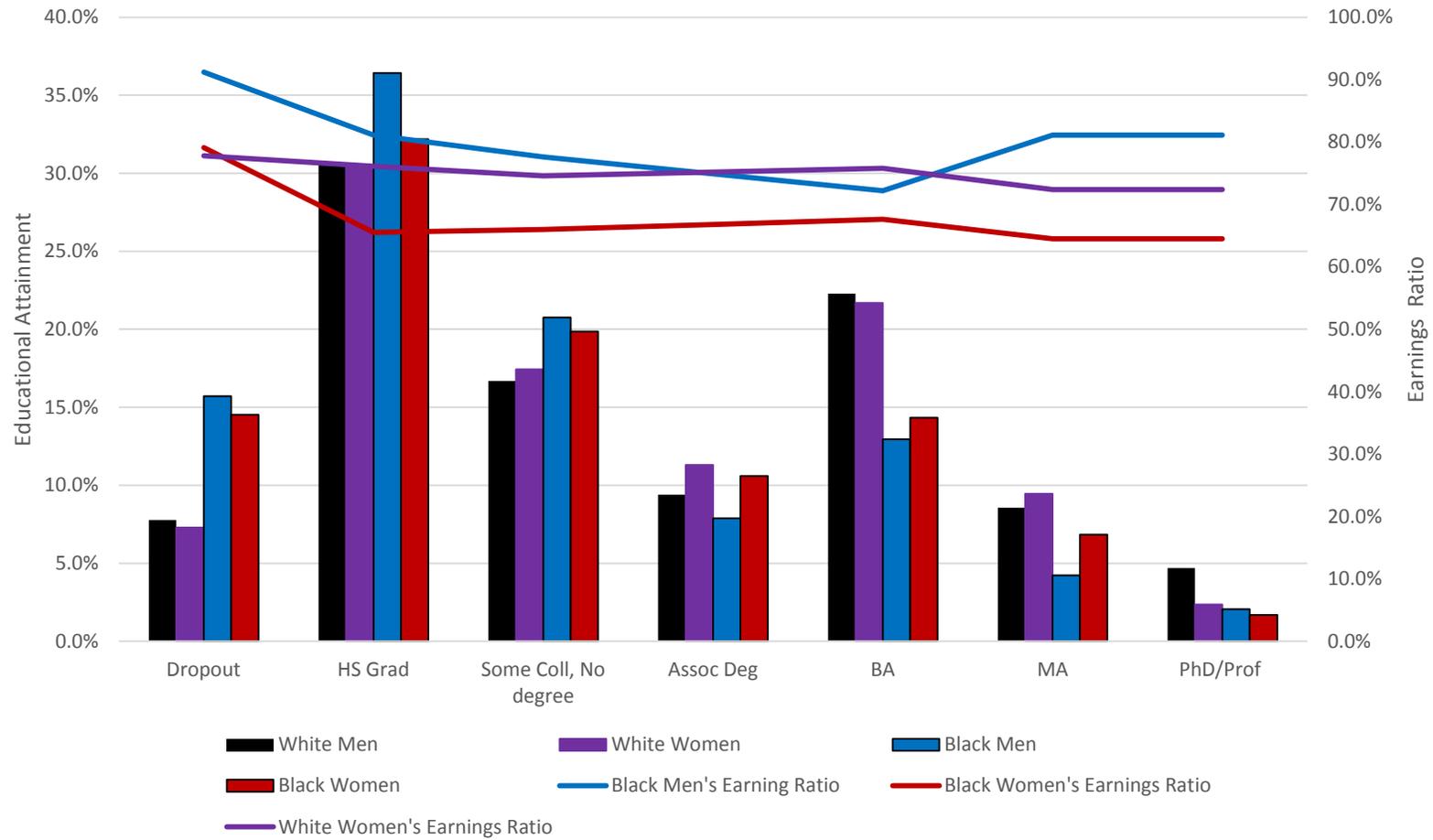
Notes: N=80,267 person years from 7,882 individuals, with an average of 14.71 years per person. \*\*\* is  $p < .001$ , \*\* is  $p < .01$ , and \* is  $p < .05$ , two-tailed tests. “NA” means too few cases to analyze. Coefficients are from separate models for each gender-racial group. Group differences in coefficients were tested with z-tests for significant differences in coefficients for every pair-wise combination of groups.

Figure 1. Rates of High School and College Completion Among Persons Aged 25+, by Gender and race: Selected Years, 1940-2015



Data source: Kena et al. 2016. *The Condition of Education 2016* (NCES 2016-144), [Educational Attainment of Young Adults](#). U.S. Department of Education, National Center for Education Statistics.

Figure 2: Educational Attainment and Earnings Ratio Relative to White Men, of US Civilians Aged 25 and Over, by Race and Gender



Data sources: 1) US Bureau of Labor Statistics. 2015. Usual Weekly Earnings of Wage and Salary Workers Fourth Quarter 2014. 2) US Census Bureau. 2012. *Educational Attainment in the United States: 2012*, Educational Attainment of the Population 18 Years and Over, by Age, Sex, Race, and Hispanic Origin.

Table A1. Percentage Distribution of Cases Comparing Recoded Highest Grade Completed with Highest Degree Attained, 2012

	<i>Highest Grade Completed</i> (Total N = 5893)				<i>Highest Degree Attained</i> (Total N = 5822)			
	Men		Women		Men		Women	
	White N=1749	Black N=1101	White N=1855	Black N=1188	White N=1704	Black N=1091	White N=1826	Black N=1165
<12 grades completed/No diploma/GED <sup>1</sup>	7.26	12.35	5.39	8.00	9.54	18.24	6.74	13.13
12 grades completed/HS diploma/GED only <sup>2</sup>	43.11	52.41	39.78	40.91	50.92	58.94	48.58	56.31
Associate's Degree only <sup>3</sup>					9.14	7.33	12.21	11.50
Some College: 13, 14 or 15 grades completed <sup>4</sup>	20.30	20.98	23.61	31.99				
16 grades completed/BA/BS degree <sup>5</sup>	15.72	8.36	15.15	10.35	18.79	11.00	19.17	11.85
17-18 grades completed/MA/MS <sup>6</sup>	7.78	4.09	10.89	5.98	6.55	3.21	9.80	4.12
19+ grades completed/PhD Professional Degree <sup>7</sup>	5.83	1.82	5.18	2.78	2.24	0.55	0.93	0.69
Other <sup>8</sup>					2.82	0.73	2.57	2.40

<sup>1</sup> *Highest Grade Completed* includes those who indicated they completed 0-11 grades whereas *Highest Degree Attained* includes those who do not report receiving a diploma/GED, regardless of highest grade completed.

<sup>2</sup> *Highest Grade Completed* includes only those who indicated completion of 12 grades whereas *Highest Degree Attained* includes high school graduates and those with some college attendance, but no post-secondary degree.

<sup>3</sup> *Highest Degree Attained* includes those who completed an Associate's degree.

<sup>4</sup> *Highest Grade Completed* includes both those with some college attendance and those who have completed an Associate's degree.

<sup>5</sup> *Highest Grade Completed* includes only those completing 16 grades, whereas *Highest Degree Attained* category includes Bachelor's degrees, plus graduate students who have not received a graduate degree.

<sup>6</sup> *Highest Grade Completed* includes both those who attempted and completed MA/MS degrees whereas *Highest Degree Attained* limits this category to only those who have completed master's degrees.

<sup>7</sup> *Highest Grade Completed* includes doctoral studies students and those who completed a PhD/Prof. degree whereas *Highest Degree Attained* is limited to those who have completed a PhD/Prof. Degree.

<sup>8</sup> *Highest Degree Attained* codebook does not define this category.