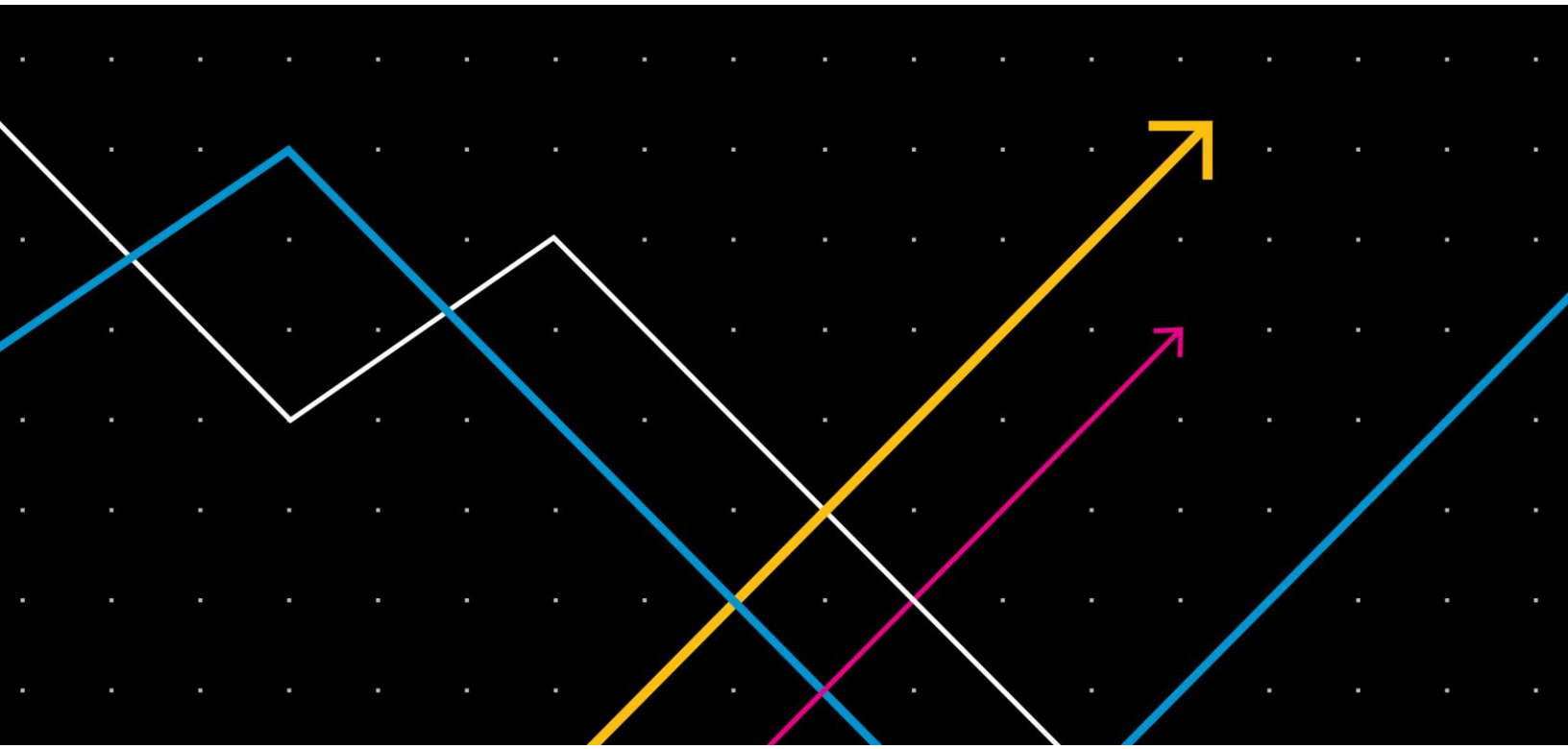

WORKING PAPER

College Premium and Its Impact on Racial and Gender Differentials in Earnings and Future Old-Age Income

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URBAN INSTITUTE

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College Premium and Its Impact on Racial and Gender Differentials in Earnings and Future Old-Age Income

Introduction

College education is a key path for social mobility. College-educated workers earn higher wages and receive more generous employee benefits, including retirement plan coverage, than workers without a college degree. Because lifetime earnings and retirement benefits are key determinants of income at old age, college-educated workers also end up with higher incomes after they retire. But the compensation returns to college education—the college premium—differ by race and gender, making human capital investments more attractive for some workers than for others. These disparities in the college premium accumulate over time to generate disparities in the old-age income.

Absent a dramatic change, such trends are likely to continue in the future. The main driving forces of the rise in the college premium—skilled-biased technological progress, growth in international trade, and diminishing bargaining power of workers—have persisted for decades. While some of them have slowed in recent years, they are still showing no signs of reversal. Race and gender disparities in wages—including returns to education—are also not likely to disappear anytime soon. These disparities interact with employment, marriage patterns, employer pension coverage, redistributive effects of Social Security and other factors to determine workers' future old-age income. They also create different incentives to obtain a college education, which can perpetuate gaps in educational attainment.

This study asks two questions about the income of college-educated workers and its differentials across gender and race. First, how do returns to college education differ across gender and race? Economists think of education as an investment in human capital. This framework developed by Becker (1962) postulates that one of the incentives for investment in education is higher compensation. Like investment in physical capital, higher returns to education make people want to invest more in human capital. When returns to education differ by race and gender, we can expect that the rates of investment will differ as well. In addition to being unjust, Lundberg and Startz (1983) showed that such

disparities can reduce allocative efficiency, and a more recent study by Hsieh, Hurst, Jones, and Klenow (2013) provided empirical evidence that removing obstacles to employment of women and blacks contributed significantly to economic growth in the long run. This study compares returns to college education in annual earnings, lifetime earnings, and old-age income in 2050, for four race and gender groups.

The second question is how wage discrimination on the bases of gender and race affects earnings and old-age income. While the first question deals with measuring race and gender differentials and makes no attempt to discern their causes, the second question is about one particular cause of these differentials. Unfortunately, discrimination is still a reality in the labor market. While gender-based discrimination has declined over last three decades (Blau and Kahn, 2017), race-based discrimination has grown with overall wage inequality (Wilson and Rodgers, 2016). As shown by Phelps (1972), animosity towards a group is not necessary for discrimination to exist, and there is no reason to believe that market forces will eliminate it. This study estimates the effects of race- and gender-based wage discrimination on earnings of college-educated workers in 2010, and their lifetime earnings and old-age income in 2050.

To answer these questions, this study uses DYNASIM, Urban Institute's microsimulation model, to simulate earnings, income from employer pensions, and Social Security benefits under the baseline and two counterfactual scenarios. It focuses on four demographic groups—black women, white women, black men, and white men[1]—and analyzes their gains from college education and disparities in those gains. The simulations start with a representative sample of the U.S. population in 2007 and run until 2050. The baseline simulation reflects the current earnings distribution, including returns to education and existing racial and gender disparities. One counterfactual scenario simulates earnings with returns to college set to zero, and the other assumes that race and gender do not play a role in wages. Comparing these scenarios with the baseline allows the estimation of gains from college education by race and gender, and identification of the effects of wage discrimination.

The study finds that labor-market outcomes for college-educated workers varied significantly across race and gender, but they were distributed differently depending on the observed measure of income. The estimated returns to college education were the highest for white women in both annual and lifetime earnings, followed by black women. In old-age income, however, college premiums for black women and black men were significantly higher than those for white women and white men. Wage discrimination hurt black women's annual earnings the most, but the loss in lifetime earnings due to wage discrimination was the highest for black men. By the time they turn 60, college educated black men were projected to lose $1,000,000 in 2015 dollars, a quarter of their projected lifetime earnings.

College-educated black women were close second, losing $710,000 or 17 percent of their lifetime earnings.

Background

While the effects of education, race, and gender on wages are among the most studied topics in labor economics, they are seldom studied together, and research on the cumulative effects they have over a person's lifetime is even less common. Becker (1962) formalized thinking on education as an investment in human capital that yields returns in earnings. Education and work experience determine workers' productivity as part of their human capital. Under the assumption of a perfectly competitive labor market, workers are paid their marginal product, and their investment in education is rewarded by higher wages. Returns to college education have been growing since the 1970s, mostly because a steady technological progress raised the productivity of college-educated workers at a higher rate than for workers without college education (Autor, 2014). The college premium also grew because of an increase in international trade, particularly imports of goods for which production is intensive in low-educated labor, which further increased the gap between lower- and higher-educated labor (Autor, Dorn, and Hanson 2013; Hakobyan and McLaren 2016). Another important factor in the widening of this gap have been diminishing unionization, on the one side, and employer concentration on the other, both of which led to a decline in bargaining power of labor (see Benmelech, Bergman, and Kim 2018). On average, lower-educated workers benefited more from collective bargaining than higher-educated workers did, which is why the decline bargaining power increased the wage differential between these two groups of workers.

Differentials in the college premium have been studied mostly on the basis of either gender or race, but not together. Several studies including Card and DiNardo (2002) and Chiappori, Iyigun, and Weiss (2009) found that women gained more in wages and annual earnings when they acquired a college degree, but few offered explanations for these findings. One possible explanation could be found in occupational segregation—currently, one of the main reasons for the gender wage gap—and the fact that it is significantly more pronounced for lower-educated workers than for those with a college degree (Blau, Brummund, and Liu, 2013). While many men without a college diploma work in production jobs that are unionized and well-paid, lower-educated women are still largely employed in the service sector, where wages are lower. Because college-educated workers are more integrated and the gender wage gap for them is smaller, the relative gain from a college diploma is higher for women than for men. Studies on the race gap in the college premium found higher returns to college education for blacks than

for whites (Ashraf, 1994; Averett and Dalessandro, 2001), although Grodsky and Pager (2001) found a higher occupational segregation by race and a larger race wage gap among the higher-educated than among the lower-educated workers in private sector.

One of the key reasons for race and gender gaps in earnings is wage discrimination. For the same level of educational attainment and job experience, women are paid less than men, and black workers are paid less than white workers (Blau and Kahn, 2017; Lang and Lehmann, 2012). These disparities in wages across race and gender for people who have the same amount of human capital represent discrimination. A model by Becker (1971) helped explain how discrimination can arise from prejudice by employers, coworkers, or customers, or any combination of the three. While in this model competitive forces act to eliminate discrimination due to prejudice in the long run, Phelps (1972) showed that this is not necessarily the case, and that discrimination can persist even when there is no animosity or prejudice. For discrimination in hiring and wages to persists, it is sufficient that one group's productivity is more difficult to predict than the other group's productivity. In addition, discrimination can act as a self-fulfilling prophecy. A group perceived as less productive might be hired at a lower rate, and receive less job-specific training and promotion, which can result in actual reduction in productivity of the group that is the target of discrimination.

Empirical studies of wage discrimination most commonly rely on Blinder-Oaxaca decomposition (Blinder, 1973; Oaxaca, 1973) to identify determinants of a wage gap. A wage gap between two groups of workers can be caused by different average levels of human capital, including educational attainment and the amount of work experience. In the Blinder-Oaxaca framework, this part of the wage gap is called the *explained* part of the wage gap. The remainder of the wage gap is considered *unexplained* and attributed to discrimination. In reality, the line between discrimination and other factors is not as clear, and it is researcher's task to draw it. As Darity and Mason (1998) point out, if the level of human capital is determined not only by individual choice but also by social expectations and disparate opportunities, then some effects of discrimination can be misattributed to the explained part of the wage gap, and the unexplained part underestimates discrimination. For example, one of the main causes of the gender gap is occupational segregation (Blau and Kahn, 2017), because traditionally female occupations pay less than traditionally male occupations do for the same level of education. If the occupational choice was solely a matter of individual choice, this part of the wage gap should be considered explained. But if the skewed distribution of occupations by gender is a result of unequal opportunities, this part of the wage gap should be attributed to discrimination. In this study, I assume the latter and attribute the gap due to occupational and sectoral distribution to discrimination.

Even though many labor economists study either the gender or racial wage gap, there are good reasons to study them together. To study only race or only gender implies an assumption that race and gender are separable and that their effects on an outcome are independent of each other. In the case of wages, it would mean that the gender wage gap is the same for all races, and that the race gap is the same for all genders. But as Paul, Hamilton, and Darity (2018) show, that is not the case. The wage penalty for black women is not equal to the sum of penalties estimated for women and blacks separately. They found that the unexplained part of the race wage gap between black and white women is 7.4 percent, and the unexplained part of the gender gap between black women and black men 10.4 percent. However, they estimated the unexplained wage gap between black women and white men to be 22.4 percent, substantially greater than 17.8 percent that is the sum of race and gender parts.

Understanding the interaction between wage disparities across gender and race on one side, and returns to college education on the other is important because returns to education also determine investment in education (Becker, 1962). In addition to issues of fairness and social justice, this imbalance is problematic with respect to the efficient allocation of resources. Unequal returns to education can lead to inefficient investment in education, with workers in advantaged groups overinvesting and those in disadvantaged groups underinvesting (Lundberg and Startz, 1983). Results in this study are broadly consistent with this hypothesis. The ranking of the four groups by the share of college-educated workers matches their ranking by returns to education, with white women at the top, black men at the bottom, and black women and white men in the middle.

Because old-age income depends on how much people earned over their lifetimes, the effects of discrimination filter from earnings into old-age income. As the cumulative advantage theory shows, any disparities in income early in life accumulate over time, generating even larger disparities later in life (Ferraro and Shippee 2009; O'Rand 1996). Workers save for retirement from their earnings, and higher lifetime earnings lead to higher retirement savings. Not only do high earners save more in absolute amount, but they typically save at a higher rate than low earners and have access to saving instruments that yield higher returns. Earnings also affect old-age income through Social Security benefits, which accounts for about half of the income for people at ages 65 and older (Bee and Mitchell, 2017). These benefits are calculated based on 35 highest years of earnings indexed to average annual earnings. Because of its progressive formula for primary insurance amount, Social Security benefits are distributed less unequally than the lifetime earnings they are based on. This feature of the Social Security program also tends to attenuate racial and gender disparities in the associated lifetime earnings. Finally, a significant component of old-age income comes from defined benefits pensions. Moderate differences by race and gender in the coverage of these pensions are amplified by the

differences in job tenure, which is the main determinant of how much the pension pays in retirement (Johnson, Sambamoorthi, and Crystal, 1999; Butrica and Johnson, 2010).

Data and Methods

Both issues analyzed in this study—college premium and wage discrimination—require information about outcomes of interest (in this case, earnings and old-age income) under alternative assumptions. In the case of college premium, we need to know the earnings that college-educated workers would receive if they had no college diploma. The difference between their actual earnings and these counterfactual earnings represents the college premium. Similarly, the effect of wage discrimination on earnings of a group of workers can be measured as the difference between these workers' actual earnings and the earnings they would have earned if they had not been discriminated against. In both cases, public survey data provide the actual data, and counterfactuals are usually estimated by various statistical methods. An alternative method, which is used in this study, is to simulate the counterfactuals.

In addition, estimating the effects of college education and discrimination on old-age income requires much richer data than what is usually available. A person's income at old age depends on their entire history of earnings, participation in pension programs or retirement plans, marital history, and saving behavior. To estimate the effect that a component of wage has on old-age income, all this information is necessary. Finally, considering that one of the goals of this study is to understand differentials in old-age income for workers who are in the labor force today and will be retiring in the future, a method for projecting future outcomes is required. Considering these requirements, DYNASIM microsimulation model is a natural choice. It allows simulation under a wide range of assumptions; it simulates life events and outcomes that are important for projecting income at old age; and it can run simulations far into the future, up to 2093.

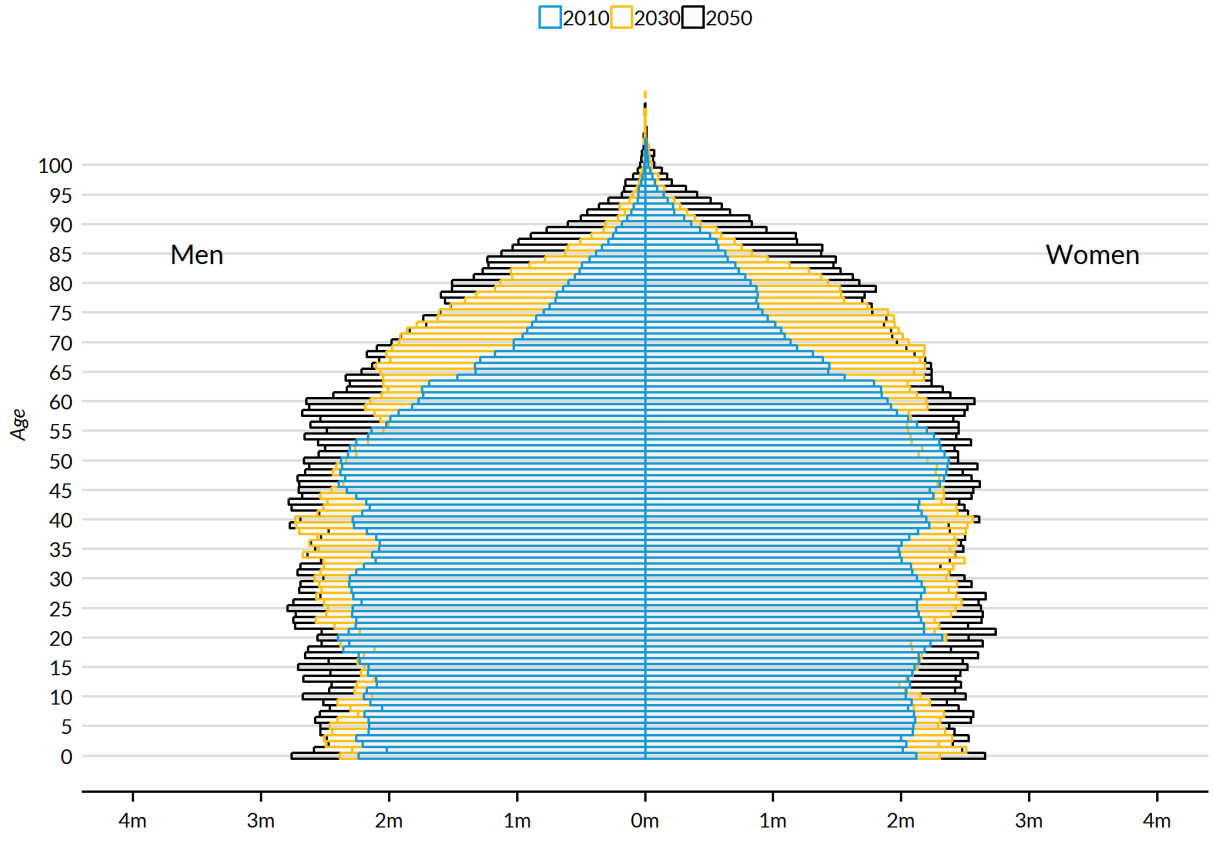
DYNASIM

DYNASIM is a dynamic microsimulation model designed to analyze the long-run distributional consequences of retirement and aging issues. The model starts with a representative sample of individuals and families from the 2004 and 2008 Survey of Income and Program Participation and ages them year by year, simulating key demographic, economic, and health events. DYNASIM projects that, each year, some people in the sample get married, have a child, or find a job, and other people become

divorced or widowed, stop working, begin collecting Social Security, become disabled, or die. These transitions are based on probabilities generated by carefully calibrated equations estimated from nationally-representative household survey data. The equations account for important differences by sex, education, earnings, and other characteristics in the likelihood of various experiences. Other equations in DYNASIM project annual earnings, savings, and home values. The model uses program rules—combined with projections of lifetime earnings, disability status, and household income and wealth—to project Social Security retirement and disability benefits and Medicaid coverage. For consistency with Social Security's projections about system's finances, we generally follow the Social Security and Medicare trustees' assumptions. For more information about DYNASIM, see Urban Institute (2015) and Favreault, Smith, and Johnson (2015).

FIGURE 1

Population of the United States by Age and Sex in 2010, 2030, and 2050



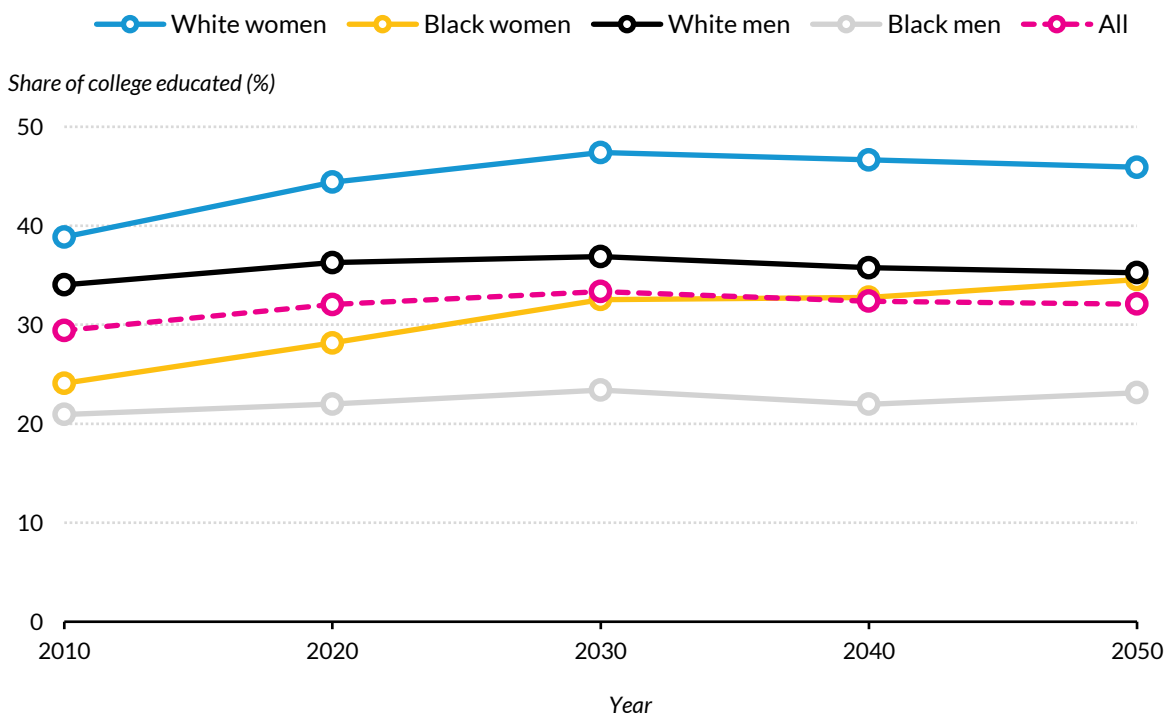
Source: DYNASIM4 ID958A

The population of the United States in 2050 is projected to grow larger and older than it is today. It will grow at all ages, but the biggest growth is expected at older ages (figure 1).[2] The number of people age 70 and older will more than double over the next three decades. The share of college graduates among people ages 25 to 54 is projected to increase moderately—from 29 percent in 2010 to 32 percent in 2050—but this growth will likely differ by race and gender (figure 2). The share of college graduates is expected to grow the fastest for black women, 35 percent of whom are expected to have a college diploma in 2050—an 11-percentage-point increase from 2010. White women are also expected to increase their college graduation rates substantially, resulting in a 7-percentage-point increase from 39 percent in 2010 to 46 percent in 2050. The share of college graduates among men is projected to rise much slower. For black men, it should increase from 21 in 2010 to 23 percent in 2050. For white men, it is projected to increase from 34 percent in 2010 to 35 in 2050.

FIGURE 2

Share of College Graduates by Race and Gender

Ages 25 to 54



Source: DYNASIM4 ID958A

Notes: The shares are calculated as the percentage of people ages 25 to 54 in each demographic group who graduated from a four-year college. DYNASIM uses a multi-stage model estimated on the National Longitudinal Survey of Youth 1979 to 2012 to simulate college enrollment, attendance, and completion for each person in the starting sample and those born during the simulation.

DYNASIM simulates annual earnings every year for people ages 16 to 80 as the product of hourly wage, employment status, and number of hours worked annually, each of which is simulated independently. Each of the three components of earnings is simulated by a separate equation for one of the four demographic groups: black women, non-black women, black men, and non-black men. Independent variables include age splines, indicator variables for educational attainment and their interactions with age splines, indicator variables for marital status, disability, Census regions, Latinx ethnicity, school enrolment, and whether the person was born in the US. The equation coefficients for young workers were estimated on the National Longitudinal Survey of Youth 1979 to 2012. Coefficients for prime-age and older workers were estimated on the Panel Study of Income Dynamics 1980 to 2013. Self-employed workers and those employed in the private household sector were excluded from the sample.

While individual earnings and employment status are simulated, the aggregate earnings and employment rate are set exogenously. We use macroeconomic projections by the Board of Trustees (2018) to set simulation targets for the average annual earnings and employment rates. This alignment to exogenous targets assures that simulation results are consistent with the Trustees' macroeconomic assumptions.

College Premium by Race and Gender

Educational attainment lies on a continuum and so do returns to education, but the approach used in this study requires a binary treatment. This treatment is defined as a diploma from a four-year college. Returns to college education represent the premium that college-educated workers earn comparing to what they would have earned without college education. Under the baseline scenario, their earnings include the college premium. To estimate what their earnings would have been if they did not have a college diploma, I simulated a counterfactual scenario in which coefficients for the indicator variable for college diploma, its interaction with age splines, and the indicator variable for post-graduate education in the hourly-wage equation were set to zero. This made the wage equations coefficients the same for workers who graduated from a four-year college and those with some college. Their wages, however, were not necessarily the same. Each individual in the sample had an individual-specific permanent error term that was estimated based on their actual wage and the wage predicted by the estimated wage equation. The difference between the two—the part of the wage that is due to unobserved characteristics—was decomposed into a permanent, individual-specific term and a transient term, which are then used in the simulation of wages. Even though college graduates under the counterfactual scenario did not receive the college premium, they were likely to have higher simulated

wages than workers with less education because some of the unobserved characteristics represented by the permanent error term (e.g. innate ability) are correlated with both educational attainment and labor productivity.

The two simulation scenarios differ only in the simulation of hourly wages. The other two components of annual earnings—employment status and hours worked—as well as other simulated variables are simulated by identical equations. This assures that the difference in annual earnings for college graduates between the baseline and the counterfactual scenario represents the gain due to college education and the existence of the college premium in hourly wages. It also implies the assumption that the entire college premium is captured by the college education term in the hourly wage equation and its interactions with age splines. In addition, to annual earnings, I also estimated the difference in lifetime earnings and old-age income between these two scenarios, to obtain the gains in these two measures of income due to college premium.

To limit the analysis to matters of wage distribution and avoid general equilibrium effects of the counterfactual earnings, I assumed that the average earnings under the baseline and the counterfactual scenario were the same; only their distributions were different. This assumption implies that the economies under the two scenarios are essentially the same, except for the wage distribution. Everything else, including prices, interest rates, and employment is the same under the two scenarios. The downside of this choice is an underestimation of the college premium because the counterfactual wages were higher than they would have been if this restriction had not been placed on average earnings. As we are interested primarily in the race and gender differentials of the college premium rather than in its absolute value, this is not a significant limitation. However, the reader should be advised that the college premium estimated here is not comparable to those estimated by other methods.

Effects of Wage Discrimination

While differences in college premium by race and gender indicate different incentives to graduate from college, they do not reveal much about wage discrimination and its effects. Black workers with or without college degree are paid lower wages than white workers, and women are paid less than men. These gaps in hourly wages are reflected in earning differentials, which accumulate over time through savings and pension programs to generate differentials in old-age income. However, earnings differ across gender and race not only because of the wage gap, but also because of differences in employment and hours worked. To isolate the effect of hourly wage, I constructed a counterfactual

scenario in which hourly wages for all workers were generated by the same equation—the equation estimated on the sample of white men—and all other variables are simulated in the same way as in the baseline.

Even though this study did not use the Blinder-Oaxaca decomposition, the logic used here is similar. The Blinder-Oaxaca decomposition estimates the wage equation for the two groups whose wages are being studied—women and men, for example—to obtain two sets of regression coefficients. To estimate the unexplained wage gap, two sets of wages for women can be predicted: one by using the coefficients from the women equation and the other by using the men equation. The latter represents the counterfactual women wages that they would have had they been paid the same way as men. The difference between these two sets of wages represents the unexplained part of the wage gap that is caused by discrimination. The earnings and old-age income generated by the no-discrimination scenario is equivalent to the counterfactual wages in the Blinder-Oaxaca decomposition.

Under the no-discrimination scenario, race and gender did not play a role in determination of hourly wage. Each person still carried the permanent error term, which reflects the person's unobserved characteristics, but the part of hourly wage that is determined by observed characteristics, including the education premium, did not depend on race or gender. Earnings differentials due to differences in employment and number of hours worked in a year remained because they are generated by equations that were estimated separately by race and gender. As in the no-education-premium scenario, I assumed that the economy in all other respects was the same as under the baseline. Distribution of wages by gender and race was different, but the total labor income, the average wage growth, prices, interest rate, and employment were the same.

To find the effects of gender and race wage differentials on earnings and old-age income, I estimated the differences in these outcomes between the baseline and the no-discrimination scenario. For each race and gender, these differences represent losses or gains in earnings and old-age income due to differentials in hourly wage. Because the wage equations don't control for occupation or sector, this estimate does not measure only the effect of wage discrimination, but also the effects of occupational and sectoral segregation.

Outcomes

The main outcomes of interest are earnings and old-age income. Earnings are estimated on an annual basis for workers ages 25 to 54 in 2010, and on a lifetime basis for people born between 1975 and 1983 who will reach ages 67 to 75 in 2050. Lifetime earnings are estimated as the present value of earnings

between ages 25 and 60 expressed in 2015 dollars and discounted at the rate of 2.7 percent to the year in which a worker turns 60. Old-age income is annual income estimated for people ages 67 to 75 in 2050. It includes Social Security benefits, income from employer-sponsored DB pension plans, and earnings. In addition, it includes annuitized income from retirement saving accounts, which was calculated as the annual, actuarially fair, annuity payment a person would receive if she or he annuitized 80 percent of their retirement accounts using a 3 percent annual real return. Income from other assets is not included because our goal is to isolate income that reflects an individual's labor market involvement. With the exception of individual retirement accounts, assets owned by married couples are usually built by contributions of both spouses. These components of old-age income under the baseline scenario are shown in table 1 by gender and race, and by income quintile.

The average total income of college educated adults at old age in 2050 varied from $64,500 for black men to $88,700 for white men, while black and white women received around $69,000. The composition of old-age income varied somewhat across racial and gender groups, but the level of income appears to be a more important determinant of shares contributed by individual components of income. Social Security benefits made between 33 and 39 percent of total income for the four groups, while earnings made between 33 and 49 percent. Looking by quintile, Social Security benefits made more than 80 percent of income for the bottom quintile of the income distribution, but only 19 percent for the top quintile. On the other hand, earnings and asset income together made close to 80 percent of the top quintile's income, but only around 15 percent for the bottom quintile. Income from DB pensions represented a small share of income because only a small share of population receive that income.

The effects of college premium by race and gender were estimated as the difference in a statistic ν (the mean or a percentile) of outcome *Y* for college-educated members of group g between the baseline and the no-college-premium scenario:

$$\Delta\nu_g^{\text{col}} = \nu\left(Y_g|\ \text{Col} = 1\right) - \nu\left(Y_g'|\ \text{Col} = 1\right)$$

where Y_g' represents the outcome of interest under the no-college-premium scenario and Y_g the outcome under the baseline. The effect of the race and gender wage discrimination on earnings and old-age income for group g is estimated as the difference in a statistic ν of outcome *Y* for college-educated members of group g between the baseline and the no-discrimination scenario:

$$\Delta\nu_g^{\text{disc}} = \nu\left(Y_g|\ \text{Col} = 1\right) - \nu\left(Y_g''|\ \text{Col} = 1\right)$$

where Y''_g represents the outcome of interest under the no-discrimination scenario.

TABLE 1

Composition of Old-age income by Race and Gender, and Income Quintile in 2050

	Women		Men	
	White	**Black**	**White**	**Black**
Social Security Benefits	26.4	26.4	29.5	23.6
	(38.6)	(38.3)	(33.2)	(36.6)
Earned Income	24.5	22.5	35.0	31.5
	(35.9)	(32.6)	(39.4)	(48.8)
DB Pension Income	3.3	7.1	3.0	1.7
	(4.8)	(10.3)	(3.4)	(2.6)
Annuitized Retirement Savings	14.2	13.0	21.2	7.7
	(20.7)	(18.8)	(23.9)	(12.0)
Total income	68.4	69.0	88.7	64.5

	Bottom	**2nd**	**3rd**	**4th**	**Top**
Social Security Benefits	82.7	68.3	53.1	34.9	18.7
Earned Income	5.2	10.9	18.5	34.7	55.2
DB Pension Income	2.6	2.8	4.3	4.3	5.2
Annuitized Retirement Savings	9.6	17.9	24.1	26.1	21.0

Source: DYNASIM4 ID 958A

Notes: Components of income by gender and race are expressed in thousands of 2015 dollars and percentage of total income in parentheses. Components of income by quintile are in percentages of total income for the quintile. Sample includes college-educated individuals ages 67 to 75 in 2050 and excludes those who have ever had annual earnings greater than $1 million in 2015 dollars.

Results

Returns to College

Results show large disparities in the college premium across race and gender, but also patterns that varied over a life cycle. Looking only at earnings, women had higher returns to college than men, both in annual earnings and when earnings are calculated over a lifetime. In 2010, gains in annual earnings due to college education were higher for whites than for blacks of both genders but gains in lifetime earnings were a little higher for black women than for white women. In old-age income, it appears that

race was a more important determinant of college premium than gender, considering that the returns to college were higher for blacks than whites of both genders.

College-educated women ages 25 to 54 had on average 25.3 percent higher earnings in 2010 than they would have had if they had not graduated from college, while these gains for men were only 14.2 percent, but race differentials were also substantial. The college premium for white women was 26.1 percent, but only 18.9 percent for black women (table 2). The race differential in college premium was smaller for men, with 14.6 percent for white men and 11.2 percent for black men.

TABLE 2

Returns to College and Share of College Graduates by Gender and Race

	Women		Men	
	White	**Black**	**White**	**Black**
Earnings (2010)	26.1	18.9	14.6	11.2
Lifetime earnings	24.4	19.8	16.7	18.3
Old-age income	13.0	28.9	12.4	22.3
Share of college-educated (in 2010)	44.1	29.9	35.5	20.6

Source: DYNASIM4 ID 958A and 958B

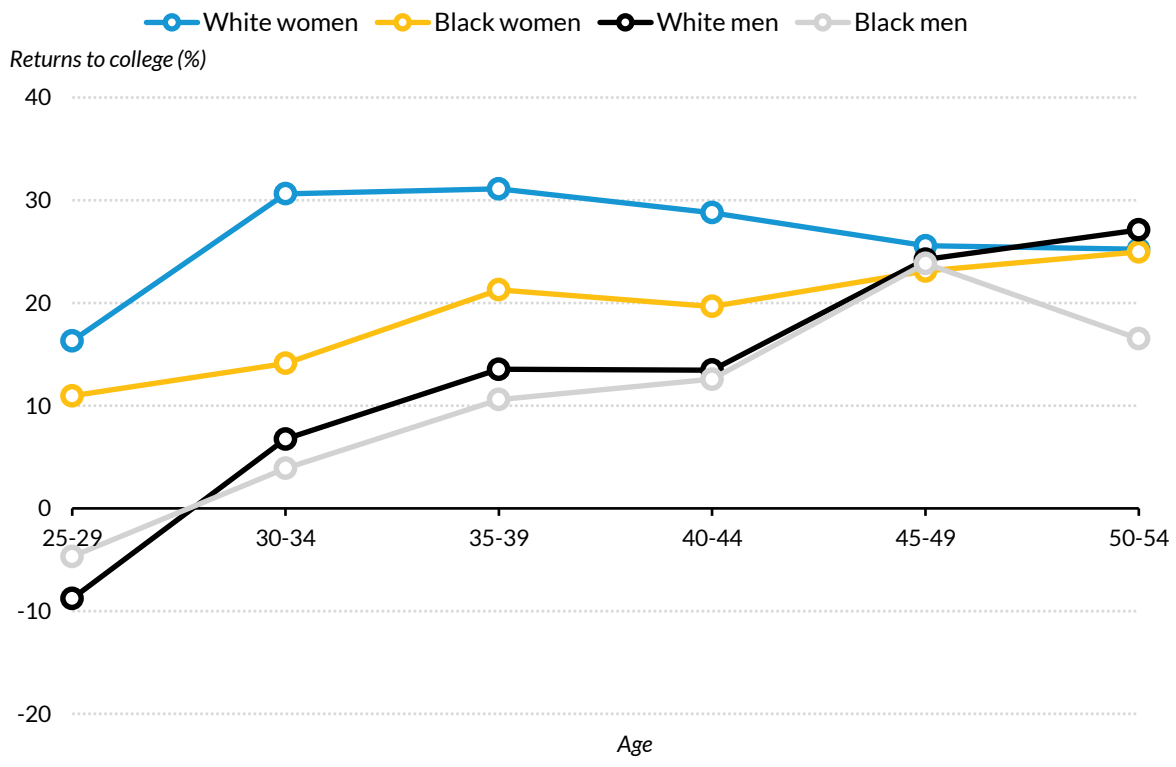
Notes: Returns to college for each outcome were calculated as the percentage difference in mean earnings between the baseline and no-education-premium scenarios. The two scenarios maintained the same average earnings. The sample included only college-educated workers who earned less than $1 million in 2015 dollars. Annual earnings were calculated for workers ages 25 to 54 in 2010. Lifetime earnings over ages 25 through 60 and annual old-age income were calculated for cohorts 1975 to 1983.

While gains in annual earnings are informative about college premium, gains in lifetime earnings are more relevant in the education-as-investment framework, in which individuals choose their level of education to maximize their lifetime utilities. As in the case of annual earnings, the college premium in lifetime earnings was higher for women than for men, but the differences among the groups were smaller. The college premium for black and white women in lifetime earnings was 20 and 24 percent, respectively, comparing to 19 and 26 in annual earnings. White men received a higher college premium in annual earnings than black men—15 and 11 percent, respectively—but their college premium in lifetime earnings was lower—17 compared to 18 percent. Gains in old-age income due to college education were substantially higher for blacks than for whites. The premium for black women was 27.7 percent and for white women only 12.7 percent. For black men, the premium was 20.6 percent, and for white men, it was 12.1 percent.

Returns to college education also varied by age, but they followed different patterns for different race and gender groups. Variation by age was especially pronounced for men, whose college premium started low at young ages and increased as they grew older (figure 3). College premium for black women also increased with age but at a slower rate, while for white women, it peaked early and slowly decreased with age. This difference in age profiles for women and men is also consistent with the occupational segregation as a key reason why college premium is higher for women than for men. As Blau and Kahn (2017) document, college-educated women start their careers at salaries that are similar to those of their male counterparts. Their earnings diverge later in their careers due to differences in labor force attachment and preferences for flexible work hours. For those without college degree, however, the gender wage gap is wide from the beginning of their careers. It is the low earnings of these women that drive women's college premium high.

FIGURE 3

College Premium in Annual Earnings by Race, Gender, and Age in 2010



Source: DYNASIM4 ID 958A and 958B

Notes: Returns to college for each outcome are calculated as the percentage difference in mean earnings between the baseline and no-education-premium scenarios. The two scenarios maintain the same average earnings. The sample includes only college-educated workers ages 25 to 54 who earned less than $1 million in 2015 dollars.

The ranking of the four groups with respect to college premium in earnings is not fully consistent with the prediction of the education-as-investment-in-human-capital framework that higher returns to education imply higher rate of investment in education. Using the share of college-educated adults ages 25 to 30 in 2010 as an indicator of the rate of investment in college education, the relationship between the returns and investment holds only for white women. The ranking of the other three groups by college premium differs from their ranking by the investment in college education.

The distribution of college premium in old-age income by race and gender was considerably different from the distribution of college premium in earnings. While returns to college in earnings were sharply divided by gender, in old-age income they varied more by race. Black women had the highest returns, followed by black men, while white men had the lowest returns to college. Contributions of individual components of old-age income to the college premium (table 3) show that college premiums were higher for blacks of both genders for each component of income except for the annuitized financial income for men. The biggest boost to the blacks' college premium in old-age income came from earnings. This was especially the case for black men, whose earnings made close to a half of their old-age income (table 1), and contributed 18 percentage points to the college premium of 22 percent. For black women, the college premium in earnings at old age raised their income by 10 percent while it was only a half of that for white women.

TABLE 3

Gains in Own Old-age income in 2050 due to College Premium

	Women		Men	
	White	**Black**	**White**	**Black**
Total income	13.0	28.9	12.4	22.3
Social Security Benefits	3.9	5.9	1.8	3.2
Earned Income	4.6	9.9	7.5	18.0
DB Pension Income	0.3	4.8	0.7	1.0
Annuitized Financial Income	4.3	8.3	2.4	0.1

Source: DYNASIM4 ID 958A and 958B

Notes: Percentage difference in old-age income between the baseline and no-college-premium scenarios. Percentage differences for individual components are multiplied by their shares in total income so that their sum equals the difference in total income. College-educated individuals ages 67 to 75.

Social Security benefits, while representing a substantial share of old-age income, generated a relatively small college premium, resulting in a small contribution to overall gains in income ranging from 2 percentage points for white men to 6 percentage points for black women. These gains were small

because of the progressivity of the formula for Primary Insurance Amount, which makes the benefits grow at a diminishing rate with lifetime earnings. The contribution of DB pension benefits was relatively small because of a small share of retirees who received them, even though those who did receive them had substantial gains due to college education.

Effects of Discrimination

The effects of wage discrimination on earnings is the difference between the actual earnings and the earnings that workers would have earned if there was no discrimination. These effects were estimated as the difference between the baseline earnings and earnings simulated under the scenario with no wage discrimination. The average earnings were held the same under the two scenarios, imposing the constraint that the total losses from discrimination equal the total gains.

TABLE 4

Effects of Wage Discrimination on Earnings and Old-age income

	Women		Men	
	White	**Black**	**White**	**Black**
Earnings in 2010	-3.8	-13.6	6.8	-8.6
	(-7.0)	(-21.6)	(9.8)	(-13.7)
Lifetime earnings in 2050	-95.0	-709.5	400.3	-1004.0
	(-2.8)	(-17.4)	(7.7)	(-24.6)
Old-age income in 2050	3.1	-3.3	3.8	-12.4
	(4.8)	(-4.5)	(4.5)	(-16.1)

Source: DYNASIM4 ID 958A, 958B, and 958C

Notes: Difference in mean earnings between the baseline and no-discrimination scenarios in thousands of 2015 dollars. Percentage differences in parentheses. The sample included only college-educated workers who earned less than $1 million in 2015 dollars. Annual earnings were calculated for workers ages 25 to 54 in 2010. Lifetime earnings (for ages 25 to 60) and annual old-age income in 2050 were calculated for cohorts 1975 to 1983.

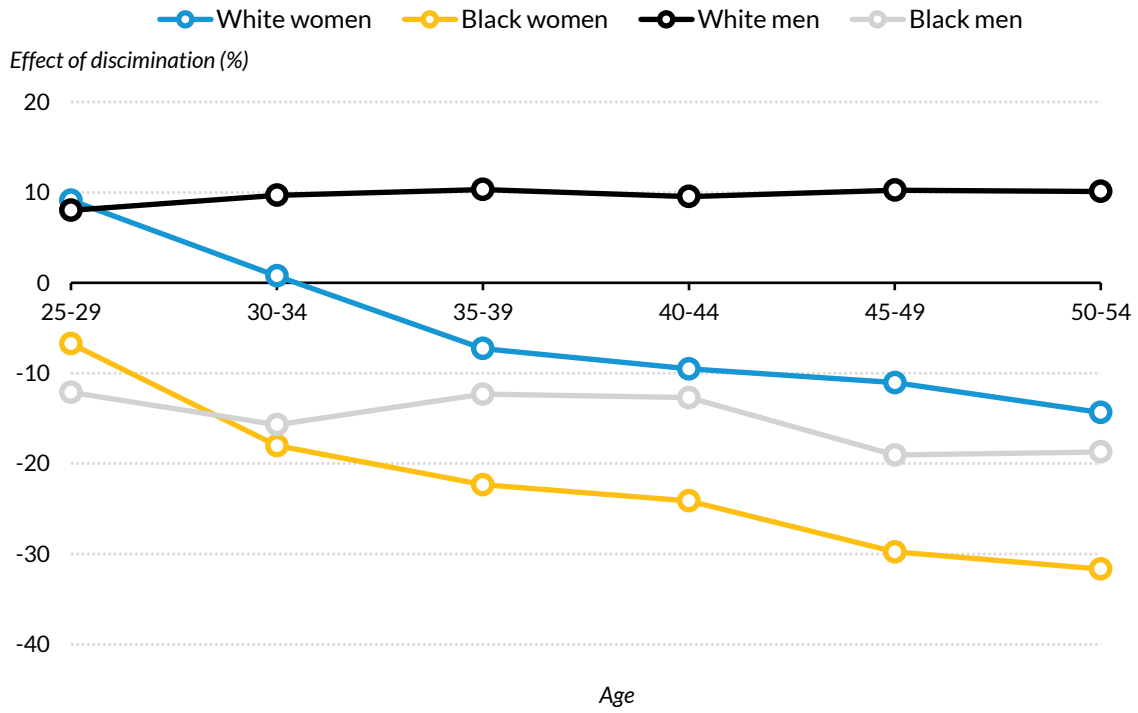
The estimates of the effects on annual earnings of wage discrimination among workers with college degree show that black women were penalized the most by the current racial and gender discrimination in wages, followed closely by black men (table 4). Black women in 2010 earned $13,600—or 21.6 percent—less, on average, because of discrimination, and black men earned $8,600—or 13.7 percent—less. The penalty for white women was smaller—$3,800 or 7 percent—while white men were the only group who gained from wage discrimination. Over a working life, however, the loss due to discrimination was the biggest for black men—$1,000,000 or 25 percent of their total lifetime earnings—followed by black women at $710,000, or 14 percent. White women lost $95,000 or 3 percent of their lifetime earnings due to discrimination. In old-age income, the discrimination effect was much smaller for women, but it persisted for black men, whose income was lower by $12,000 or 16 percent than it would have been if there was no discrimination.

Looking at discrimination effects by age, gender and race discrimination display different patterns (figure 4). Race-based discrimination started early in workers' careers and remained persistent over their working lives. Gender-based discrimination, on the other hand, was zero in the beginning of women's careers but increased steadily with age. At ages 25 to 29, both white women and white men received around 10 percent higher earnings than they would have if there was no wage discrimination. In contrast, black women and black men were negatively affected by discrimination, but men were affected slightly more. Things changed already in the next age category, 30 to 34, where both black and white women were more negatively affected than their male counterparts. In subsequent age groups, the gender gap in earnings grew with age at a steady rate. This pattern is mostly caused by career interruptions due to child bearing and shorter work hours for women, both of which have been found to cause women's hourly wages to grow slower than men's (Bertrand, Goldin, and Katz, 2010; Goldin, 2014). The race gap was more stable. The effect of discrimination on black women's earnings was between 10 and 20 percentage points stronger than its effect on white women's earnings at all ages. For men, the black-white gap was greater than 20 percentage points.

FIGURE 4

Effects of Wage Discrimination on Earnings of College Graduates

Workers ages 25 to 54 in 2010



Source: DYNASIM4 ID 958A and 958C

Notes: Percentage difference in earnings by earnings percentile between the baseline and no-discrimination scenarios. College-educated adults ages 25 to 54.

Conclusion

Racial and gender disparities in wages have been a persistent feature of the labor market, affecting workers at any level of educational attainment. These disparities do not only affect workers' earnings; they also determine how much workers can save for retirement and how much in Social Security benefits they will receive at old age. In addition to unjust outcomes, disparities in wages of college-educated workers create disparate incentives to obtain college education, likely resulting in an inefficient allocation of resources.

This study presented new evidence of racial and gender discrepancies in annual earnings of college-educated workers and projections of their lifetime earnings and old-age income in 2050. It showed that incentives to graduate from college, as represented by returns to college education in earnings, vary by

race and gender and that distribution of these incentives across race. Furthermore, it estimated the effects of gender- and race-based wage discrimination and showed that they had a large negative impact on earnings. The negative effect was especially strong and persistent for black women and black men resulting in a large loss in lifetime earnings.

While equal opportunities and elimination of discrimination are foremost matters of justice, economic literature has shown that they can also improve economic efficiency. For example, Hsieh et al. (2013) estimated that between 15 and 20 percent of economic growth in the U.S. over last 50 years can be attributed to a decrease in occupational segregation on the bases of gender and race. But occupational segregation is still prevalent and one of the main causes of disparities in labor market outcomes. Wage discrimination is similarly persistent, and the literature shows that the labor market is not likely to eliminate it even in the long run.

This is why it is important for policy makers to step in and consider policies for eliminating discrimination in the labor market. As shown here, the effects of discrimination accumulate over time. If we want to have more equitable outcomes in 2050, policy makers have to act now. This is not an easy task. In the past, much of discrimination was obvious and susceptible to regulation. This is partly why the civil rights legislation of the 1960s was successful in reducing both race- and gender-based discrimination. Discrimination takes more subtle forms today, which makes it more difficult to detect and regulate. One of the important ways in which policy makers could make a difference is by gathering more detailed information about discrimination. Providing incentives to employers to be more open about their payroll data and to self-evaluate their payrolls on an ongoing basis to detect discrimination would be a step in the right direction. Employers who discriminate are sometimes not aware of it because it often takes place on the subconscious level due to implicit bias. And because most private companies keep wages secret, employees may be unaware that discrimination is occurring, or even that they are the subject of discrimination. Bennedsen, Simintzi, Tsoutsoura, and Wolfenzon (2019) show that such policies have intended effects. A Danish law that requires firms to provide gender disaggregated wage statistics lowered gender pay gap by 7 percent. Researchers can provide a big picture based on survey data, but making progress in eliminating discrimination requires that all labor market participants be aware of it.

Notes

[1] Even though DYNASIM projects earnings for other racial and ethnic groups, the structure of its earning module—four equations for black women, white women, black men, and white men—allows for the counterfactual scenarios used in this study to be simulated only for black and white workers. This study uses the terms black and white to describe race categories, adopting the terminology from the 2004 and 2008 Survey of Income and Program Participation, which is used to create the DYNASIM starting sample.

[2] DYNASIM's projections of the population by age are similar to the projections by the US Census Bureau's Orman and Guarneri (2009) (https://www.census.gov/content/dam/Census/library/working-papers/2009/demo/us-pop-proj-2000-2050/analytical-document09.pdf).

References

Ashraf, Javed. 1994. "Differences in Returns to Education: An Analysis by Race." The American Journal of Economics and Sociology 53 (3): 281–90.

Autor, David. "Skills, Education, and the Rise of Earnings Inequality among the 'Other 99 Percent.'" *Science*, May 22, 2014, 843–51.

Autor, David H., David Dorn, and Gordon H. Hanson. "The China Syndrome: Local Labor Market Effects of Import Competition in the United States." *The American Economic Review* 103, no. 6 (2013): 2121–68.

Averett, Susan, and Sharon Dalessandro. 2001. "Racial and Gender Differences in the Returns to 2-Year and 4-Year Degrees." Education Economics 9 (3): 281–292.

Becker, Gary S. "Investment in Human Capital: A Theoretical Analysis." *Journal of Political Economy* 70, no. 5, Part 2 (1962): 9–49.

Becker, Gary. *The Economics of Discrimination*. Chicago: University of Chicago Press, 1971.

Bee, Adam, and Joshua Mitchell. 2017. "Do Older Americans Have More Income than We Think?" SESHD Working Paper No. 2017-39. Washington, DC: US Census Bureau.

Benmelech, Efraim, Nittai Bergman, and Hyunseob Kim. 2018. "Strong Employers and Weak Employees: How Does Employer Concentration Affect Wages?" National Bureau of Economic Research.

Bennedsen, Morten, Elena Simintzi, Margarita Tsoutsoura, and Daniel Wolfenzon. 2019. "Do Firms Respond to Gender Pay Gap Transparency?" Working Paper 25435. National Bureau of Economic Research.

Bertrand, Marianne, Claudia Goldin, and Lawrence F. Katz. 2010. "Dynamics of the Gender Gap for Young Professionals in the Financial and Corporate Sectors." *American Economic Journal: Applied Economics* 2 (3): 228–55.

Blau, Francine D., Peter Brummund, and Albert Yung-Hsu Liu. 2013. "Trends in Occupational Segregation by Gender 1970-2009: Adjusting for the Impact of Changes in the Occupational Coding System." Demography 50 (2): 471–94.

Blau, Francine D., and Lawrence M. Kahn. "The Gender Wage Gap: Extent, Trends, and Explanations." *Journal of Economic Literature* 55, no. 3 (September 2017): 789–865.

Blinder, Alan S. "Wage Discrimination: Reduced Form and Structural Estimates." *The Journal of Human Resources* 8, no. 4 (October 1, 1973): 436–55.

Butrica, Barbara, and Richard W. Johnson. "Racial, Ethnic, and Gender Differentials in Employer-Sponsored Pensions." Urban Institute, 2010.

Card, David, and John E. DiNardo. 2002. "Skill-Biased Technological Change and Rising Wage Inequality: Some Problems and Puzzles." Journal of Labor Economics 20 (4): 733–783.

Chiappori, Pierre-Andre, Murat Iyigun, and Yoram Weiss. 2009. "Investment in Schooling and the Marriage Market." American Economic Review 99 (5): 1689–1713.

Darity, William A., and Patrick L. Mason. "Evidence on Discrimination in Employment: Codes of Color, Codes of Gender." *Journal of Economic Perspectives* 12, no. 2 (June 1998): 63–90.

Favreault, Melissa M., Karen E. Smith, and Richard W. Johnson. "The Dynamic Simulation of Income Model (DYNASIM)." Research Report). Washington, DC: Urban Institute Program on Retirement Policy, 2015.

Ferraro, Kenneth F., and Tetyana Pylypiv Shippee. "Aging and Cumulative Inequality: How Does Inequality Get under the Skin?" *The Gerontologist* 49, no. 3 (2009): 333–343.

Goldin, Claudia. 2014. "A Grand Gender Convergence: Its Last Chapter." *American Economic Review* 104 (4): 1091–1119.

Grodsky, Eric, and Devah Pager. 2001. "The Structure of Disadvantage: Individual and Occupational Determinants of the Black-White Wage Gap." American Sociological Review 66 (4): 542–67.

Hakobyan, Shushanik, and John McLaren. "Looking for Local Labor Market Effects of NAFTA." *Review of Economics and Statistics* 98, no. 4 (March 23, 2016): 728–41.

Hsieh, Chang-Tai, Erik Hurst, Charles I Jones, and Peter J Klenow. 2013. "The Allocation of Talent and U.S. Economic Growth." Working Paper 18693. National Bureau of Economic Research.

Johnson, Richard W., Usha Sambamoorthi, and Stephen Crystal. "Gender Differences in Pension Wealth: Estimates Using Provider Data." *The Gerontologist* 39, no. 3 (June 1, 1999): 320–33.

Lang, Kevin, and Jee-Yeon K. Lehmann. "Racial Discrimination in the Labor Market: Theory and Empirics." *Journal of Economic Literature* 50, no. 4 (December 2012): 959–1006.

Lundberg, Shelly J., and Richard Startz. "Private Discrimination and Social Intervention in Competitive Labor Market." *The American Economic Review* 73, no. 3 (1983): 340–47.

Mincer, Jacob. *Schooling, Earnings and Experience*. New York: Columbia University Press, 1974.

Oaxaca, Ronald. "Male-Female Wage Differentials in Urban Labor Markets." *International Economic Review* 14, no. 3 (October 1, 1973): 693–709.

O'Rand, Angela M. "The Precious and the Precocious: Understanding Cumulative Disadvantage and Cumulative Advantage over the Life Course." *The Gerontologist* 36, no. 2 (1996): 230–238.

Ortman, Jennifer M., and Christine E. Guarneri. "United States Population Projections: 2000 to 2050." The U.S. Census Bureau, 2009.

Paul, Mark, Khaing Zaw, Darrick Hamilton, and William Jr. Darity. "Returns in the Labor Market: A Nuanced View of Penalties at the Intersection of Race and Gender." Working Paper. Center for Equitable Growth, August 7, 2018.

Phelps, Edmund S. "The Statistical Theory of Racism and Sexism." *The American Economic Review* 62, no. 4 (1972): 659–61.

Board of Trustees (Board of Trustees, Federal Old-Age and Survivors Insurance and the Federal Disability Insurance Trust Funds). 2018. "The 2018 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds."

Urban Institute. 2015. *DYNASIM: Projecting Older Americans' Future Well-Being*. Washington, DC: Urban Institute. http://www.urban.org/research/publication/dynasim-projecting-older-americans-future-well-being.

Wilson, Valerie, and William M. Rodgers III. 2016. "Black-White Wage Gaps Expand with Rising Wage Inequality." Washington, D.C.: Economic Policy Institute.

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