Wage Growth Disparities by Gender and Race/Ethnicity Among Entrants to Mid-Level Occupations in the United States

Findings from the Career Trajectories and Occupational Transitions Study

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Executive Summary

Career pathways programs offer articulated education and training steps between occupations in an industry sector, combined with a range of supports. Such programs aim to help individuals enter and exit pathway training at various levels, depending on their initial skills and work experience, and advance over time to higher skills and better jobs with higher pay (Fein, 2012). Women and workers of color constitute a large proportion of individuals served by those programs (Peck et al., 2021). Past research has shown large gaps in employment outcomes according to gender and race/ethnicity (Cajner et al., 2017; Mandel & Semyonov, 2014). Recognizing that employment disparities are a long-standing issue in the United States, this paper presents a new analysis examining gender and racial/ethnic differences in ten-year wage growth among workers who take jobs in occupations that require some preparation beyond a high school degree, but less than a four-year college degree—the kinds of occupations that career pathways programs generally target.

The study finds that otherwise similar workers entering the same mid-level occupations experience large gender and racial/ethnic disparities in wage growth. The study also finds:

- Wage growth disparities widen steadily over the course of those 10 years.
- When individuals are grouped by race/ethnicity *and* gender, Black and Hispanic women experience the least wage growth of all groups.
- Wage growth disparities are pervasive across occupational clusters.
- Women experience less wage growth than men despite being more likely to go on to obtain additional postsecondary degrees.
- Wage growth disparities cannot be explained by differences in other career-related outcomes, such gaps in time spent not working or in advancement to higher-level occupations.

Understanding wage growth disparities important for practitioners in career pathways programs and other employment and training programs and for policymakers generally. The results presented in this paper are particularly striking given that they compare workers who started in the same occupation at similar starting wages, prior education, and age. Given that this study finds that differences in other career-related outcomes explain little of the disparity in wage growth, much of what drives these disparities appears to stem from their employment experience in mid-level occupations. The findings highlight the need for additional research focused on understanding the reasons for wage disparities for similar workers entering the same occupation.

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1. Introduction

Employment and earnings gaps between workers of different genders and racial/ethnic groups are a long-standing issue in the United States (Cajner et al., 2017; Mandel & Semyonov, 2014). Women and workers of color are disproportionately represented among workers in low-wage jobs (Blau & Kahn, 2017; Carnevale et al., 2019). Helping workers advance from low-paying jobs to higher-paying ones is a primary goal of the employment and training field, particularly for those workers facing wage disparities associated with gender and race/ethnicity.

The growing visibility of the career pathways approach (in legislation and federal grant programs in addition to among programs that directly provide training) highlights the workforce field's focus on participants' longer-term career outcomes. Career pathways programs offer articulated education and training steps between occupations in an industry sector, combined with a range of supports. Programs adopting this approach aim to help individuals enter and exit pathway training at various levels, depending on their initial skills and work experience, and advance over time to higher skills, industry-recognized credentials, and better jobs with higher pay (Fein, 2012).

Importantly, a large proportion of participants in employment and training programs, including career pathways programs, are women or workers of color.[1] As a result, the success of career pathways and other efforts in promoting participants' career advancement will be limited to the extent that barriers related to gender and race/ethnicity impede those participants' wage growth after completing education and training programs and finding employment. Possible barriers to career advancement for women and workers of color include, but are not limited to, receiving less mentoring and other on-the-job learning opportunities, biased performance reviews, and unwelcoming work cultures (Mackenzie et al., 2019; Travis and Thorpe-Moscon, 2018; Paap, 2008). Training programs may not be able to fully address the range of factors that drive wage trajectories associated with gender and race/ethnicity, but understanding the differences in wage growth among groups, and factors that affect them, may help identify strategies to reduce them.

This paper presents a new analysis examining gender and racial/ethnic differences in wage growth among workers in the United States who, between the ages of 18 and 34, entered occupations that require some training or experience beyond a high school degree, but do not necessarily require a college degree (referred to as "mid-level" occupations).[2] The paper includes implications for policymakers and practitioners. The "mid-level" occupations that the analyses focus on are occupations that require an extent of prior preparation that is similar to that of occupations that career pathways programs focus on for training. Using data from 1997-2018, the study examines difference in wage growth for a 10-year period after individuals first enter one of those mid-level occupations. Because the analysis explores wage growth among workers assuming the same occupational starting point (that is, controlling for occupation and wage at entry), it provides important information specifically on the role of career

[1] For example, the Pathways for Advancing Careers and Education (PACE) evaluation of nine career pathways programs across the country found that in eight of those programs, women constituted the majority (66 percent) of participants and nearly 80 percent identified as Hispanic, Black, or a different race other than White (Gardiner & Juras, 2019). In a meta-analysis of career pathways programs (Peck et al., 2021) about 38 percent of participants were White, 35 percent were Black, and 23 percent were Hispanic/Latino, and more than half (53 percent) were women.

[2] As discussed in Section 3, occupations were classified as "mid-level" based on O*NET job zones, which reflect average educational and training requirements. Individual workers may have more or less education and preparation than is generally required.

advancement, rather than initial hiring,[3] in contributing to overall wage disparities associated with gender and race/ethnicity. This paper addresses four questions:

1) Among workers who take jobs in mid-level occupations, how do gender and racial/ethnic disparities in wage growth evolve over the course of the 10 years after entering the occupation?
2) In what ways do gender disparities in wage growth vary by race/ethnicity, and in what ways do racial/ethnic disparities in wage growth vary by gender?
3) To what extent do gender and racial/ethnic wage growth disparities vary among occupational clusters?
4) What gender and racial/ethnic gaps exist in other career-related outcomes, and to what extent can those gaps explain wage growth disparities?

This paper is part of the ***Career Trajectories and Occupational Transitions* (*CTOT*) *Study*** conducted for the U.S. Department of Labor by Abt Associates. The CTOT study, one of three studies that comprise the Descriptive and Analytical Career Pathways (D&A CP) Project, examines trajectories in wage growth that workers experience in the years after they enter mid-level occupations. The CTOT study found significant differences in wage growth associated with gender and race/ethnicity among workers starting in the same occupation at similar wages. This paper provides fuller analysis of these wage disparities.

The Descriptive & Analytical Career Pathways Project and Its Career Trajectories and Occupational Transitions Study

- The Workforce Innovation and Opportunity Act emphasizes the use of career pathways programs and requires the US Department of Labor (DOL) to conduct a study to develop, implement, and build upon career advancement models and practices. To respond to the need for information and evidence in the field due to this growing emphasis, DOL's Chief Evaluation Office, in collaboration with DOL's Employment and Training Administration, contracted with Abt Associates to conduct the Descriptive & Analytical Career Pathways (D&A CP) Project (2018-2021). The project's purpose is to advance the evidence base in the career pathways field by addressing key research gaps, drawing primarily on existing data, to inform career pathways systems and program development to help meet the needs of both participants and employers.
- The Career Trajectories and Occupational Transitions (CTOT) Study aims to fill a research gap identified by DOL's Career Pathways Design Study (2015-2018) for more information about how workers move through their careers, particularly in those occupational clusters typically targeted by career pathways programs. CTOT's analysis yields insights about medium- to long-term (up to 10 years) experiences of workers in the labor market generally that could help career pathways and other employment and training programs target occupations and design programs to support participants' advancement.

Full reports from the Career Pathways Design Study are available here: https://www.dol.gov/agencies/oasp/evaluation/completedstudies

The next section describes the context for the CTOT Study and this paper's focus on gender and racial/ethnic wage disparities and its research questions. The third section describes the study's data sources and methods. The fourth section addresses findings for each of the four research

[3] Of course, gender and racial/ethnic disparities also exist in which occupations workers enter and wages between and within those occupations. Any differences in wages at the start of the trajectory would mean that overall wage gaps would be larger than any gaps in wage growth described in this study (e.g. they would be the sum of the difference in the starting wage in addition to the difference in wage growth). This paper focuses solely on comparisons of wage growth among workers entering the same occupations, holding constant starting wages, as it is most directly related to the CTOT study's focus on workers' career trajectories.

questions described above. The final section discusses the limitations and implications of the study for policymakers and practitioners.

Key Study Concepts and Definitions

Racial/Ethnic Groups. This paper looks at wage growth disparities and differences in employment patterns by **racial/ethnic** groupings. The study obtained and analyzes data in the categories of Hispanic any race, White non-Hispanic, Black non-Hispanic, and Other race non-Hispanic. These groups are referred to as Hispanic, White, Black, and Other through the paper.

The paper uses the terminology "racial/ethnic" because our analyses defined groups by a combination of race and ethnic measures from surveys. Though "race" and "ethnicity" do have distinct definitions, in common social usage "Hispanic", "Black", and "White are treated as distinct classifications, rather than cross-cutting ones (Rumbaut, 2011; De Genova & Ramos-Zayas, 2010).

Due to small sample sizes, the study cannot examine how wage trajectories differ for Hispanic workers of different races and thus examines all those of Hispanic origin in one group. Similarly, "Other" groups together Asians, Pacific Islanders, Native Americans, workers who report multiple racial identities, and workers who report no racial identity or Hispanic ethnicity. Moreover, the sample sizes for the combined Other category as a whole are also small enough that there is greater uncertainty in the results compared to other groups. Thus, though this paper does provide some analyses for the Other category, most of the analyses provide results only for Hispanic, Black, and White worker groups.

Entrant. A worker who takes a job in an occupation for the first time.

Career trajectory. This term describes where *entrants* to an occupation end up in the years after they first take a job in the occupation. We focus particularly on how much wage growth workers go on to experience, but we also consider how much formal education they go on to obtain, how much unemployment they experience, how many job changes they make, and how likely they are to stay within the same occupational cluster. Advancement in wage growth could be steady, or there could be periods of earnings instability, including unemployment.

Occupational cluster. We use this term to describe a set of related occupations. Our set of "occupational clusters" is based on the broad occupational categories used by the Census and the Standard Occupational Classification (SOC) System. For purposes of this study, some of our clusters are combinations of more than one broad category, when useful for coherence or sample size. For example, our "Healthcare" cluster includes both Healthcare Practitioners and Technical Occupations (SOC 29) and Healthcare Support Occupations (SOC 31).

Occupation. A set of jobs with a common role and set of characteristics (e.g., Registered Nurse).

2. Study Context and Research Questions

After describing the impetus for the overall CTOT Study, as well as this paper's focus on gender and racial/ethnic differences in wage growth, this section discusses the paper's four research questions, with details on the underlying hypothesis of each one.

A. Study Context

The CTOT Study is designed to provide occupation-specific information on workers' advancement patterns to help inform the targeting and design of career pathways programs. The study's findings aim to supplement labor market information currently available on occupational opportunities. In particular, the

study aims to provide information to help programs target occupations and design programs in ways that lead to stronger longer-run wage growth for participants.

Research indicates that on average, career pathways programs increase educational progress and employment in a targeted occupation or industry (Peck et al., 2021). But programs have to date been less successful at improving earnings, particularly beyond the first year or two after program completion (Peck et al., 2021; Gardiner & Juras, 2019).[4] One potential strategy to improve those longer-term outcomes is to focus more training programs on occupations that are more reliable "launchpads" for future wage growth—that is, occupations in which workers tend to go on to earn higher wages over time. But programs currently have little information available to identify those occupations.

Labor market information that is currently available to employment and training programs can help them identify which occupations have more job openings and how much those occupations tend to pay. Existing labor market information generally describes characteristics within each occupation, rather than what happens to workers in terms of possible paths from those occupations. Using data that follow workers over time, the CTOT Study aims to help fill that gap, by providing information on which mid-level occupations are the most reliable launchpads for careers with high wage growth, as well as information on the types of occupational transitions through which that advancement tends to occur.

An important element of the CTOT Study is to examine career advancement prospects not just across occupations but among workers from different backgrounds within a given occupation. Indeed, the study finds substantial gaps in wage growth by workers' gender and race/ethnicity (e.g., Schwartz et al., 2021).[5] For example, 10 years after entering mid-level occupations, Black entrants experience wage growth that is $3.07 less per hour than similar White entrants to the same occupations—$8.13 per hour versus $11.21 per hour.[6] Proportionally, this means that Black workers' wages grow 27 percent less than their White peers. The study's analyses also find that 10-year wage growth is $1.25 per hour lower for Hispanic workers relative to White workers and $3.61 per hour lower for women relative to men.

An extensive body of research has identified factors that can cause wage disparities for women or workers of color (e.g., see Tucker, 2020; Bleiweis, 2020). Some of this work examines factors affecting hiring outcomes, such as differences in social networks (Henley, 2000), applicant screening technologies (Lee et al., 2019; Lee, 2018), and manager bias (Riach & Rich, 2002; Rich, 2014; Neumark, 2018). These factors may prevent workers who are women or of color from reaching the same occupational entry point as those who are men or White (Pager et al., 2009; Quillian et al., 2017). Further, barriers related to race and gender may not simply be additive, but rather may interact with one another (Browne & Misra, 2003). For instance, racial bias may exhibit differently for Black men than for Black women.

Other studies focus on factors that are associated with wage disparities by deterring career advancement (Gould et al., 2016). Those include gender and racial/ethnic biases in performance review, promotion, and retention decisions (Mackenzie et al., 2019); exclusionary workplace culture (Travis &Thorpe-Moscon, 2018); biases in task assignment and hours scheduling (Lambert et al., 2019); disparities in mentoring and other on-the-job learning opportunities (Paap, 2008); and differences in care

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[4] Studies vary in the time frame in which they measure earnings impacts, but a meta-analysis of career pathway programs (see Peck et al., 2021) found these impacts were less likely after a three-year follow-up period.

[5] See also the Career Trajectories and Occupational Transitions interactive dashboard at https://www.dol.gov/agencies/oasp/evaluation/resources/career-trajectories-and-occupational-transitions-dashboard

[6] We report whole numbers, and some may not appear to add up due to rounding at greater levels of precision. The precise equation is $11.206-8.133=3.073

responsibilities outside of work and transportation challenges that impinge on work availability or ability to obtain additional formal credentials (Pal & Waldfogel, 2014; Ruetschlin & Asante-Muhammad, 2015).

As described further below, because the analyses in this paper examine wage growth among workers at the same occupational starting point, it provides important information specifically on the role of career advancement, rather than initial hiring, in contributing to overall wage disparities associated with gender and race/ethnicity.

B. Research Questions

Building off the broader CTOT Study, this paper examines four research questions on wage growth differences associated with gender and race/ethnicity. Examining patterns in these wage growth differences—including how widespread or concentrated they are and how they relate to other career outcomes—provides valuable information on the factors that are likely to be important in determining wage growth differences across gender and racial/ethnic groups. Below we discuss the rationale for each research question in more detail.

Research Question #1: Among workers who take jobs in mid-level occupations, how do gender and racial/ethnic disparities in wage growth evolve over the course of the 10 years after entering the occupation?

Much of the research that focuses on gender and racial/ethnic disparities focuses on a snapshot of workers at a certain point in time. In contrast, the analysis in this paper examines wage growth differences three, five, and 10 years after workers start in mid-level occupations. If wage growth disparities are most pronounced later, this may suggest some "glass ceiling" effect, in which new barriers to advancement for women and workers of color emerge as they progress in their careers (Jackson & O'Callaghan, 2011; Davies-Netzley, 1998). If, instead, disparities start early and grow steadily over time, this may indicate barriers that remain similarly present throughout their careers.

Research Question #2: In what ways do gender disparities in wage growth vary by race/ethnicity, and in what ways do racial/ethnic disparities in wage growth vary by gender?

The study also examines how race/ethnicity and gender interact to condition wage growth after hire among workers who have entered the same occupation. Women of color are likely to experience barriers related to both race/ethnicity and gender. But overall racial/ethnic wage differences may obscure how biases based on race/ethnicity may be experienced differently by men versus women (McBride et al., 2015; McCall, 2005). Similarly, looking solely at overall gender differences may obscure how biases based on gender may be experienced differently by one racial/ethnic group or another. For example, research has found that Hispanic women are stereotyped as docile and not career-oriented (Williams et al., 2002), whereas Hispanic men are stereotyped as threatening and aggressive (Ghavami & Peplau, 2013). Though both stereotypes are of Hispanic people, they vary by gender and may result in different types of employment barriers for Hispanic women and men.

As another example, the benefits that are expected to accrue to men may not accrue equally to men of different racial or ethnic groups. For example, research indicates that men are rewarded for being assertive in the workplace (whereas that same behavior by women may be seen as violating gender norms and lead to negative career consequences; Rudman et al., 2012). But actions by a White man that are seen as assertive and masculine in the workplace may be seen as threatening if performed by a Black man (Travis & Thorpe-Moscon, 2018).

Research Question #3: To what extent do gender and racial/ethnic wage growth disparities vary among occupational clusters?

Existing research suggests that workers of color and women may face more barriers to advancement in some occupations—particularly occupations where the large majority of workers are White or male—than in others (e.g., Kelly et al., 2015). This is because an occupation's incumbents may be less welcoming to newcomers who are of a race, ethnicity, or gender that has not been highly represented in that occupation in the past. This could include being subjected to overt hostility and harassment (Denissen & Saguy, 2014; Price, 2002), receiving less mentoring (Paap, 2008), or being excluded from networks that contribute to advancement opportunities (Duke et al., 2013). The emotional tax of needing to feel on guard against potential bias also may affect their work (Travis & Thorpe-Moscon, 2018).

This paper compares disparities among 15 occupational clusters, as well as how disparities vary by a cluster's demographic composition. If disparities are more pronounced in some clusters than others, that may indicate a need to examine processes specific to those clusters that may be contributing to inequities in wage growth. By contrast, if disparities are relatively similar across clusters, then that may indicate that the primary drivers of wage growth disparities are more pervasive.

Research Question #4: What gender and racial/ethnic gaps exist in other career-related outcomes, and to what extent can those gaps explain wage growth disparities?

Wage growth over time is affected by other career-related outcomes, including time spent not working, frequent job changes, postsecondary degree attainment, and advancement to a "high-level" occupation. Differences in these outcomes associated with gender and race/ethnicity—and the extent to which those differences can explain wage growth disparities—provide information on possible mechanisms behind wage growth disparities. Below we briefly describe those outcomes and how they may relate to wage growth and wage growth disparities.

Employment interruptions. Workers may experience time not employed for various reasons, including reasons that disproportionately affect women and workers of color. Gender and racial/ethnic biases in retention decisions and unfriendly work cultures may make women and workers of color more likely to leave a job either involuntarily or voluntarily (McKay et al., 2007). Conventional gender role expectations may result in women spending more time out of the labor force than men for family care obligations (Ferrant et al., 2014). Working reduced hours can play a role in wage disparities between men and women and different racial/ethnic groups (Hegewisch & Lacarte, 2019). Residential segregation may impose barriers to retaining employment for some workers of color, through more segregated social networks that are less connected to employment opportunities (Boustan, 2013; Dickerson vonLockette & Johnson, 2010). Further, disparities in health outcomes and criminal justice involvement may also contribute to increased employment interruptions (Wilson & Jones, 2018).

Employers may interpret workers' prior interruptions negatively, thus impeding future career advancement. Research notes that labor force interruptions may contribute to wage disparities by gender and race (Antecol & Bedard, 2004; Looze, 2015). For example, one study found that women who did not work for one year earn 39 percent less annually as compared to women who did not have any labor force interruptions over 15 years (Rose & Hartmann, 2018). The same study found that women are penalized more for time out of the labor force than men are; women may also spend more time not employed. Weisshaar (2018) finds that parents who spend time out of work to care for family experienced worse hiring prospects than parents who spent time out of work due to job loss.

Number of job changes. Research on the labor market suggests that job changes may be a key way to obtain higher wages (Andersson et al., 2004; Bernstein & Hartmann, 2000; Faberman & Justiniano, 2015). When workers look for new jobs, they frequently can find employers that pay better wages and offer more opportunities for growth and promotion. On the other hand, overly frequent job changes may reflect employment instability, which has been connected to poorer subsequent employment outcomes (Holzer & Lalonde, 2000).

Postsecondary degrees. Obtaining a postsecondary degree is generally recognized as a way for workers to increase wages. For example, in one study, median lifetime earnings are 74 percent higher for workers with a bachelor's degree and more than 30 percent higher for workers with an associate degree, compared to workers with only a high school diploma (Carnevale et al., 2011). In theory, gender or racial/ethnic disparities in ability to return to school or degree-granting institutions could influence disparities in advancement prospects.

Advancement to a high-level occupation. Wage growth may occur through wage setting and promotion within mid-level occupations. But it may also occur through advancement to "high-level" occupations. We define a high-level occupation as one that requires considerable or extensive preparation, generally (though not necessarily) a bachelor's degree or more (see textbox). Of course, high-level jobs typically pay more than mid-level jobs, so any disparities in advancing to a high-level job would be expected to contribute to disparities in wage growth. If gender and racial/ethnic disparities in wage growth can be explained by differences in rates of advancement to high-level occupations, then that may indicate that solutions should focus on how to promote that advancement. But if wage growth disparities are not related to such advancement, it suggests a need to focus on gender and race/ethnicity in wage setting and promotion within mid-level occupations.

"High-Level" Occupations

The study classified jobs according to O*NET job zones (see footnote 11). High-level occupations are those with a Job Zone of 4 or 5, which O*NET defines as requiring "considerable or extensive" preparation, generally a bachelor's degree or more.

3. Data Sources, Key Measures, and Methods

The analyses for the CTOT Study and for this paper use a data file of career trajectories constructed using data from the National Longitudinal Survey of Youth 1997 (NLSY97) and the Panel Study of Income Dynamics (PSID) (Exhibit 1).[7] Both the NLSY97 and PSID are *panel datasets*, meaning that they follow the same people over time, interviewing them every few years to gather information on their work histories since the last survey round. Because of the CTOT Study's interest in creating wage trajectory estimates for up to 10 years for as many occupations as possible and because of the relatively small sample sizes in the NLSY97 and PSID individually, the study combined observations across the two sources. It generated weights to create a sample that is representative of the employed U.S. population between 18 and 34 in 2020 on gender, race/ethnicity, and educational attainment as of 2020.[8] The study limits the analysis to trajectories that start when the individual is age 34 or younger, because this is the oldest that entrants could be to allow for 10-year follow-up in the NLSY97 and because the median age

[7] The data used are from nationwide random samples, then combined and weighted to be demographically representative. The dataset has broad coverage across workers from all demographic backgrounds, geographic locations, and occupations, but may not be a representative sample in all ways.

[8] March 2020 data from the Current Population Survey's Annual Social and Economic Supplement is used as the benchmark for workforce composition.

for career pathways program participants tends to be early 30s (Peck et al. 2021).For further details on the data sources and construction of the data set, see Appendix B of Schwartz et al. (2021).

Exhibit 1: Source Data Used for the Career Trajectories Analyses

Dataset	Source	Years	Content/Additional Variables (other than occupation)	Sample Size	Length of Panel / Occupational History
Panel Study of Income Dynamics (PSID)	University of Michigan	2003–2017	Wages, education, demographic characteristics	24,000 individuals from 10,000 families	14 years
National Longitudinal Survey of Youth, 1997 (NLSY97)	U.S. Bureau of Labor Statistics	1997–2018	Wages, education, demographic characteristics	8,984 individuals	20 years

Notes: For more information on the PSID see https://psidonline.isr.umich.edu/Guide/Brochures/PSID.pdf.For more information on the NLSY97 see https://www.bls.gov/nls/nlsy97.htm
Source: Abt Associates

The next section describes the construction of the trajectories file from the NLSY97 and PSID data. This is followed by definitions of the key measures used to measure wage growth and other career outcomes.

Constructing Career Trajectories

The primary unit of analysis for this paper is *career trajectory*, defined as the set of career outcomes that a worker new to an occupation as their main or primary job (an "entrant") experiences in the 10 years after first starting work in that occupation. Each trajectory begins at the point in time when the NLSY97 or PSID survey respondent reports a new occupation, and it continues by month until the end of the observed data for that respondent. The 10-year trajectory file includes only those trajectory observations for which we are able to observe the individual for at least 10 years[9] after entering the occupation. For each NLSY97 or PSID sample member, the analysis contains more than one observation if they worked in more than one occupation during the observed data period and allows outcomes to be observed for at least 10 years after the individual entered each of those occupations.

The analyses in this paper include only trajectories where the occupation that the worker enters at the start of the observation is a "mid-level" occupation—an occupation that typically requires some education, training, or experience beyond high school but not necessarily a four-year college degree. The study uses the U.S. Bureau of Labor Statistics' O*NET Job Zone classifications to classify job levels.[10] The 10-year

[9] The study also includes analyses at three years and five years after the trajectory start. The shorter the trajectory period, the larger the sample sizes available. This is because there are fewer trajectories for which we have 10 years of outcomes than three or five years of outcomes. For example, suppose the data series for an individual ends in 2018. If the individual started a job in a new occupation in 2013, we would be able to report on five-year outcomes (2013-2018) or three-year outcomes (2013-2016) but would not be able to report on 10-year outcomes because the data series ends in 2018. Another implication of this is that the set of entrants for whom we can observe 10-year trajectory outcomes is younger than the set of entrants for whom we can observe five-year outcomes, because our analysis is based on the age at which they entered the occupation.

[10] Because NLSY97 and PSID use different systems to classify occupations, crosswalks are required. O*NET's occupational classifications are finer grained than Census classifications. As such, in some cases multiple O*NET codes correspond to a single Census code. In those cases, the Job Zone for the Census occupation is calculated as the simple average of the Job Zones for the set of corresponding O*NET codes. The study defined mid-level jobs as those with Job Zones of at least 2 but less than or equal to 3.8. This means that mid-level occupations typically require some postsecondary preparation but not a four-year

trajectories dataset we use to analyze wage changes includes a total of 25,038 observations from across the NLSY97 and PSID. The earliest data available start in 1997 and go through 2018. As such, all 10-year trajectories start between 1997 and 2008. [11] They end between 2007 (10 years after 1997) and 2018 (10 years after 2008).

Defining Key Measures

Below we define the key measures used in the analyses.

Wage growth. This is defined as the absolute difference between the hourly wage for a respondent's primary job at the end of the 10-year trajectory (Month 119) and the first month in the trajectory (Month 0). Wage growth is defined only for individuals who are still employed at the end of the trajectory.

Gender. Consistent with gender categories available in the NLSY97 and PSID, workers are classified as women or men.

Race/ethnicity. The study examines the following four racial/ethnic categories: Hispanic, Black non-Hispanic, White non-Hispanic, and Other non-Hispanic. NLSY97 and PSID ask respondents whether they identify ethnically as Hispanic, and how they identify racially. The racial/ethnic classification uses responses from both of those survey items. The Other non-Hispanic category includes individuals who do not identify as Hispanic and who identify racially as Asian, American Indian, Pacific Islander, any other race, or multiple races. (The sample for the Other category is 57 percent Asian, 8 percent American Indian, 32 percent multiple or other races, and 4 percent not reported). Individuals in the Hispanic group may identify as any race. The Black and White categories consist only of people who self-identify with one racial category, Black or White, respectively. Ideally, the analyses would examine various racial groups from within the Other category separately, given the likely range of experiences among the subgroups categorized as Other. However, sample sizes are too small to permit meaningful analyses for these different groups. Moreover, the sample sizes for the combined Other category as a whole are also small enough that there is greater uncertainty in the results compared to other groups. Thus, though this paper does provide some analyses for the Other category, most of the analyses provide results only for Hispanic, Black, and White worker groups.

Employment interruption. Several of the study's analyses include the number of months in which individuals were experiencing an employment interruption as a variable. Individuals are considered to be experiencing an employment interruption in a given month if they are neither working for pay in a given month nor enrolled in school. This includes individuals who are in the labor force (i.e., unemployed but looking for work) and those who are not in the labor force (i.e., not employed and not looking for work). These analyses do not examine the number of hours worked per week; "non-employment" is working zero hours per week.

Job changes. The number of job changes an individual has made is equal to one less than the number of different primary jobs the individual reports having during the 10-year trajectory period. If the individual were to stay in the same job for the whole trajectory, then the number of job changes would equal zero.

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college degree. High-level occupations are those with an average Job Zone higher than 3.8, meaning that they require more extensive preparation.

[11] The trajectories described here reflect labor market conditions from 1997 to 2018. They are subject to being affected both by cyclical changes in the economy and by trends in occupational structures during that time period. Future periods will differ. That said, there is a fair amount of stability in many occupational structures—though likely more so in some occupational clusters than others. Although the past is not perfectly predictive of the present, economic structures change slowly enough that past patterns likely can inform expectations for the future

Educational attainment/acquiring a postsecondary degree. Education at the start of a trajectory is categorized either as having a bachelor's degree, an associate degree, or no college degree. An individual is counted as acquiring a postsecondary degree during the occupational trajectory if their reported highest educational attainment is at least one degree higher than their degree level at the trajectory start. That is, an associate degree, if they started the trajectory with no college degree; a bachelor's degree, if they started with no more than an associate degree; or a master's or other graduate degree, if they started with no more than a bachelor's degree.

Analytic Methods

Estimating differences in outcomes. To analyze disparities in wage trajectory outcomes, the study uses statistical techniques to ensure that wage growth comparisons are among workers from the same occupation and to adjust for other potential causes of wage growth. Specifically, the study uses ordinary least squares (OLS) regression with occupation fixed effects and a set of statistical controls for starting wage,[12] age, gender, race/ethnicity, starting education, and highest level of education attained by parents. The coefficients for the gender and race/ethnicity indicators in those regressions are the source for the estimated disparities in wage growth and other career trajectory outcomes[13] presented in the paper. The racial/ethnic differences are measured for each group compared to the White group. That is, the coefficients on the indicators for each of the other three racial/ethnic groups—Hispanic, Black, and Other—are the estimates for the size of the difference in the outcome between workers from that particular racial/ethnic group and their White peers. Similarly, the coefficients on the indicators for women are the estimates for the size of the difference in the outcome between women and men. Although the overall sample includes nearly 25,000 observations, some of the subgroup samples are too small to provide analyses, particularly the Other subgroup, for outcomes by gender within the group, and some occupational clusters.

Statistical significance tests. The study reports whether estimated wage growth differences are statistically significant. Being "statistically significant" means that we can be confident that differences are real and not the result of random chance. Most tests of statistical significance that this paper presents are based on whether the coefficient for the particular indicator is different from zero. For race/ethnicity, for instance, the comparisons made are between average wage growth for workers from a given racial/ethnic group of color compared to the wage growth of White workers. A statistically significant result for Hispanic workers, as an example, would indicate confidence that average wage growth does differ between the Hispanic group and the White group, and that estimated differences are not due to chance. All statistical estimates have some level of uncertainty. The smaller the sample, the greater the uncertainty. To make clear the amount of uncertainty around an estimate, exhibits show the 95 percent confidence intervals (colloquially, the "margins of error") around the estimates, where possible. Those confidence intervals will tend to be wider when samples are smaller.

This paper refers to findings as statistically significant if the likelihood that the finding is due to chance is equal to or less than five percent. Given the exploratory nature of this research, however, this paper also

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[12] Specifically, using both linear and quadratic terms to capture possible non-linearities in the relationship between starting wage and wage growth.

[13] A control for parent education is included because the socioeconomic status of an individual's family of origin may influence their access to financial, informational, and networking resources that could help promote advancement. Parent education is defined using three categories for the highest level of education attained by either parent: bachelor's degree or higher, associate degree or higher, and no college degree (the last being typically the omitted category). The analyses in Schwartz et al. (2021) show that parent education predicts wage growth, even after accounting for all other measured factors, including the individual's own educational attainment.

discusses findings that fall short of this conventional $p<.05$ threshold but are within the more lenient $p<.10$ threshold.

How to Read Select Exhibits on Wage Differences

Many of the exhibits use the approach shown in Exhibit 2 to present wage differences. Exhibit 2 shows a portion of an actual exhibit (Exhibit 5 in the Key Findings section below). Specifically, Exhibit 2 displays the estimated difference in wage growth between White women and White men. The top purple dot indicates that our analyses found that, on average, 10 years after entering the same mid-level occupations, White women experience hourly wage growth that is $4.26 per hour lower than their otherwise similar White male peers. For example, if we assumed starting wages of $10 per hour, and that men experienced wage growth of $10 over ten years, at the ten year mark men would be earning $20 per hour while women would be earning $15.74. That the wage growth was *lower* is indicated by the minus sign and that the dot is to the left of the vertical line showing the reference category (in this example, White men). The light purple bar indicates the "95 percent confidence intervals," an indicator of the precision of the estimate. The bar represents the range of values within which we are 95 percent statistically confident the actual value falls. In this case, we are 95 percent confident that the actual value falls between –$5.40 and –$3.10. Because the confidence interval does not cross zero (the vertical line), the estimated difference is statistically significant at the .05 level (as indicated by the asterisk). That is, we are confident that White women experience less wage growth than their White male peers because the actual disparity is somewhere within the range represented by that bar, and all of the values in that range have the same sign (negative).

Exhibit 2: Example Chart (Wage Growth Disparities Between White Women and White Men)

4. Key Findings

This section presents CTOT Study findings on this paper's four research questions.

Research Question #1: Among workers who take jobs in mid-level occupations, how do gender and racial/ethnic disparities in wage growth evolve over the course of the 10 years after entering the occupation?

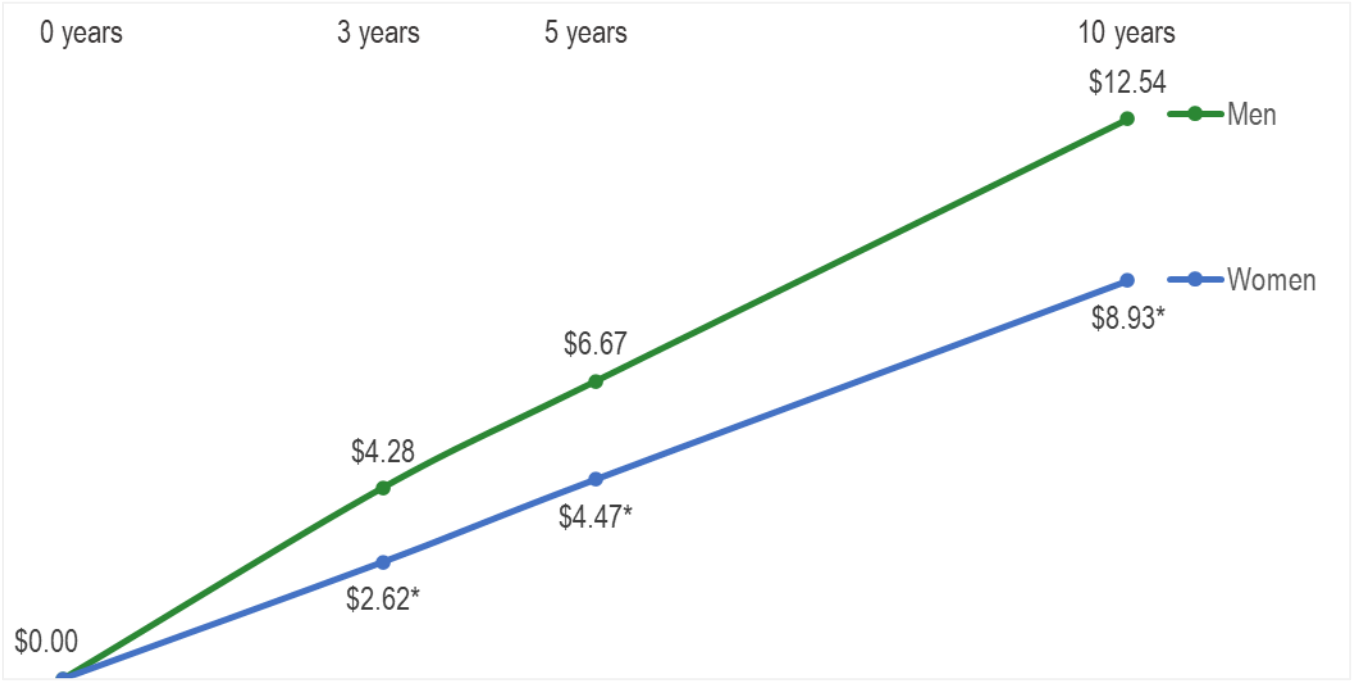
As discussed above, the CTOT Study found large gender and racial/ethnic disparities in wage growth over a 10-year period among workers starting in a given mid-level occupation(Schwartz et al., 2021). This research question examines whether and how those wage growth disparities changed over these 10 years, first by gender and then by race/ethnicity. In particular, do disparities expand steadily over the 10-year career trajectory, or do they expand more rapidly at earlier or later career stages?

Wage growth disparities between women and men expand over time after starting in an occupation.

Exhibit 3 shows wage growth for men (green line) and women (blue line) over the 10-year period. As is apparent from comparing the pair of lines, the gender differences in wage growth observed over 10 years start early in workers' careers and, proportionally, remain relatively constant over time. At each of the three time points examined (three, five, and 10 years), women's wage growth is roughly 30 to 40 percent less than their male peers,' and these differences are statistically significant at all points.

A 30 to 40 percent difference represents a larger disparity in absolute dollar terms in later years, when overall wages are higher, than in earlier years. For example, at Year 3, the gender gap in wage growth is $1.66 per hour—men's wages have grown by $4.28 per hour, whereas women's have grown by only $2.62 per hour. By Year 10, that wage growth gender gap is $3.61 per hour—with women's wages having grown by only $8.93 per hour, compared to $12.54 per hour for men. Assuming full-year, full-time hours[14] at three years the difference in wage growth amounts to $3,450 less in earnings for women relative to their male peers; at 10 years this gap has grown to around $7,500 per year.

Exhibit 3: Hourly Wage Growth Over Time, by Gender



How to Read This Graph: The dots represent the estimated wage growth at each point in time for members of the given category. Estimates reflect expected wage growth for someone with "average" characteristics of the sample in question. The asterisks indicate that women's wage growth to that point in time is statistically less than that of men. For instance, women entrants to an occupation, on average, are making $8.93 per hour more after 10 years while men are making $12.54 per hour more, on average. The asterisk on the $8.93 for women's wage growth indicates that the difference between women's wage growth and men's wage growth is statistically significant.
Note: *N*=25,038 trajectories. Estimates are drawn from OLS regressions that include occupation fixed effects and control for the worker's starting wage in the occupation, starting education, age, race/ethnicity, data source, and the characteristics above. Asterisks (*) indicate a statistically significant difference at the .05 level.

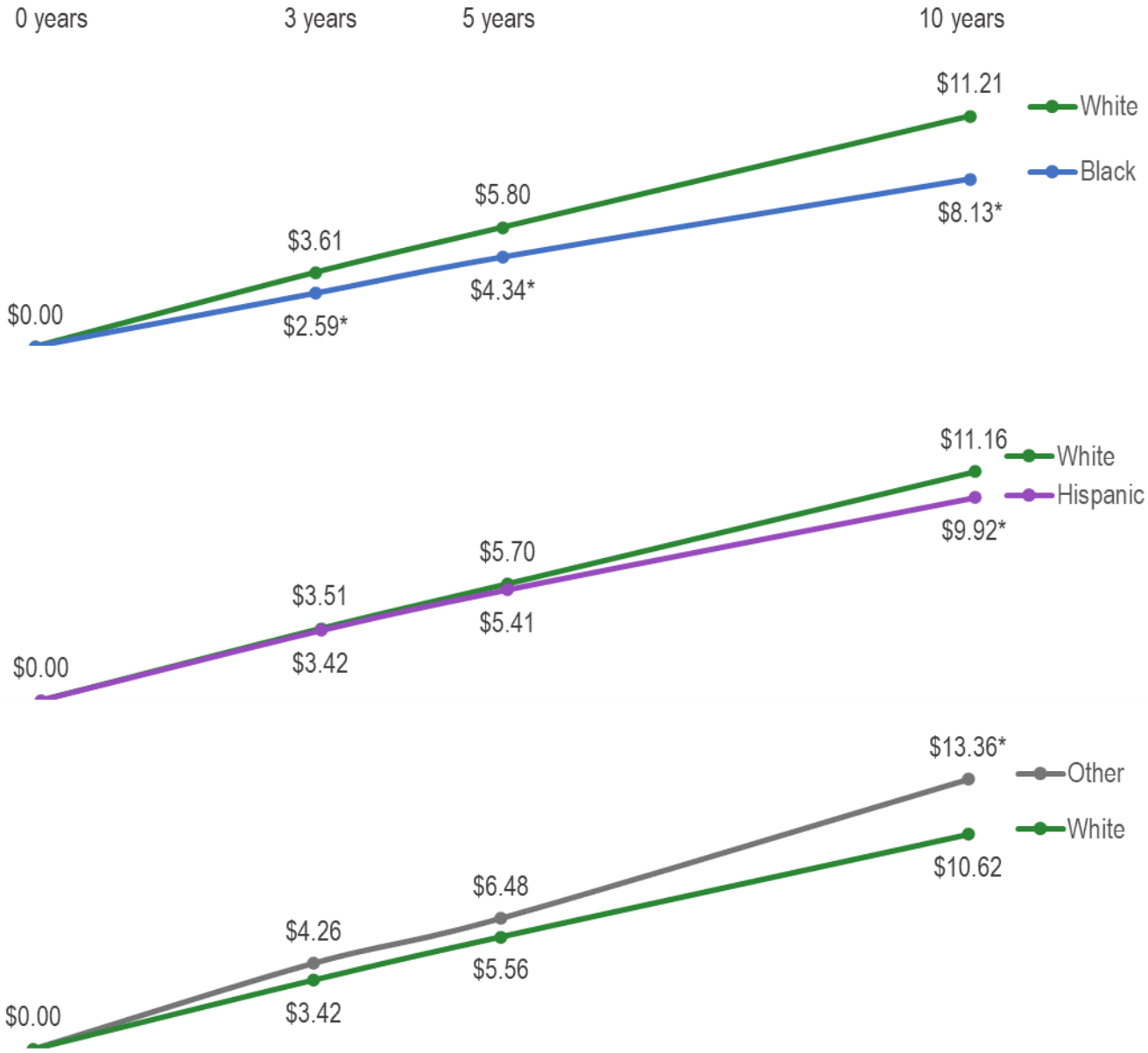
[14] The gap in full-year, full-time earnings is calculated by multiplying the hourly wage gap ($3.61) by 40 (typical full-time hours per week, which gives the weekly earnings gap), then multiplying that product by 52 (the number of weeks per year). The product of $3.61, 40, and 52 is $7,508.80. This does not imply that men and women are equally likely to be working full-year, full-time. As noted in later in this paper, women do experience more employment interruptions than men.

Source: NLSY97 and PSID

For both Black and Hispanic workers, disparity in wages grows steadily over time; for Hispanic workers, the difference does not become statistically significant until 10 years after entering the occupation.

Exhibit 4 shows wage growth for White workers (green line), Black workers (blue), Hispanic workers (purple), and Other workers (gray line) over the 10-year period (assuming the same starting wages). As with gender, the disparity in wages for otherwise similar Black and White workers starting in the same occupations grows steadily over time, as shown by the widening gap.

Exhibit 4: Hourly Wage Growth Over Time, by Race/Ethnicity



How to Read This Graph: The dots represent the estimated wage growth at each point in time for members of the given category. Estimates reflect expected wage growth for someone with "average" characteristics of the sample in question. The wage growth figures for White workers vary slightly across the three panels because of differences in average characteristics across the three samples (Black-White; Hispanic-White, and Other-White). The asterisks indicate that the wage growth for the group in question is statistically different than the wage growth for their White peers over the same time period. For instance, wages of Black entrants to an occupation, on average, have grown by $8.13 per hour after 10 years; compared to $11.21 per hour wage growth for White entrants. The asterisk on $8.13 at Year 10 indicates that Black workers' wage growth is statistically different from White workers' wage growth.

Note: *N*=25,038 trajectories. Estimates are drawn from OLS regressions that include occupation fixed effects and control for the worker's starting wage in the occupation, starting education, age, race/ethnicity, data source, and the characteristics above. The Hispanic category includes Hispanic workers of all races. The Black, White, and Other categories include only those workers who do not report Hispanic ethnicity. Other includes non-Hispanic individuals who identify racially as Asians, Pacific Islander, Native American, of multiple racial identities, and workers who report no racial identity or Hispanic ethnicity. They are grouped for analysis purposes only because sample sizes are insufficient to consider each separately.

Source: NLSY97 and PSID

As shown in the top panel of Exhibit 4, the wage growth gap widens from about $1 per hour after three years to $3 per hour after 10 years. At all three time points studied, Black workers experienced about 25 percent less wage growth than did White workers,[15] and those gaps are statistically significant at all points.

The disparities between Hispanic and White workers (middle panel) are smaller than the gaps between Black and White workers (top panel), although disparities grow over the 10-year span. After three years, Hispanic workers' wage growth is estimated to be 3 percent less than that of their White peers ($3.42 vs. $3.51 per hour), a difference that is not statistically significant. By five years, the wage growth gap remains proportionally about the same size—5 percent less for Hispanic workers ($5.41 vs. $5.70 per hour)—and again not statistically significant. However, the difference in wages between Hispanic and White workers grows over the subsequent five years. By 10 years, Hispanic workers have experienced 11 percent less wage growth ($9.92 vs. $11.16 per hour) than their White peers, and this difference is statistically significant.

Wage growth for workers in the Other category is significantly higher than for White workers after 10 years. The gap expands particularly during the latter five years (Exhibit 4, bottom panel). However, these estimates are less precise due to wider variations in individual wages than for other racial/ethnic categories. The differences are not statistically significant at three years and five years, but they are at 10 years.

Because the disparities detected are present early on and grow steadily, the preceding results are inconsistent with the hypothesis that a glass ceiling imposes *greater* barriers as women and workers of color advance in their careers. Although in absolute terms disparities widen in later years, that widening does not accelerate later and proportionally, the gaps remain similar across all three time points. One possible exception is among Hispanic workers, whose wages grow nearly as quickly as those of White workers for the first five years, before disparities begin to increase over the next five years. It is important to note that this study examines outcomes for only 10 years after workers start in their occupations, and for workers who are relatively young at the time of entry (no older than age 34). It may be that glass ceilings exist but tend not to occur until later in careers than we are able to observe.

Research Question #2: In what ways do gender disparities in wage growth vary by race/ethnicity, and in what ways do racial/ethnic disparities in wage growth vary by gender?

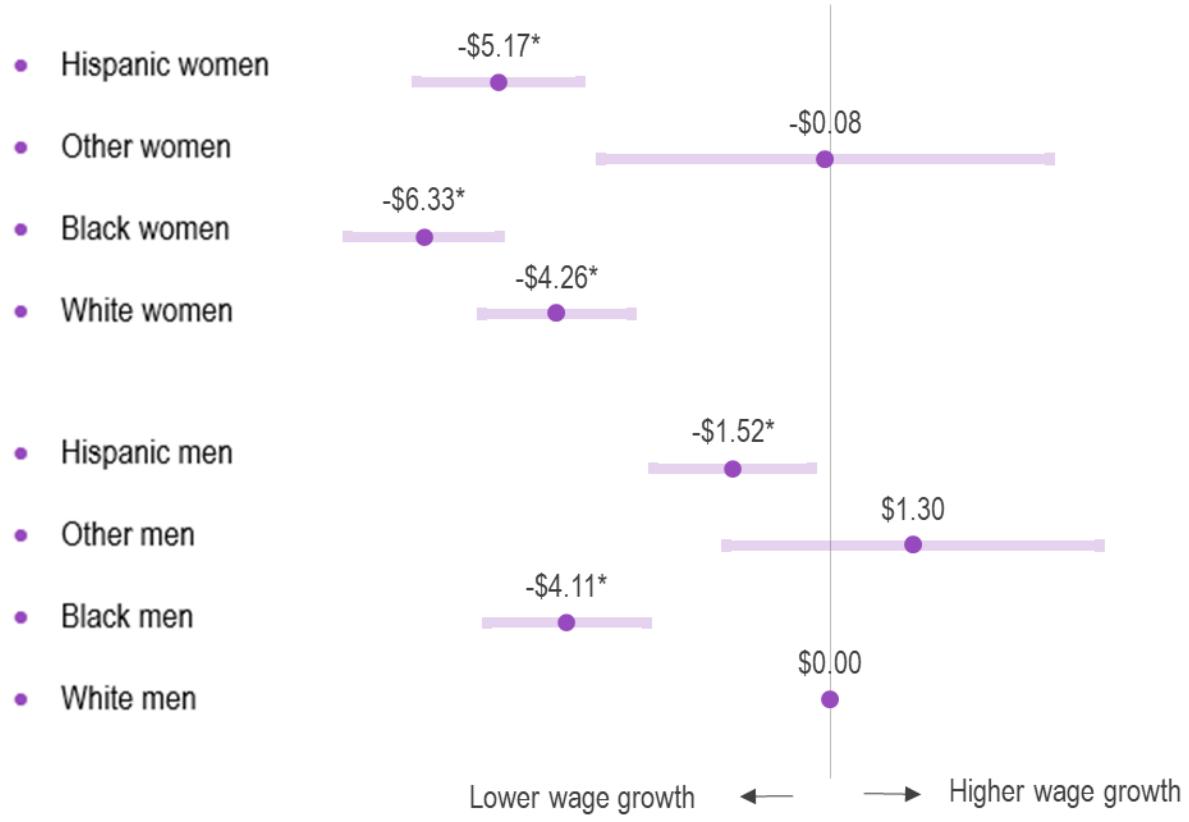
Wage disparities related to gender may also vary by race/ethnicity. Similarly, wage differences associated with race/ethnicity may be different for men and women. Wage growth differences for workers of various combinations of gender and race/ethnicity are presented below.

Black and Hispanic women experience the least wage growth; the wage growth of White women, Black men, and Hispanic men also lags behind that of White men.

Exhibit 5 shows the estimated difference in average wage growth over 10 years for workers of various groups defined by both gender and race/ethnicity, compared to White male workers. Black women, Black men, Hispanic women, Hispanic men, and White women all experience wage growth that is significantly less than that of White men. As shown, Black and Hispanic women have the lowest estimated 10-year wage growth: 10 years after entering a mid-level occupation, Black women's wages have grown on average $6.33 per hour less and Hispanic women's wages have grown $5.17 per hour less than their White male peers. Wages of White women and Black men experience similar 10-year wage growth; each lagging more than $4 per hour behind that of White men. Hispanic men's wages have grown $1.52 per hour less than White men's.

[15] At three years, Black workers' wage growth was 28 percent less than that of their White peers ($2.59 vs. $3.61). That gap is 25 percent at five years ($4.34 vs. $5.80) and 28 percent at 10 years ($8.13 vs. $11.21).

Exhibit 5: Ten-Year Differences in Hourly Wage Growth, by Gender and Race/Ethnicity



How to Read This Graph: The dots represent the estimated difference in average wage growth for members of the given category, compared to members of the reference category who are otherwise similar (same starting occupation, starting wage, and demographic characteristics other than those in question). Dots on the vertical zero line are for the reference category itself (in this case, White men). Dots to the right indicate that, on average, entrants from that demographic group experience more wage growth than do otherwise similar entrants from the reference category. Likewise, dots to the left indicate that, on average, entrants from that demographic group experience less wage growth than do otherwise similar entrants from the reference category. For instance, Black women experience, on average, $6.33 per hour less in wage growth 10 years after entering the occupation compared to otherwise similar White men. The bars indicate the precision of our estimates (the 95 percent "confidence interval"); the actual wage differences could fall anywhere in that range, though they are more likely to fall toward the middle of the range than the ends. Asterisks indicate that the difference is statistically significant at the p <.05 level.
Note: *N*=25,038 trajectories. Estimates are drawn from OLS regressions that include occupation fixed effects and control for the worker's starting wage in the occupation, starting education, age, race/ethnicity, data source, and the characteristics above. The Hispanic category includes Hispanic workers of all races. The Black, White, and Other categories include only those workers who do not report Hispanic ethnicity. Other includes Asians, Pacific Islanders, Native Americans, workers who report multiple racial identities, and workers who report no racial identity or Hispanic ethnicity; they are grouped only because sample sizes are insufficient to consider each separately.
Source: NLSY97 and PSID

Gender gaps exist among all racial/ethnic groups but vary in size.

The preceding finding that Black and Hispanic women experience the lowest wage growth indicates that workers in those groups experience barriers related to both their race/ethnicity and their gender. Overall, the study finds that gender disparities in wages vary by race/ethnicity and that racial/ethnic differences vary by gender. Exhibit 5 above shows that within all racial/ethnic groups, women's wages grow less than men's wages (however, these differences are not necessarily statistically significant). However, as discussed, while the wage growth disparity between White men and White women is $4.26 per hour, among Hispanic and Black workers, this gender wage difference is $3.65 and $2.22 per hour

respectively.[16] While among both men and women Black workers experience less wage growth than White workers, the Black-White wage growth gap is about twice as large among men ($4.11 per hour) as among women ($2.07 per hour).[17]

The gender wage growth gap among workers in the Other race/ethnicity category is $1.38,[18] smaller than the estimated gender gaps for Black, Hispanic, or White workers. And both Other men and Other women experience wage growth estimated to be similar to or greater than White men's wage growth. However, small sample sizes and large confidence intervals make it difficult to draw conclusions about disparities for men and women in the Other category. Because of this limitation and because the Other category may obscure meaningful variation in experiences among workers in that group, the remainder of the analyses in this paper focus on Hispanic, Black, and White workers.

Research Question #3: To what extent do gender and racial/ethnic wage growth disparities vary among occupational clusters?

This research question examines how gender and racial/ethnicity disparities in wage growth vary by occupational cluster. As discussed, occupational clusters are sets of related occupations (e.g., Healthcare or Construction). The study uses the major occupational categories from 2002 Census as the basis for defining occupational clusters, in some cases combining major categories.[19] The box below provides examples of mid-level occupations for each occupational cluster.

As discussed above, one reason that gender gaps in wage growth may be larger in some occupational clusters than in others is that occupations where women or workers of color have typically been underrepresented may be less welcoming environments (Denissen & Saguy, 2014; Duke et al., 2013l Paap, 2008; Price, 2002, Travis & Thorpe-Moscon, 2018). In turn, women and workers of color may encounter greater gender-specific and/or race/ethnicity-specific barriers to advancement in those fields than they do in fields where workers of their same gender, race/ethnicity are more highly represented. To address this issue, the study examines the extent to which gender and racial/ethnic gaps in wage growth are smaller in occupational clusters where the relevant groups are more highly represented.

Due to sample size limitations, this section does not present findings by race/ethnicity *and* gender within the same analysis (e.g., the section provide findings for Black workers and for women, but not for Black women as a distinct category).

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[16] Based on the figures in Exhibit 5, the $3.65 gender disparity for Hispanic workers can be calculated as the difference between –$5.17 and –$1.52. Similarly, the $2.22 gender disparity for Black workers can be calculated as the difference between –$6.33 and –$4.11. We report whole numbers, and some may not appear to add up due to rounding at greater levels of precision.

[17] Based on figures in Exhibit 5, the $2.07 Black-White disparity for female workers can be calculated as the difference between -$6.33 and -$4.26.

[18] $1.38 is the difference between –$0.08 (the estimated wage growth disparity between Other women and White men) and +$1.30 (the estimated wage growth disparity between Other men and White men).

[19] For example, the study combines the category Healthcare Practitioners and Technical Occupations and the category Healthcare Support Occupations into a single Healthcare cluster. See Appendix E of Schwartz et al. (2021) for further detail on how occupational clusters are classified and the occupations that are included in each cluster.

Examples of Mid-Level Occupations by Cluster

Agriculture: Farmers and ranchers; forest and conservation workers

Arts and Entertainment: Athletes, coaches, and umpires; designers

Construction: Carpenters; painters, construction, and maintenance workers

Education, Legal, Social Services: Preschool and kindergarten teachers; paralegals and legal assistants

Engineering, Science, and Architecture: Engineering technicians; drafters

Healthcare: Nursing assistants; registered nurses

Information Technology (IT): Computer support specialists; network systems analysts

Maintenance and Repair: Auto service technicians and mechanics; computer, Automatic Teller Machine (ATM), and office machine repairers

Management, Business, and Finance: Human resources, training, and labor relations specialists; wholesale and retail buyers

Office and Administrative Support: Customer service representatives; receptionists and information clerks

Personal Service: Waiters and waitresses; cooks; childcare workers

Production: Assemblers and fabricators; inspectors, testers, sorters, samplers, and weighers

Protective Services: Security guards and surveillance officers; lifeguards

Sales: Cashiers; retail salespersons

Transportation: Hand laborers and material movers; driver/sales workers and truck drivers

Note: Our set of occupational clusters (shown here) is based on the broad occupational categories of the Census (which carry over to SOC). For purposes of this study, some of our clusters are combinations of more than one broad category, when useful for coherence or sample size. For example, our "Healthcare" cluster includes both Healthcare Practitioners and Technical Occupations (SOC 29) and Healthcare Support Occupations (SOC 31). Managerial occupations are the one exception. For more, see Appendix E of Schwartz et al., 2021, which contains full details of how our occupational clusters map to Census occupational codes.

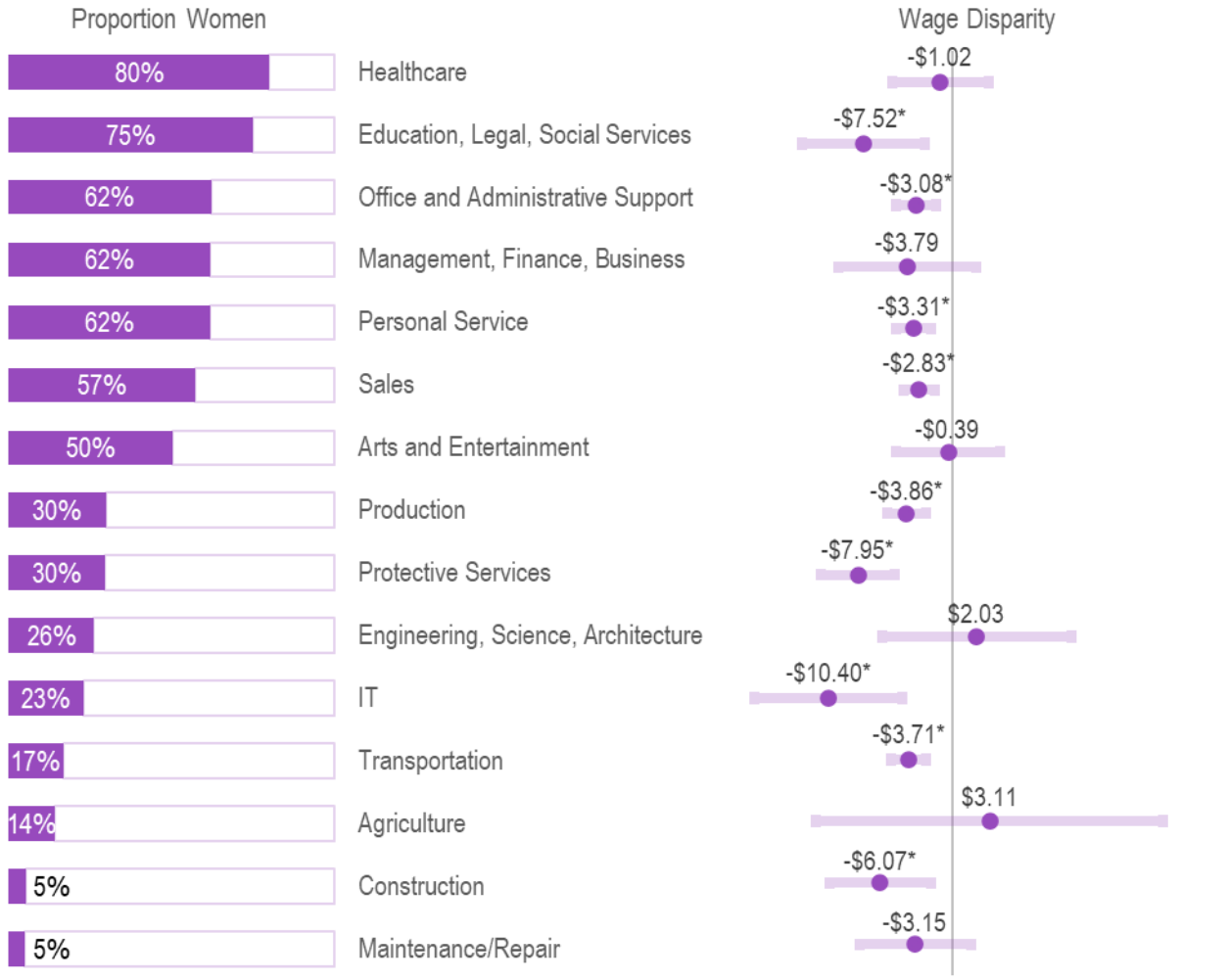
Women experience significantly lower wage growth than men across most occupational clusters, including clusters where women make up a majority of the entrants.

Exhibit 6 ("Wage Disparity" panel on right) shows gender gaps in 10-year wage growth for each of the 15 example occupational clusters. As shown, the differences in wage growth range from –$10.40 per hour for women versus men in IT to +$3.11 per hour for women versus men in Agriculture. Wage disparities appear to be particularly large (over $6 per hour) in Education, Legal, and Social Services; Protective Services; IT; and Construction. It is important to note that the confidence intervals are wide for several occupations (e.g., Agriculture) and moderately wide for many others (e.g., Construction). As a consequence, it is generally not possible to draw conclusions about whether disparities are greater in one occupational cluster than another. Statistical tests show that there are real differences in the size of gender disparities across the set of occupational clusters as a whole.[20]

[20] This is based on a joint Wald test of equality among occupational clusters in the gender coefficients (in a model that interacts occupational cluster with gender).

Exhibit 6 ("Proportion Women" panel) ranks the 15 occupational clusters, with clusters in which women are a larger fraction of entrants at the top. If women face stronger barriers to advancement in male-dominated occupational clusters, then one would expect to see smaller wage growth disparities in occupations toward the top of the chart and larger disparities further down the chart. In fact, three of the four occupations in which women face the largest wage gaps with men are in the bottom half of the chart, where there are fewer women entering the occupation. However, the other occupational cluster with large gender disparities in wage growth—Education, Legal, and Social Services—has one of the highest proportions of women entrants. Moreover, a statistical test for whether gender disparities are larger if the proportion of entrants who are women is smaller does not find any statistically significant association.[21]

Exhibit 6: Ten-Year Differences in Wage Growth Between Male and Female Workers, by Occupational Cluster



How to Read This Graph: The bars on the left side of the graph represent the proportion of entrants to each occupational cluster who are women. For example, 80 percent of entrants to Healthcare occupations are women. The dots on the right side of the graph represent the estimated difference in average wage growth for members of the given category, compared to members of the reference category (in this case, men) who are otherwise similar (same starting occupation, starting wage, and demographic characteristics other than the one in question). Dots to the right of the vertical zero line indicate that, on average, entrants to that occupational cluster experience more wage growth than do otherwise similar entrants from the reference

[21] This test was conducted by adding a measure for the gender composition of entrants, as well as a term interacting that measure with the indicator for the gender of the individual worker, to the basic regression specification. The coefficient for the interaction term is not statistically significant, indicating no evidence that gender gaps in wage growth vary depending on the gender composition of workers in the occupational cluster.

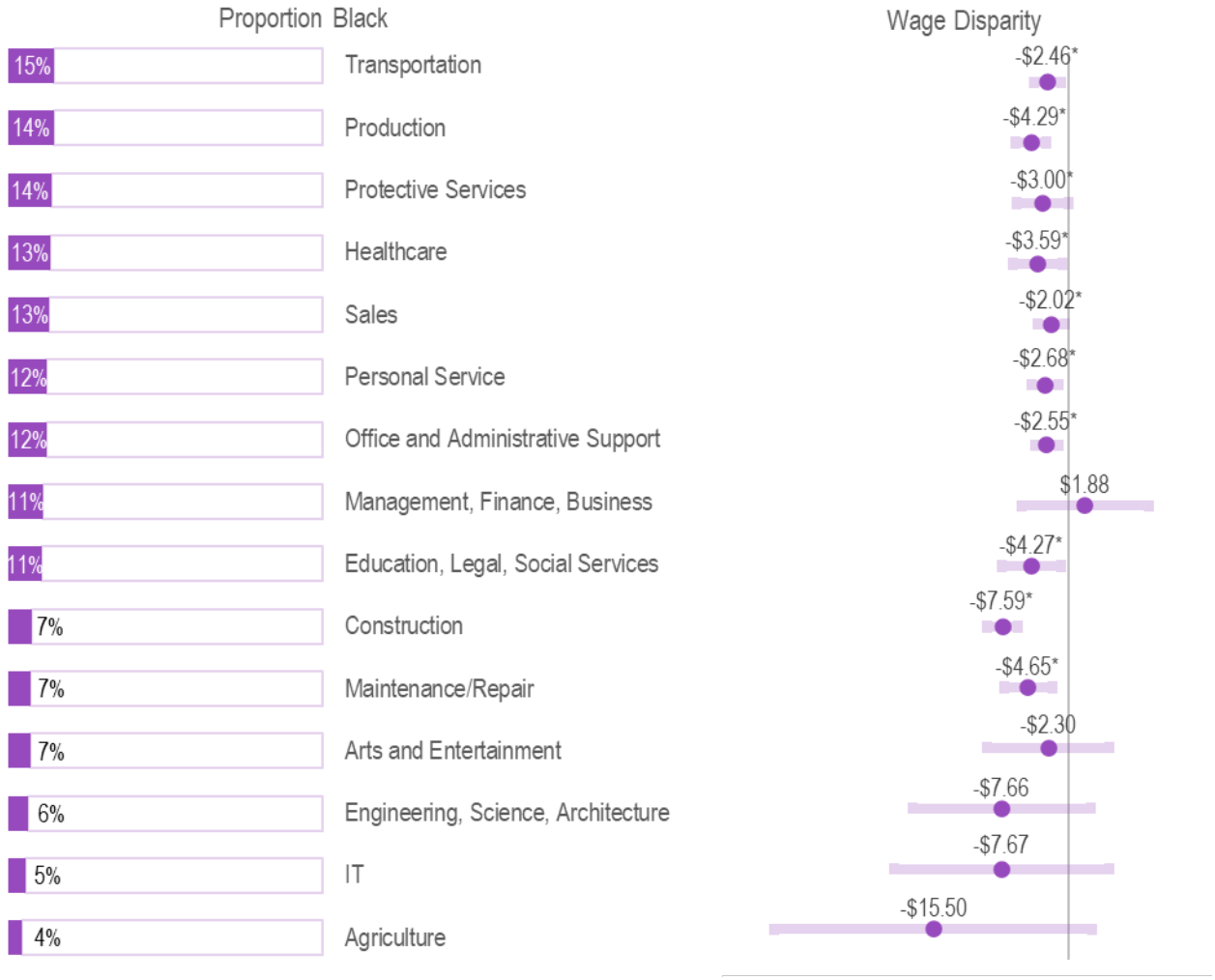
category. Likewise, dots to the left of the line indicate that, on average, entrants to that occupational cluster experience less wage growth than do otherwise similar entrants from the reference category. For instance, women entrants to an IT occupation experience, on average, $10.40 per hour less in wage growth 10 years after entering the occupation compared to the otherwise similar male entrants. The bars indicate the precision of our estimates (the 95 percent "confidence interval"); the actual wage differences could fall anywhere in that range, though they are more likely to fall toward the middle of the range than the ends.
Note: *N*=25,038 trajectories. Cluster proportions are the weighted proportions from the sample used to calculate wage disparity estimates. Wage disparity estimates are drawn from OLS regressions that include occupation fixed effects and control for the worker's starting wage in the occupation, starting education, age, race/ethnicity, data source, and the characteristics above.
Source: NLSY97 and PSID

Disparities in wage growth between Black and White entrants to mid-level occupations may be larger in fields where Black workers are less represented.

Exhibit 7 ("Wage Disparity" panel) shows estimated wage growth disparities for Black workers relative to White workers, by occupational cluster. The "Proportion Black" panel ranks the 15 occupational clusters, with clusters in which Black workers are a larger fraction of entrants at the top. Visually, gaps do appear to be larger among clusters at the bottom of the chart—those in which a smaller proportion of entrants are Black. However, the confidence intervals are also wide for the estimates in many of those occupational clusters. As a result, a statistical test for whether Black-White disparities in wage growth are larger if the proportion of entrants who are Black is smaller finds an association that is marginally statistically significant; its *p*-value is .06.[22] Though not conclusive, this suggests that Black workers may face greater barriers to advancement in occupations where they are less highly represented.

[22] A *p*-value of .06 is just short the typical $p<.05$ threshold, though within a $p<.10$ threshold. Note that a Wald test of whether Black-White disparities are the same across all occupational clusters rejects that hypothesis ($p<.001$), confirming that there is real variation in those disparities among clusters.

Exhibit 7: Ten-Year Differences in Wage Growth Between Black and White Workers, by Occupational Cluster



How to Read This Graph: The bars on the left side of the graph represent the proportion of entrants to each occupational cluster who are Black. For example, 15 percent of entrants to Transportation occupations are Black. The dots on the right side of the graph represent the estimated difference in average wage growth for members of the given category, compared to members of the reference category (in this case, White, workers) who are otherwise similar (same starting occupation, starting wage, and demographic characteristics other than the one in question). Dots to the right of the vertical zero line indicate that, on average, entrants to that occupational cluster experience more wage growth than do otherwise similar entrants from the reference category. Likewise, dots to the left indicate that, on average, entrants to that occupational cluster experience less wage growth than do otherwise similar entrants from the reference category. For instance, Black entrants to a Construction occupation experience, on average, $7.59 per hour less in wage growth 10 years after entering the occupation compared to the otherwise similar White entrants. The bars indicate the precision of our estimates (the 95 percent "confidence interval"); the actual wage differences could fall anywhere in that range, though they are more likely to fall toward the middle of the range than the ends.
Note: *N*=25,038 trajectories. Cluster proportions are the weighted proportions from the sample used to calculate wage disparity estimates. Wage disparity estimates are drawn from OLS regressions that include occupation fixed effects and control for the worker's starting wage in the occupation, starting education, age, race/ethnicity, data source, and the characteristics above.
Source: NLSY97 and PSID

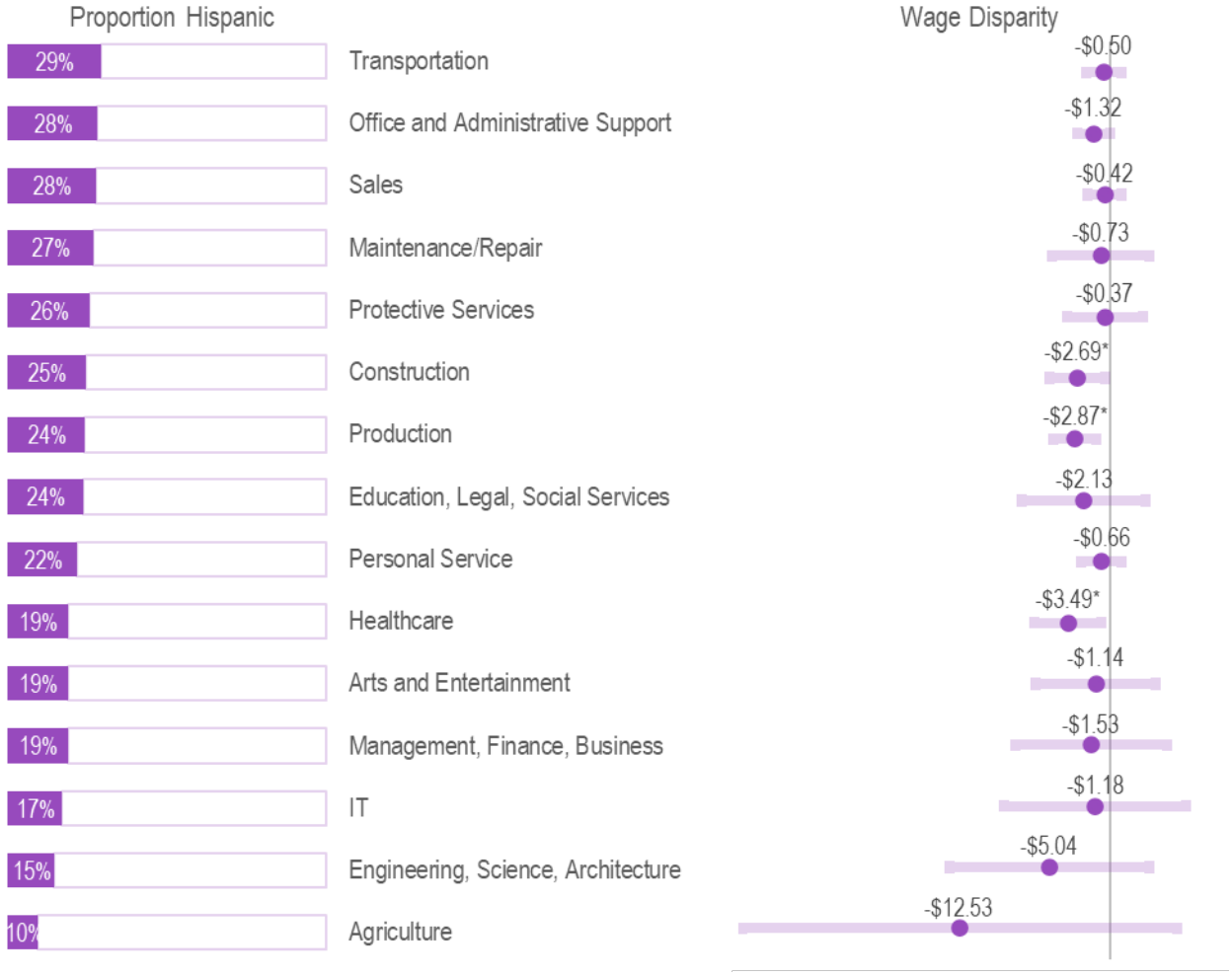
The wage growth disparities between Hispanic and White entrants do not vary demonstrably among occupational clusters.

Exhibit 8 ("Wage Disparity" panel) shows estimated wage growth disparities for Hispanic workers relative to White workers, by occupational cluster. As with the gender and Black disparities, the "Proportion Hispanic" panel ranks the 15 occupational clusters, with clusters in which Hispanic workers are a larger

fraction of entrants at the top. Visually, gaps do appear to be larger among clusters at the bottom of the chart—those in which a smaller proportion of entrants are Hispanic. However, the confidence intervals are also wide for the estimates in those occupational clusters. As a result, a statistical test for whether Hispanic-White disparities in wage growth exist does not confirm real differences across the set of occupational clusters as a whole, nor is there statistically significant evidence that Hispanic-White wage growth disparities vary.[23]

[23] Specifically, an interaction term between the worker-level Hispanic ethnicity indicator and the percentage of a cluster's entrants who are Hispanic is not statistically significant.

Exhibit 8: Ten-Year Differences in Wage Growth Between Hispanic and non-Hispanic Workers, by Occupational Cluster



How to Read This Graph: The bars on the left side of the graph represent the proportion of entrants to each occupational cluster who are Hispanic; for example, 29 percent of entrants to Transportation occupations are Hispanic. The dots on the right side of the graph represent the estimated difference in average wage growth for members of the given category, compared to members of the reference category (in this case, White workers) who are otherwise similar (same starting occupation, starting wage, and demographic characteristics other than the one in question). Dots to the right of the vertical zero line indicate that, on average, entrants to that occupational cluster experience more wage growth than do otherwise similar entrants from the reference category. Likewise, dots to the left indicate that, on average, entrants to that occupational cluster experience less wage growth than do otherwise similar entrants from the reference category. For instance, Hispanic entrants to a Healthcare occupation experience, on average, $3.49 per hour less in wage growth 10 years after entering the occupation compared to the otherwise similar White entrants. The bars indicate the precision of our estimates (the 95 percent "confidence interval"); the actual wage differences could fall anywhere in that range, though they are more likely to fall toward the middle of the range than the ends.
Note: *N*=25,038 trajectories. Cluster proportions are the weighted proportions from the sample used to calculate wage disparity estimates. Wage disparity estimates are drawn from OLS regressions that include occupation fixed effects and control for the worker's starting wage in the occupation, starting education, age, race/ethnicity, data source, and the characteristics above. The Hispanic category includes Hispanic workers of all races.
Source: NLSY97 and PSID

In sum, these results provide some evidence that wage growth disparities may vary across occupational clusters—specifically gender disparities and Black-White disparities. Further, the study finds that the size of the gap between Black workers' wage growth and the wage growth of their White peers tends to be larger in occupational clusters with fewer Black workers. This finding is consistent with other research

(discussed above) that occupations where workers from a particular background are less well represented tend to be less welcoming to those workers.

But the study did not find that female-male wage disparities varied by the gender composition of the occupational clusters. When examining Hispanic-White wage growth disparities, the study found no statistically significant variation at all. On average, those disparities are smaller than Black-White and Women-Men disparities. It is possible that variation does exist, but the smaller overall sample size makes the variation harder to detect.

Research Question #4: What gender and racial/ethnic gaps exist in other career-related outcomes, and to what extent can those gaps explain wage growth disparities?

This section explores disparities in other career-related outcomes that occur during a career trajectory. Specifically, this section presents findings on gender and racial/ethnic differences in:

- Employment interruptions
- Number of job changes
- Postsecondary degrees
- Advancement to a high-level occupation

While these other career-related outcomes are important on their own, they also provide information on wage disparities—and possible strategies to address them. For instance, if wage growth disparities were explained in large part by differences in receipt of new credentials, that would suggest that promoting more equitable access to and completion of postsecondary credentials is important.

The analyses below examine how much the estimates of racial disparities in wage growth change once controls are added for other career related outcomes.[24] Because the analyses do not attempt to determine whether those other outcomes do causally affect wage growth (and wage growth disparities), our discussion focuses on magnitudes, not tests of whether wage growth disparities are statistically different before and after adding controls for other outcomes.

Groups that experience the least wage growth (women of all races/ethnicities and Black men) experience the most employment interruptions, but those interruptions only account for a small proportion of wage growth disparities.

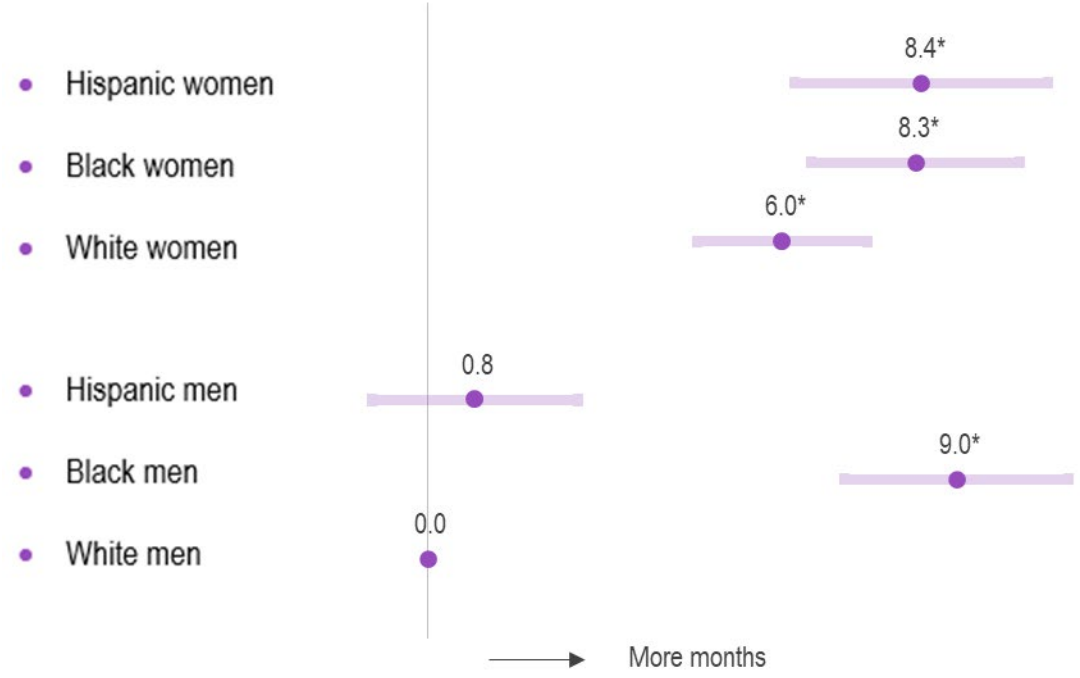
The CTOT study found that more months not working during the 10 years after entering a mid-level occupation is associated with lower wage growth by the end of the 10 years. (Schwartz et al., 2021). This is consistent with prior research on career impacts of employment interruptions (e.g., Glass, 2004; Imbens & Lynch, 2006).

Exhibit 9 below shows the total number of months not working over the course of 10 years after entering a mid-level occupation for different gender and racial/ethnic groups. Hispanic women and Black women, the workers who experience the least wage growth, also have about 8 months more cumulative employment interruptions compared to their White male peers (8.4 months and 8.3 months, respectively).

[24] These are not formal causal tests of whether disparities in wage growth are mediated by racial gaps in other outcomes. Rather the analyses are heuristic examinations of the extent to which other outcomes are capable of explaining wage growth disparities, were we to accept that the correlations between disparities in those other outcomes and disparities in wage growth reflected solely a causal impact of other outcomes (or unobserved drivers of those outcomes) on wage growth.

That difference is similar to that between Black men and White men (9 months). White women experience slightly less time not working compared to workers from any of those groups (6 months) but still substantially more time than White men.

Exhibit 9: Differences in Employment Interruptions Over 10 Years, by Workers' Gender and Race/Ethnicity



How to Read This Graph: The dots represent the estimated difference in months not working for members of the given category, compared to members of the reference category who are otherwise similar (same starting occupation, starting wage, and demographic characteristics other than the one in question). Dots on the vertical zero line are for the reference category itself (in this case, White men). Dots to the right of the line indicate that, on average, entrants from that demographic group experience more time not working than do otherwise similar entrants from the reference category. Likewise, dots to the left of the line indicate that, on average, entrants from that demographic group experience less time not working than do otherwise similar entrants from the reference category. For instance, Black women entrants to an occupation experience, on average, 9 months more not working 10 years after entering the occupation compared to the otherwise similar White men entrants. The bars indicate the precision of our estimates (the 95 percent "confidence interval"); the actual wage differences could fall anywhere in that range, though they are more likely to fall toward the middle of the range than the ends.
Note: *N*=31,813 trajectories. Estimates are drawn from OLS regressions that include occupation fixed effects and control for the worker's starting wage in the occupation, starting education, age, data source, and the characteristics above.
Source: NLSY97 and PSID

Although employment interruptions are strongly associated with wage growth overall, this analysis shows that employment interruptions can account for at most a small fraction of the gender and racial/ethnic disparities in wage growth. Exhibit 10 below shows estimated wage growth disparities presented above (in purple) and how much disparity remains if adjusted for months spent not working (in green).[25]

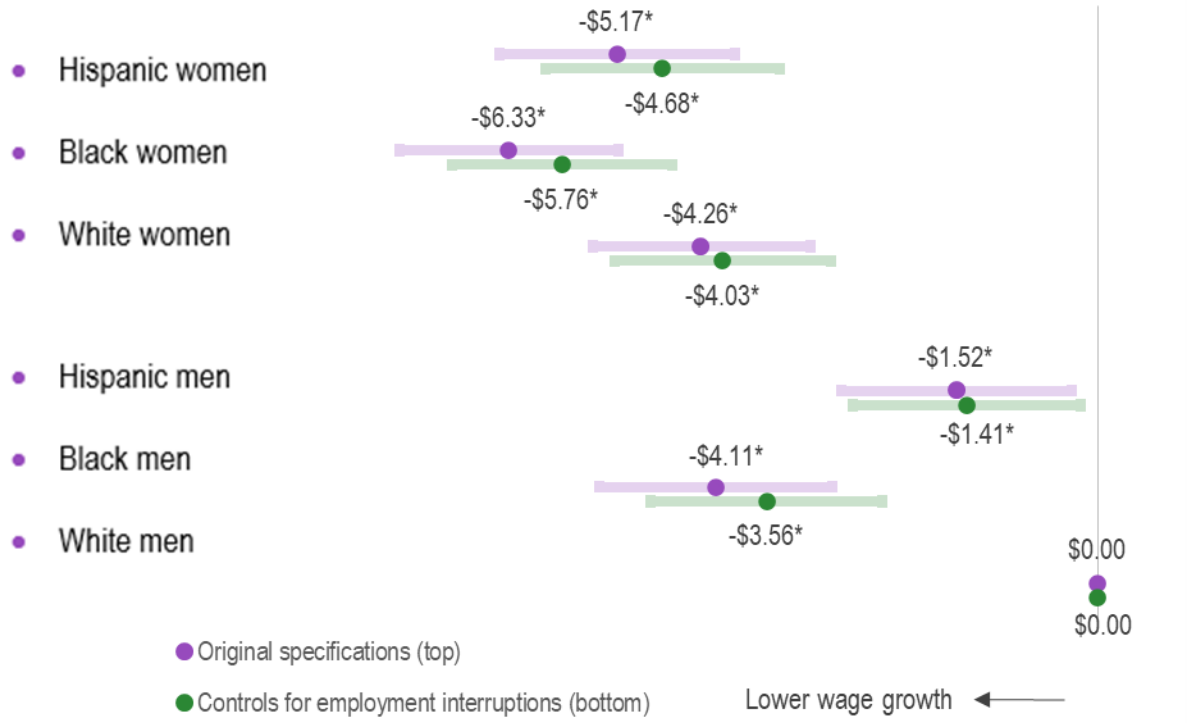
As shown, the wage disparity estimates do tend to be smaller after that adjustment. For example, after adjusting for employment interruptions, the wage growth disparity between Black women and their White men peers shrinks by 9 percent (from –$6.33 per hour to –$5.76 per hour). Similary, adjusting for employment interruptions decreases the estimated wage growth gap between Hispanic women and White men by 9 percent (from –$5.17 per hour to –$4.68 per hour), the gap between White women and White

[25] We have also examined disparities in time spent as a student during the 10-year trajectory after entering a mid-level occupation. Those gaps are relatively small. Relative to White men, Other women (+1.4 months), Other men (+2.5 months), and Black women (+1.1 months) on average spend more time as students. Hispanic men spend slightly less time as students (–0.7 months) than do White men. Accounting for these differences has no meaningful influence on estimated disparities in wage growth.

men by 5 percent (from –$4.26 per hour to –$4.03 per hour), and the gap between Black men and White men by 13 percent (from –$4.11 per hour to –$3.56 per hour).

Overall, while non-employment is itself an important outcome, these results indicate that the large majority of any wage disparities results from factors that occur during employment, not from not working.

Exhibit 10: Ten-Year Differences in Wage Growth With and Without Adjustments for Employment Interruptions, by Workers' Gender and Race/Ethnicity



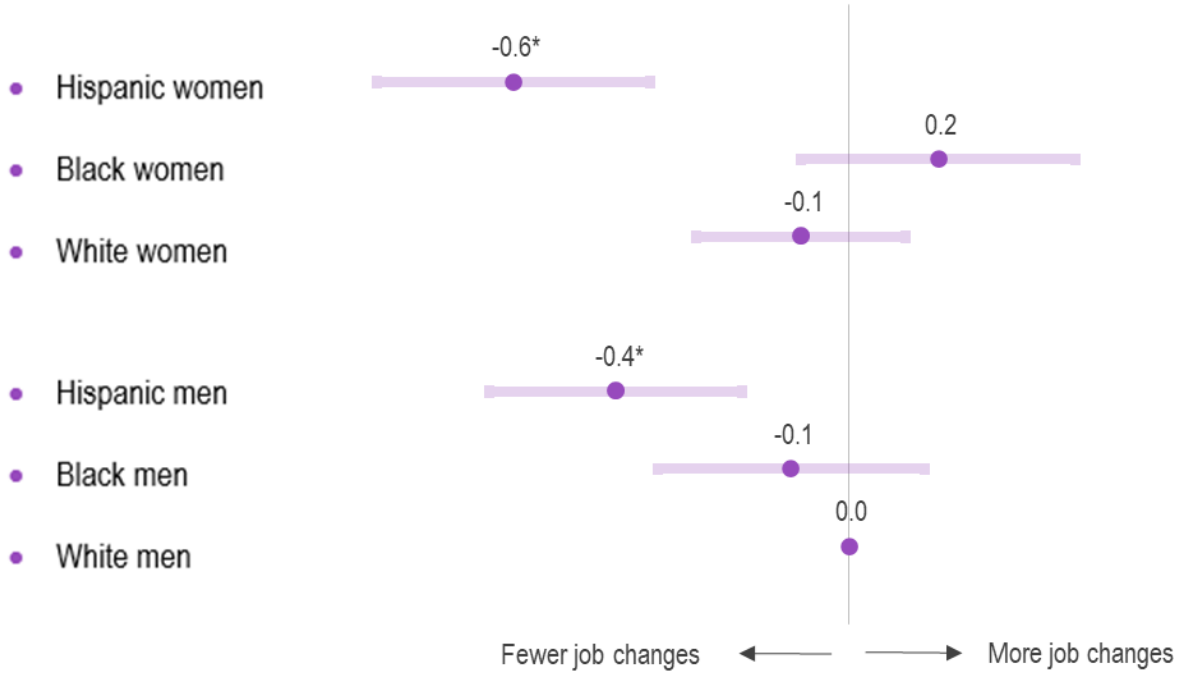
How to Read This Graph: The dots represent the estimated difference in average wage growth for members of the given category, compared to members of the reference category who are otherwise similar (same starting occupation, starting wage, and demographic characteristics other than the one in question). Dots on the vertical zero line are for the reference category itself (in this case, White men). Dots to the right of the line indicate that, on average, entrants from that demographic group experience more wage growth than do otherwise similar entrants from the reference category. Likewise, dots to the left of the line indicate that, on average, entrants from that demographic group experience less wage growth than do otherwise similar entrants from the reference category. Purple denotes estimates using the original model specifications; green denotes estimates that also control for months spent not working. For instance, Black women experience, on average, $6.33 less per hour in wage growth 10 years after entering the occupation compared to the otherwise similar White men in the original model. Controlling for months spent not working or in school, the disparity between Black women and White men decreases to $5.76 less per hour. The bars indicate the precision of our estimates (the 95 percent "confidence interval"); the actual wage differences could fall anywhere in that range, though they are more likely to fall toward the middle of the range than the ends.
Note: *N*=25,038 trajectories. Estimates are drawn from OLS regressions that include occupation fixed effects and control for the worker's starting wage in the occupation, starting education, age, data source, and the characteristics above. The Hispanic category includes Hispanic workers of all races. The Black and White categories include only those workers who do not report Hispanic ethnicity.
Source: NLSY97 and PSID

Frequency of job changes does not vary greatly by gender and race/ethnicity.

The CTOT study found three to four job changes over the 10 years after entering an occupation are associated with higher wage growth (compared to zero to two), but larger numbers of job changes are associated with lower wage growth (Schwartz et al.,
). If women or workers of color change jobs often (either voluntarily or due to job loss), then the number of job changes could account for some of the disparities in their wage growth.

Exhibit 11 shows the number of job changes entrants to mid-level occupations made over the next 10 years by gender and race/ethnicity. As shown, Hispanic workers (both women and men) change jobs less frequently than do White men. These differences are statistically significant, though these differences are substantively fairly small.

Exhibit 11: Differences in Job Changes Over 10 Years, by Workers' Gender and Race/Ethnicity

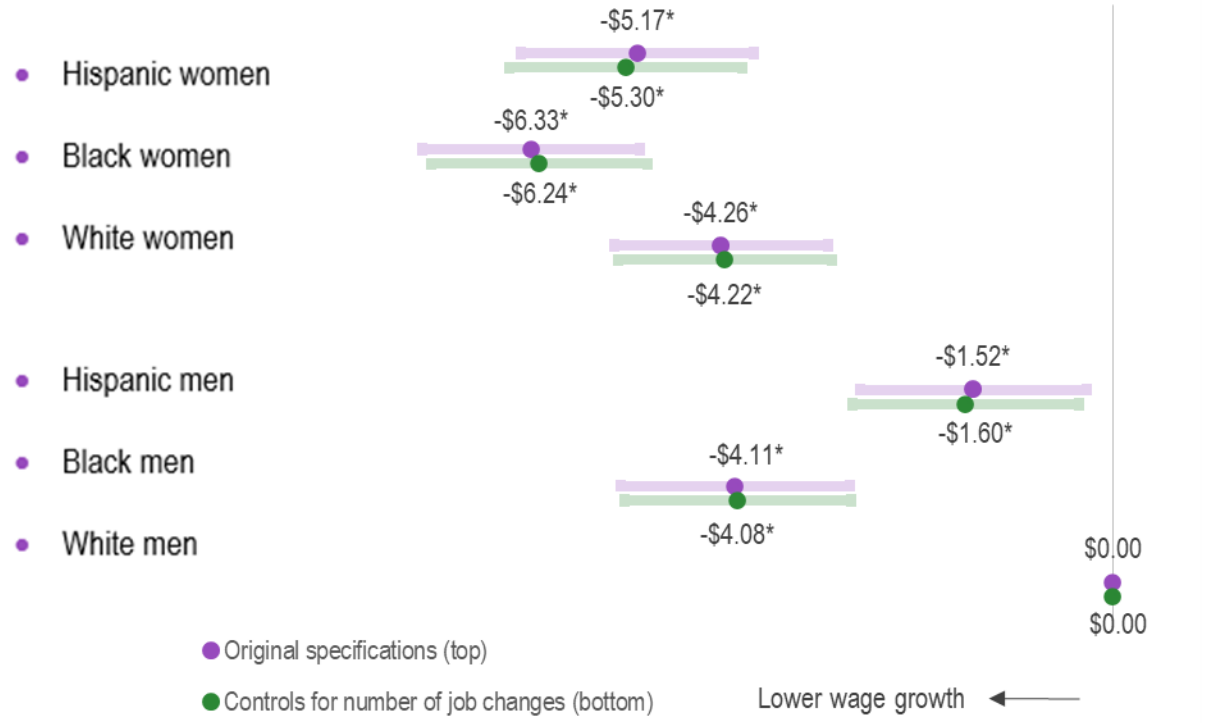


How to Read This Graph: The dots represent the estimated difference in number of job changes for members of the given category, compared to members of the reference category who are otherwise similar (same starting occupation, starting wage, and demographic characteristics other than the one in question). Dots on the vertical zero line are for the reference category itself (in this case, White men). Dots to the right of the line indicate that, on average, entrants from that demographic group experience more job changes than do otherwise similar entrants from the reference category. Likewise, dots to the left of the line indicate that, on average, entrants from that demographic group experience fewer job changes than do otherwise similar entrants from the reference category. For instance, Hispanic women entrants to an occupation experience, on average, less than one job change fewer in the 10 years after entering the occupation compared to the otherwise similar White men entrants. The bars indicate the precision of our estimates (the 95 percent "confidence interval"); the actual wage differences could fall anywhere in that range, though they are more likely to fall toward the middle of the range than the ends.
Note: *N*=31,813 trajectories. Estimates are drawn from OLS regressions that include occupation fixed effects and control for the worker's starting wage in the occupation, starting education, age, data source, and the characteristics above. The Hispanic category includes Hispanic workers of all races. The Black and White categories include only those workers who do not report Hispanic ethnicity.
Source: NLSY97 and PSID

Despite these differences in the number of job changes. the corresponding wage disparities for different gender and racial/ethnic groups do not change meaningfully when they are adjusted for the number of job changes. As shown in Exhibit 12, only minimal changes in wage differences over the 10-year period are

found. For example, the estimated wage growth disparity between Hispanic women and White men grows by $0.13 (from –$5.17 to –$5.30) after adjusting for number of job changes.

Exhibit 12: Ten-Year Differences in Wage Growth With and Without Adjustments for Job Changes, by Workers' Gender and Race/Ethnicity



How to Read This Graph: The dots represent the estimated difference in average wage growth for members of the given category, compared to members of the reference category who are otherwise similar (same starting occupation, starting wage, and demographic characteristics other than the one in question). Dots on the vertical zero line are for the reference category itself (in this case, White men). Dots to the right of the line indicate that, on average, entrants from that demographic group experience more wage growth than do otherwise similar entrants from the reference category. Likewise, dots to the left of the line indicate that, on average, entrants from that demographic group experience less wage growth than do otherwise similar entrants from the reference category. Purple denotes estimates using the original model specifications; green denotes estimates that also control for number of job changes. For instance, Black women experience, on average, $6.33 per hour less in wage growth 10 years after entering the occupation compared to the otherwise similar White men in the original model. Controlling for number of job changes, the disparity between Black women and White men decreases from $6.33 less per hour to $6.24 less per hour. The bars indicate the precision of our estimates (the 95 percent "confidence interval"); the actual wage differences could fall anywhere in that range, though they are more likely to fall toward the middle of the range than the ends.
Note: *N*=25,038 trajectories. Estimates are drawn from OLS regressions that include occupation fixed effects and control for the worker's starting wage in the occupation, starting education, age, data source, and the characteristics above. The Hispanic category includes Hispanic workers of all races. The Black and White categories include only those workers who do not report Hispanic ethnicity.
Source: NLSY97 and PSID

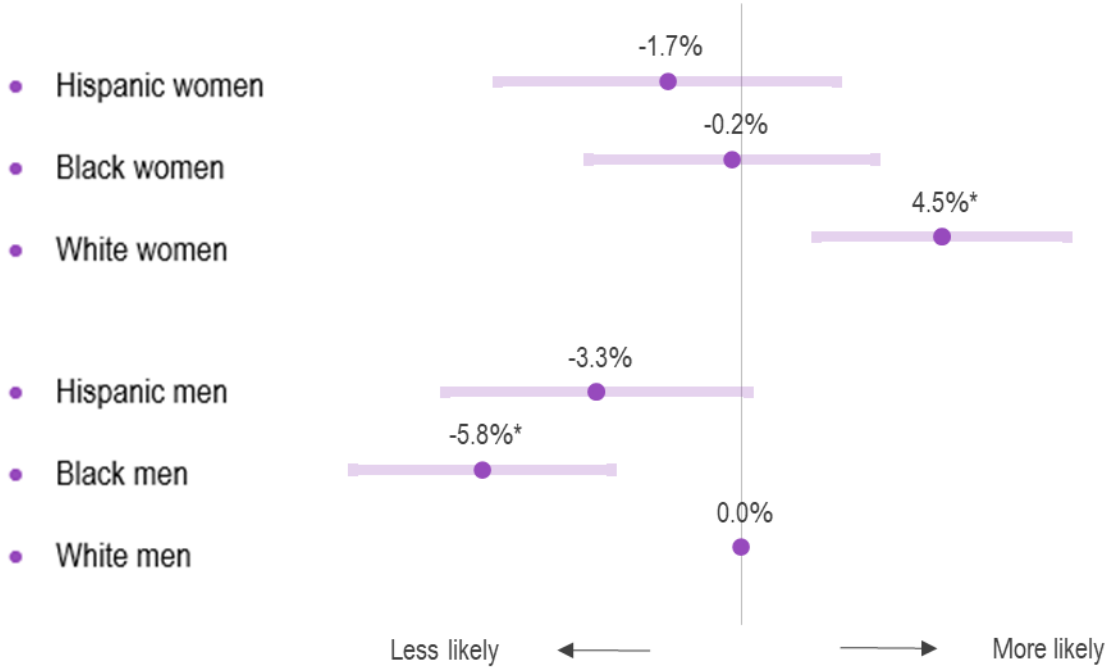
Gender and racial/ethnic differences in new postsecondary degree attainment largely do not mirror wage growth disparities—in particular, women are more likely than men to earn degrees during the 10 years after they enter an occupation.

The CTOT study found that those who obtain a first or additional postsecondary degree during the 10 years after entering a mid-level occupation also tend to have larger wage growth (Schwartz et al., 2021). This occurs even though obtaining the degree may require reducing hours worked or stopping work

entirely while in school—which are factors that could impede wage growth. This study also found that women are more likely than men to earn new postsecondary degrees.

Similarly, Exhibit 13 shows that Hispanic women, Black women, and White women were, at a minimum, no less likely to earn a postsecondary degree relative to men of their respective racial/ethnic group. Within each racial/ethnic group the estimated rates of earning degrees are higher for women then for men, though these differences are not necessarily statistically significant). Specifically White women are more likely to earn a postsecondary degree during the 10 years that follow their entry to an occupation than their White men counterparts (a 4.5 percentage point difference), a result that is statistically significant. Black men are significantly less likely to earn a postsecondary degree—5.8 percentage points less likely than White men. The percentages of Hispanic women, Black women, and Hispanic men returning to earn a new postsecondary degree do not differ statistically from that of White men.

Exhibit 13: Differences in the Likelihood of Earning a Postsecondary Degree Over 10 Years, by Workers' Gender and Race/Ethnicity

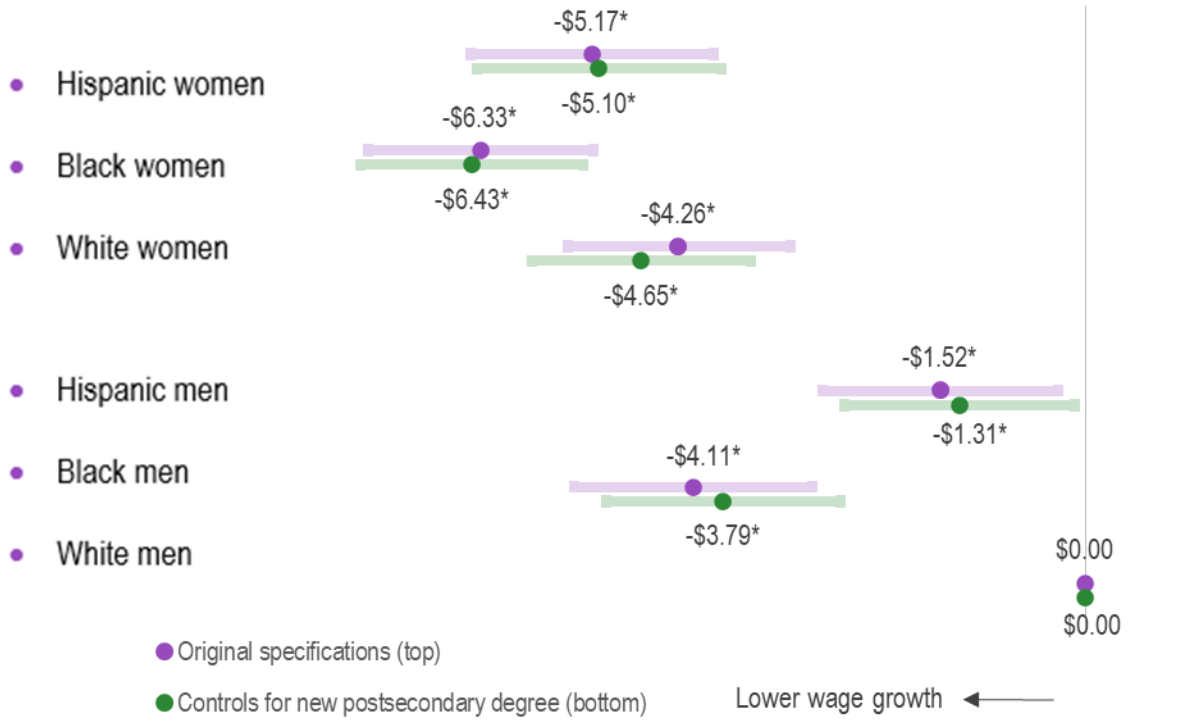


How to Read This Graph: The dots represent the estimated difference in likelihood of earning a new postsecondary degree for members of the given category, compared to members of the reference category who are otherwise similar (same starting occupation, starting wage, and demographic characteristics other than the one in question). Dots on the vertical zero line are for the reference category itself (in this case, White men). Dots to the right of the line indicate that, on average, entrants from that demographic group are more likely to earn a new postsecondary degree than otherwise similar entrants from the reference category. Likewise, dots to the left of the line indicate that, on average, entrants from that demographic group are less likely to earn a new postsecondary degree than otherwise similar entrants from the reference category. For instance, White women entrants to an occupation are, on average, 4.5 percentage points more likely to earn a new postsecondary degree in the 10 years after entering the occupation compared to the otherwise similar White men entrants. The bars indicate the precision of our estimates (the 95 percent "confidence interval"); the actual wage differences could fall anywhere in that range, though they are more likely to fall toward the middle of the range than the ends.
Note: *N*=31,813 trajectories. Estimates are drawn from OLS regressions that include occupation fixed effects and control for the worker's starting wage in the occupation, starting education, age, data source, and the characteristics above. The Hispanic category includes Hispanic workers of all races. The Black and White categories include only those workers who do not report Hispanic ethnicity.
Source: NLSY97 and PSID

Exhibit 14 shows how wage differences associated with gender and race/ethnicity discussed above change after adjusting for new postsecondary degree attainment during the 10 years following entrance into a mid-level occupation. As shown, little if any of the observed wage disparities can generally be explained by differences in attainment of a new degree after starting in a mid-level occupation. For example, the estimated wage growth disparity between Hispanic women and White men shrinks only by $0.07 per hour (from –$5.17 to –$5.10) after adjusting for postsecondary degree attainment. For Black women and White women, the wage growth disparity compared with their White men peers actually increases after adjusting for degree attainment. For Black women, the wage disparity relative to White men increases from $6.33 to $6.43 an hour, and for White women it increases from $4.26 to $4.65.

Only for Black men and Hispanic men do differences in new degree attainment appear to be a factor in explaining wage growth disparities with White men. After adjusting for postsecondary degree attainment, the wage growth gap between Black men and White men declines by 8 percent (from –$4.11 per hour to –$3.79 per hour), and the wage growth gap between Hispanic men and White men declines by 14 percent (from –$1.52 per hour to –$1.31 per hour).

Exhibit 14: Ten-Year Differences in Hourly Wage Growth With and Without Controls for Earning a New Postsecondary Degree, by Workers' Gender and Race/Ethnicity



How to Read This Graph: The dots represent the estimated difference in average wage growth for members of the given category, compared to members of the reference category who are otherwise similar (same starting occupation, starting wage, and demographic characteristics other than the one in question). Dots on the vertical zero line are for the reference category itself (in this case, White men). Dots to the right of the line indicate that, on average, entrants from that demographic group experience more wage growth than do otherwise similar entrants from the reference category. Likewise, dots to the left of the line indicate that, on average, entrants from that demographic group experience less wage growth than do otherwise similar entrants from the reference category. Purple denotes estimates using the original model specifications; green denotes estimates that also control for gaining an additional postsecondary degree. For instance, Black women experience, on average, $6.33 per hour less in wage growth 10 years after entering the occupation compared to the otherwise similar White men in the original model. Controlling for new postsecondary degrees, the disparity between Black women and White men increases to $6.43 per hour (with White men

seeing higher wage growth). The bars indicate the precision of our estimates (the 95 percent "confidence interval"); the actual wage differences could fall anywhere in that range, though they are more likely to fall toward the middle of the range than the ends.
Note: *N*=25,038 trajectories. Estimates are drawn from OLS regressions that include occupation fixed effects and control for the worker's starting wage in the occupation, starting education, age, data source, and the characteristics above. The Hispanic category includes Hispanic workers of all races. The Black and White categories include only those workers who do not report Hispanic ethnicity.
Source: NLSY97 and PSID

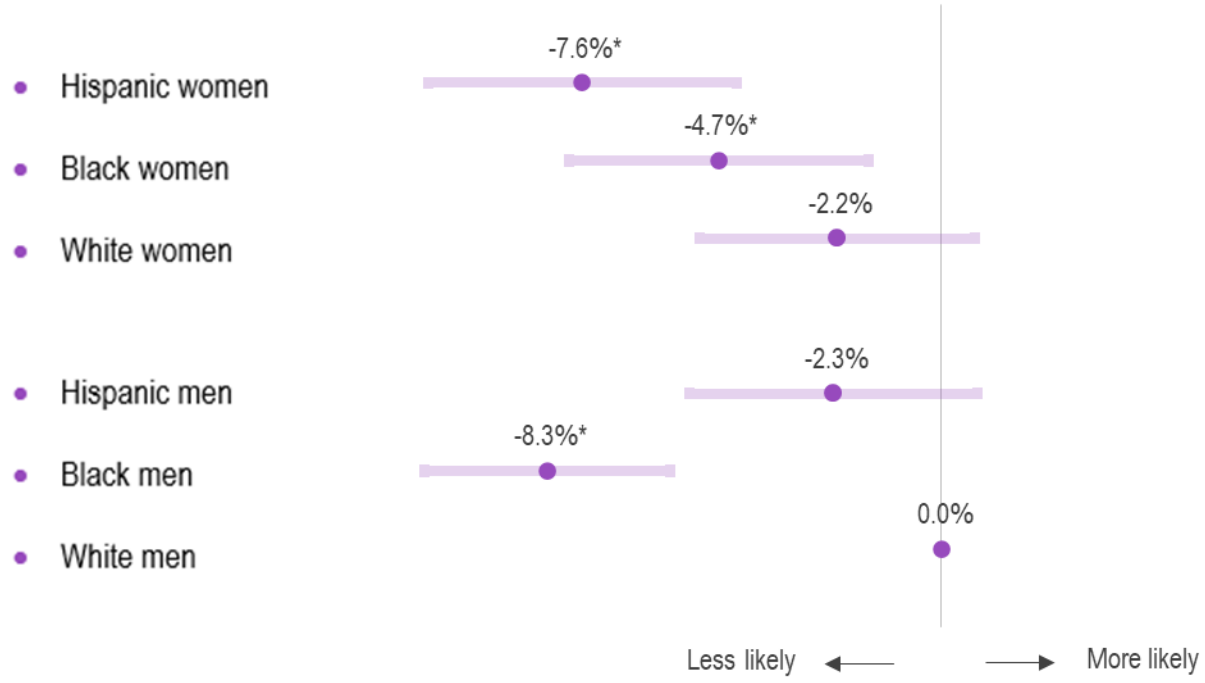
Black men, Black women, and Hispanic women are less likely than White men to be working in a high-level occupation 10 years after entering a mid-level job.

As discussed above, this study defines a high-level occupation as one that requires considerable or extensive preparation, generally (though not necessarily) a bachelor's degree or more. Unsurprisingly, high-level jobs typically pay more than mid-level jobs (Carnevale et al., 2011), and thus any gaps among groups in advancing to a high-level job would be expected to contribute to disparities in wage growth. Employer processes, such as biases in task assignments, mentoring, or performance evaluation could present barriers to advancing to higher-level occupations (see discussion above). Moreover, discrimination in hiring practices could hinder advancement to a higher-level occupation with a new employer. Previous research has found that the percentage of workers with a college degree who are underemployed relative to their skills—that is, are working in jobs that do not require their level of educational attainment—is higher for Black workers than for White workers (Williams & Wilson, 2019) and higher for women than for men (Burning Glass, 2018).

Exhibit 15 below shows differences in the likelihood of working in a high-level occupation for different gender and racial/ethnic groups. As shown, after 10 years and among entrants to mid-level occupations, White men are the most likely to advance to a high-level occupation, whereas their peers who are Black men and Hispanic women are least likely. Relative to White men, Black men and Hispanic women are, respectively, 8.3 percentage points and 7.6 percentage points less likely to advance to a high-level occupation. Black women are 4.7 percentage points less likely than White men who started in the same occupation to be working in a high-level occupation at the end of 10 years. All these differences are statistically significant. This advancement disparity occurs even though Black women are equally as likely as White men to have attained additional postsecondary degrees (discussed above)—the types of credentials that would generally help qualify them for such positions.[26] White women and Hispanic men are each estimated to be more than 2 percentage points less likely than their White men peers to advance to a high-level occupation, but those differences fall just short of statistical significance.

[26] The analyses adjust for educational attainment at entry, so these disparities in advancing to high-level occupations are also not the result of differences in educational attainment at the start of the 10-year trajectory period.

Exhibit 15: Differences in the Likelihood of Working in a High-Level Occupation After 10 Years, by Workers' Gender and Race/Ethnicity

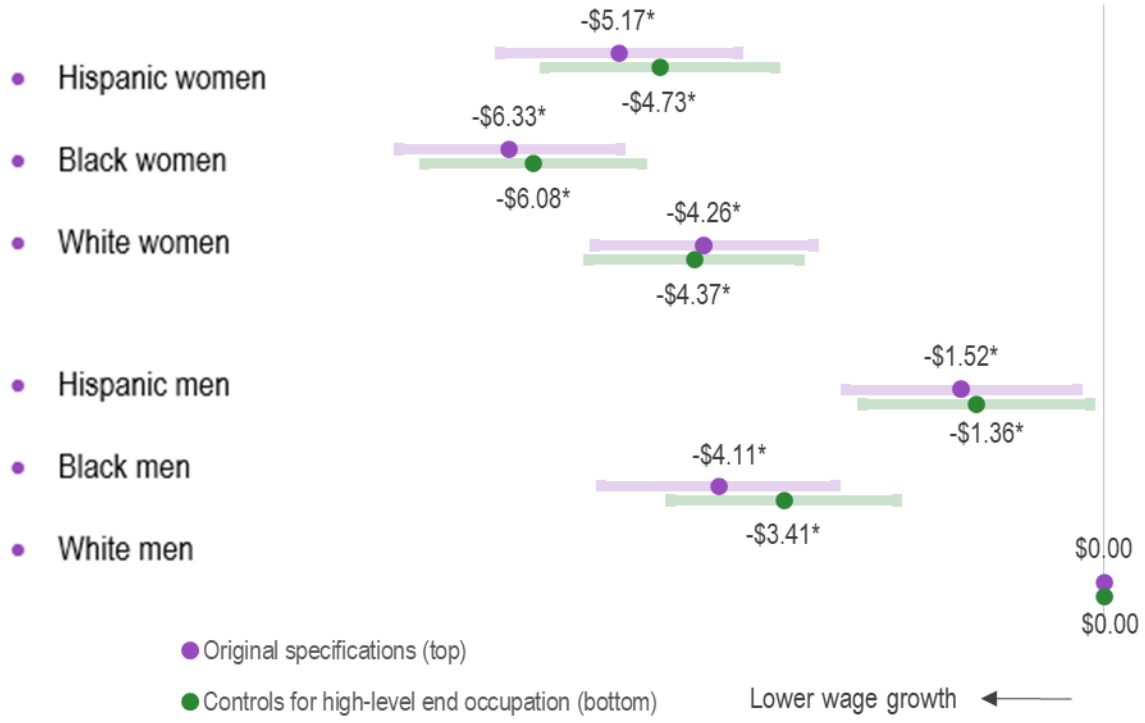


How to Read This Graph: The dots represent the estimated difference in likelihood of ending up in a high-level occupation for members of the given category, compared to members of the reference category who are otherwise similar (same starting occupation, starting wage, and demographic characteristics other than the one in question). Dots on the vertical zero line are for the reference category itself (in this case, White men). Dots to the right of the line indicate that, on average, entrants from that demographic group are more likely to end up in a high-level occupation than otherwise similar entrants from the reference category. Likewise, dots to the left of the line indicate that, on average, entrants from that demographic group are less likely to end up in a high-level occupation than otherwise similar entrants from the reference category. For instance, Black women entrants to an occupation are, on average, 4.7 percentage points less likely to end up in a high-level occupation 10 years after entering the occupation compared to the otherwise similar White men entrants. The bars indicate the precision of our estimates (the 95 percent "confidence interval"); the actual wage differences could fall anywhere in that range, though they are more likely to fall toward the middle of the range than the ends.
Note: *N*=31,813 trajectories. Estimates are drawn from OLS regressions that include occupation fixed effects and control for the worker's starting wage in the occupation, starting education, age, data source, and the characteristics above. The Hispanic category includes Hispanic workers of all races. The Black and White categories include only those workers who do not report Hispanic ethnicity.
Source: NLSY97 and PSID

Overall, though these disparities in advancing to high-level jobs seem meaningfully large in size and advancing to a high-level occupation is strongly associated with higher wage growth,[27] they appear to account for at most a modest amount of observed gender and racial/ethnic disparities in wage growth. As shown in Exhibit 16 below, adjusting for advancement to a high-level occupation reduces the estimated wage growth disparity between Black men and White men from –$4.11 per hour to –$3.41 per hour, or 17 percent. However, differences in advancing to a high-level job explain no more than 10 percent of the originally estimated wage growth disparity between White men and any other groups. For White women, the adjustment does not account for any of the original wage growth disparity with White men.

[27] $p<.001$ from a specification that also includes the following as independent variables: starting wage, starting wage squared, age category indicators, whether the worker is a woman, indicators for worker's race/ethnicity, worker's educational attainment at the time of entering the occupation, highest level of education attained by either of the worker's parents, and a set of indicators for the occupation at trajectory start.

Exhibit 16: Ten-Year Differences in Hourly Wage Growth With and Without Controls for Working in a High-Level Occupation After 10 Years, by Gender and Race/Ethnicity



How to Read This Graph: The dots represent the estimated difference in average wage growth for members of the given category, compared to members of the reference category who are otherwise similar (same starting occupation, starting wage, and demographic characteristics other than the one in question). Dots on the vertical zero line are for the reference category itself (in this case, White men). Dots to the right of the line indicate that, on average, entrants from that demographic group experience more wage growth than do otherwise similar entrants from the reference category. Likewise, dots to the left of the line indicate that, on average, entrants from that demographic group experience less wage growth than do otherwise similar entrants from the reference category. Purple denotes estimates using the original model specifications; green denotes estimates that also control for ending up in a high-level occupation. For instance, Black women experience, on average, $6.33 per hour less in wage growth 10 years after entering the occupation compared to the otherwise similar White men in the original model. Controlling for ending up in a high-level occupation, the disparity between Black women and White men decreases to –$6.08 per hour. The bars indicate the precision of our estimates (the 95 percent "confidence interval"); the actual wage differences could fall anywhere in that range, though they are more likely to fall toward the middle of the range than the ends.
Note: *N*=25,038 trajectories. Estimates are drawn from OLS regressions that include occupation fixed effects and control for the worker's starting wage in the occupation, starting education, age, data source, and the characteristics above. The Hispanic category includes Hispanic workers of all races. The Black and White categories include only those workers who do not report Hispanic ethnicity.
Source: NLSY97 and PSID

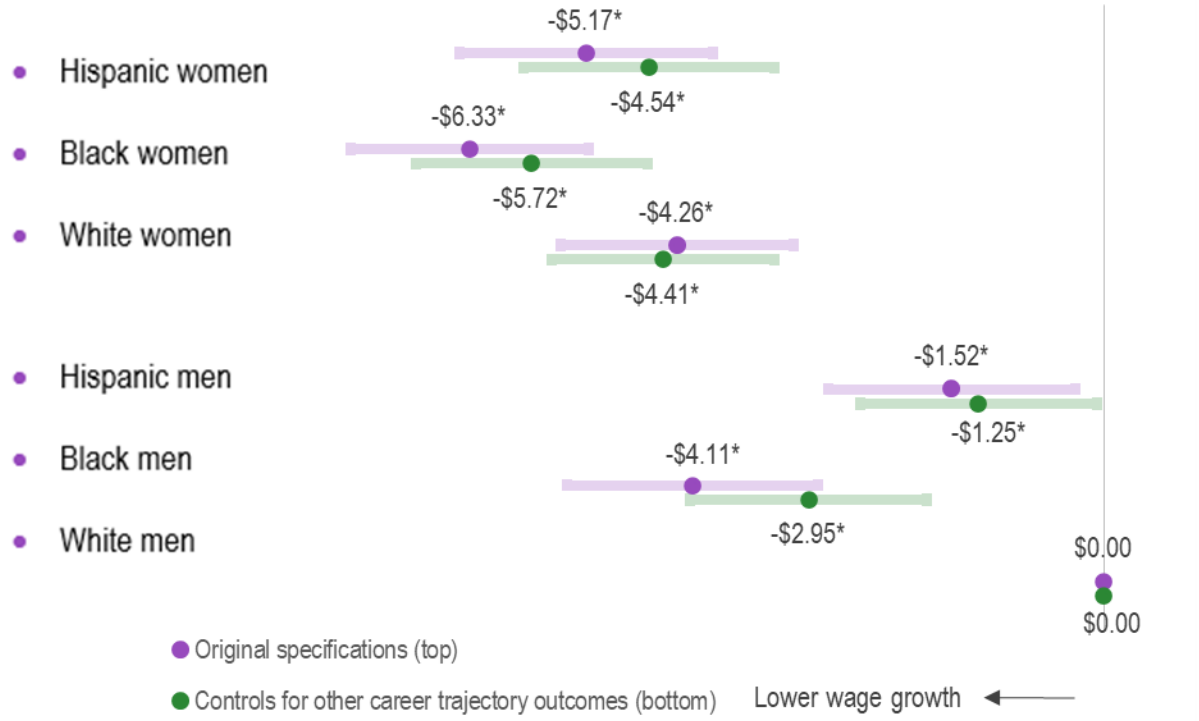
Taken as a whole, the combination of career trajectories outcomes does not account for most of the wage growth disparities between gender and racial/ethnic groups.

Exhibit 17 below shows differences in wages after controlling for all the factors (employment interruptions, number of job changes, attaining a postsecondary degree, and working in a high-level job) examined in this section. Even after adjusting for all the other outcomes, the large majority of wage disparities remain for each group examined. Black women and Hispanic women experience the lowest wage growth, but after adjusting for all factors above, our analysis accounts for roughly 10 percent of the originally estimated disparity between

women in those groups and White men. [28] The estimated wage growth disparity between White women and White men is slightly larger after making those adjustments (–$4.41 vs. –$4.26).

The outcomes appear to explain more of the differences among men of different racial/ethnic identities. The wage growth gap between Hispanic men and White men is 18 percent smaller (–$1.25 vs. –$1.52) after adjustment. The wage growth disparity between Black men and White men is 28 percent smaller after adjustment (–$2.95 vs. –$4.11).

Exhibit 17: Ten-Year Differences in Wage Growth With and Without Controls for Employment Pattern Variations, by Workers' Gender and Race/Ethnicity



How to Read This Graph: The dots represent the estimated difference in average wage growth for members of the given category, compared to members of the reference category who are otherwise similar (same starting occupation, starting wage, and demographic characteristics other than the one in question). Dots on the vertical zero line are for the reference category itself (in this case, White men). Dots to the right of the line indicate that, on average, entrants from that demographic group experience more wage growth than do otherwise similar entrants from the reference category. Likewise, dots to the left of the line indicate that, on average, entrants from that demographic group experience less wage growth than do otherwise similar entrants from the reference category. Purple denotes estimates using the original model specifications; green denotes estimates that also control for other employment pattern variation. For instance, Black women experience, on average, $6.33 per hour less in wage growth 10 years after entering the occupation compared to the otherwise similar White men in the original model. Including other employment pattern controls, the disparity between Black women and White men decreases to –$5.72 per hour. The bars indicate the precision of our estimates (the 95 percent "confidence interval"); the actual wage differences could fall anywhere in that range, though they are more likely to fall toward the middle of the range than the ends.

"Other career trajectory outcomes" include job and cluster changes, employment interruptions, time as a student, new postsecondary degree, and ending up in a high-level occupation.

Note: *N*=25,038 trajectories. Estimates are drawn from OLS regressions that include occupation fixed effects and control for the worker's starting wage in the occupation, starting education, age, data source, and the characteristics above. The Hispanic category includes Hispanic workers of all races. The Black and White categories include only those workers who do not report Hispanic ethnicity.

[28] After adjustments, the unexplained wage growth disparity between Black women and White men is –$5.72, or 10 percent less than the originally estimated –$6.33. For Hispanic women, 12 percent of the gap can be accounted for (–$4.54 vs. –$5.17).

Source: NLSY97 and PSID

If other career related outcomes were able to explain most of the observed wage growth disparities, it would indicate that wage growth disparities are mostly driven by employment-related barriers related specifically to them. However, while about 28 percent of the wage growth disparities between Black men and White men can be explained by those other outcomes, overall, their limited explanatory power suggests that the primary drivers of the observed wage growth disparities lie elsewhere, as discussed further below.

5. Summary and Discussion

This paper examines gender and racial/ethnic differences in wage growth among workers entering mid-level occupations over a 10-year period. The CTOT Study from which it draws compares wage trajectories for workers who started in the same occupation at similar starting wages. Using this approach allows for understanding the extent to which wage disparities emerge *after* workers enter a specific mid-level occupation. The study complements existing research that examines disparities in likelihood of reaching a given occupational entry point, and differences in starting wages based on gender and race/ethnicity. This final section provides a summary of the results and discusses study limitations, areas for future research, and implications for policymakers and practitioners.

A. Summary

The paper examines gender and racial/ethnic differences for workers in mid-level occupations in four areas: (1) how wage growth varies over the 10-year period; (2) how wage growth varies considering gender and race/ethnicity together; (3) the extent to which differences in wage growth vary by occupational cluster; and (4) whether gender and racial/ethnic disparities in other career-related outcomes (i.e., employment interruptions, number of job changes, postsecondary degrees, or advancement to high-level jobs) explain observed wage differences. The key findings are discussed below:

- **Disparities in wage growth (both by gender and by race/ethnicity) expand over time.**

In terms of overall wage growth over 10 years among workers entering mid-level occupations, the study finds: (1) Women's and men's wages steadily diverge over time. By 10 years, women's hourly wages have grown almost $4 per hour less than men's hourly wages. (2) Wage disparities between Black and White workers also grow steadily over time. After 5 years, the wage difference between Black and White workers is $1.46 per hour. By 10 years, the difference doubles to $3.08 per hour. (3) Hispanic workers' wage growth is not statistically different from White workers' after 5 years but grows to be so after ten years.[29]

- **When considering workers' gender and race/ethnicity together, Black women, Hispanic women, White women, Black men, and Hispanic men all experience lower wage growth than do White men.**

Black women and Hispanic women experience the lowest 10-year wage growth. Compared to White men, Black and Hispanic women earn $6.33 and $5.17 less per hour, respectively.

- **Wage growth disparities appear to be widespread across occupational clusters. Generally, no clear association between wage disparities and the composition of the workforce in the occupational cluster was found, although a possible association for Black workers was detected.**

[29] Because of data limitations, the study is limited in its ability to separately and in detail examine wage growth for individuals who identify as being Asian, American Indian, multiracial, or other races/ethnicities.

The study finds a statistically significant variation in disparities in wage growth for women among different occupational clusters, but no relationship between the size of those disparities and the proportion of women in a cluster's entrants. Variation in Black-White disparities among occupational clusters was detected—with suggestive evidence that these disparities are larger in clusters where Black workers are less represented. No variation in Hispanic-White wage growth disparity among occupational clusters was identified.

- **Disparities in other career-related outcomes appear to explain little of the gender and racial/ethnic disparities in wage growth.**

The study finds gender and racial/ethnic differences in several other career-related outcomes: employment interruptions, frequency of job changes, earning new postsecondary degrees, and advancing to high-level occupations. In some cases, patterns of between-group differences in those outcomes mirror patterns of disparities in wage growth. For example, Black women, Hispanic women, White women, and Black men all experience more employment interruptions than do White men. Black women, Hispanic women, and Black men are also less likely than White men to advance to high-level occupations. One could expect wage growth disparities to be affected by disparities in these other career-related outcomes, but the study finds that they are able to explain only a small part of the differences in wage growth at most.

When examining racial/ethnic and gender differences in other career-related outcomes, the study also finds instances where those differences contrast with patterns of wage growth disparities. For example, White men are not more likely to earn new postsecondary degrees than are their Black women or Hispanic women peers. And White women are the most likely group to do so—statistically more likely than White men. In general, across all racial/ethnic groups, women are more likely than men to return to earn post-secondary degrees. This pattern also appears to hold for each racial/ethnic group though these differences are not always statistically significant. But despite equal or higher rates of degree attainment, women in all racial/ethnic groups overall experience less wage growth than do their male counterparts.

B. Study Limitations

This analysis has a number of limitations. As noted above, small sample sizes prevented analysis of individuals who identify as American Indian, Asian, multiple races, or other races (as well as analyses of findings for individual occupations). In addition, this paper focuses on disparities by gender and racial/ethnic groups only. These data do not allow analyses on disparities experienced by workers of the LGBTQ+ community, workers of a different country of origin or immigration status, workers who are non-native English speakers, workers with disabilities, or workers with criminal records, among many others. Research has shown that biases around gender, race/ethnicity, country of birth, citizenship status, age, and criminal record all affect occupational sorting and advancement in potentially interacting ways that likely would have subsequent effects on wage trajectories (Bertrand & Mullainathan, 2003; Boushey, 2005; Carnevale et al., 2018; Neumark et al., 2017; Quillian et al., 2017; Young, 2013; Schultz, 2019; Pager, 2003; The Pew Charitable Trusts, 2010). And many of those biases may interact.

Several limitations result from the dataset developed for this project. First, the analyses necessarily use data for trajectories that started 10 or more years ago (as early as 1997) . It is possible that some of the employment dynamics that disadvantage women and workers of color have changed in the interim, particularly given the greater focus on diversity, equity, and inclusion in the workplace and elsewhere in the United States since 2020,(Menasce Horowitz, et al., 2020) as well as the COVID-19 pandemic, which disproportionately affected women and workers of color (Albanesi & Kim, 2021). Moreover, given a lifetime of earnings, for most workers, this time period only captures a defined period and the trends observed may change with more time. Second, the analysis focuses on workers entering mid-level occupations, and patterns may be different for workers entering higher- or lower-level occupations. Third, while the study examines four factors that could

affect wage growth, there are other factors that could affect wage growth that this study was unable to measure and include. While the study controls for certain characteristics of job entrants to ensure workers of different groups are similar (including educational attainment and parental education), not all characteristics, including those that are unmeasurable, could be included. Thus, workers may have characteristics that drive the wage differences beyond what could be measured for this study. Finally, some of the occupational categories are broad enough that jobs within those occupations may vary, and the particular jobs held within an occupation could differ among workers with different backgrounds (Martin-Caughey, 2021).

C. Future Research

The results of this study indicate several important areas for future research. One potential area is to better understand the reasons for wage disparities for similar workers entering the same occupation, including the role of employer practices in job advancement policies. This could include both studies of employer processes in career advancement, and studies of workers' employment experiences over time and the barriers to career advancement they encounter. Some of this research may focus on particular occupations or occupational clusters. Although our findings suggest that disparities are widespread across clusters, the causes may not be uniform across them.

The findings also indicate that it would be valuable to examine patterns of transitions between occupations to assess to the extent to which they vary by gender and race/ethnicity. This study found that occupational transitions made by women, and Black and Hispanic workers were less likely to lead to higher-paying jobs than transitions made by men and White workers (Schwartz et al., 2021). Future research could build on this work by examining differences in the types of transitions between occupations made by workers of different genders and racial/ethnic groups.

Finally, the study was unable to address disparities for Asian groups or for Hispanic subgroups (such as Mexican or Puerto Rican), and further information on the experiences of these groups add to the understanding of career trajectories and job advancement. Moreover, understanding the extent to which gender and racial/ethnic disparities more broadly interact with factors such as socioeconomic background and immigration status would also be important.

D. Policy and Program Implications

Understanding the wage growth disparities documented in this paper is important for practitioners in career pathways programs and other employment and training programs and for policymakers generally. A range of factors may affect the extent to which women or workers of color reach the same occupational entry point as workers who are male or White (Tucker, 2020; Bleiweis, 2020), but the results presented in this paper are particularly striking given that they compare workers who started in the same occupation at similar starting wages, prior education, and age. Moreover, some of the disparities are large enough to have meaningful implications for workers' ability to support themselves and their families. For example, the difference in wage growth between White men and Black women ($6.33 per hour) would amount to a difference in annual earnings of over $13,000 ten years after starting in the same occupation, assuming a full-year, full-time job.

Given that this study finds that time spent not working and rates of advancement to higher-level occupations explain little of the disparity in wage growth, much of what drives disparities in wage growth among entrants to mid-level occupations appears to stem from their employment experience while working in mid-level occupations. It is beyond the scope of this study to definitively identify the reasons for differences in wage trajectories that may occur while employed, but the results offer some insights into the mechanisms that lead to these disparities and the strategies needed to address them. First, it might be that workers of different genders and/or race/ethnicities may be paid differently for the same work (Foster et al., 2020). Addressing this would require a continued focus on establishing equity wage setting processes. Alternatively, transitions to

new occupations that result in wage growth after job entry may vary by gender and race ethnicity. Such differences would indicate the importance of focusing on task assignment, on-the-job learning opportunities, promotion practices, and between-group differences in occupational transitions (Lambert et al., 2019; Mackenzie et al., 2019) or hiring (Quillian et al., 2017).

The success of career pathways and other employment and training programs in promoting participants' career advancement will be limited to the extent that barriers related to gender and race/ethnicity impede those participants' wage growth after completing education and training and finding employment. Training programs are not likely to be able to fully address the range of factors that drive wage trajectories associated with gender and race/ethnicity but the study suggests several important steps for these practitioners to promote wage advancement for participants:

- **Work with employers to identify and raise awareness about strategies to address barriers to career advancement for women and workers of color.**

Career pathways efforts often emphasize the importance of building relationships with employers.[30] Career pathways and other employment and training programs may be able to engage their employer and industry partners to help identify and raise awareness about the sources of bias and other barriers to advancement for women and workers of color and strategies that could potentially address them. For example, studies have reported increased transparency in salary setting and limiting the role of salary history in setting current salaries may help reduce wage disparities (Churches, 2018; Recalde & Vesterlund, 2020). Programs may be able to encourage employers with whom they work to conduct analyses on their own labor forces to identify wage disparities and strategies for addressing them.

- **Recognize the prevalence of these wage disparities and consider ways to equip participants with resources to navigate barriers.**

Although many employer processes around hiring, promotions and wage setting that contribute to disparities in wage growth and other career advancement outcomes are beyond the control of program administrators, programs may be able to provide participants with information and resources to help them navigate and overcome potential barriers. For instance, this could include helping participants understand criteria for promotion and how to effectively advocate for on-the-job learning opportunities, time off necessary for care obligations, and pay raises.[31]

- **Develop strategies to help women and workers of color make job changes that result in advancement.**

For the 10-year period of this study, some workers made job changes rather than staying at one employer (this analysis does not distinguish between voluntary jobs changes and job changes due to job loss). This study shows that for women and workers of color, it appears likely that some of these changes did not result in the same career advancement as they did for White men as they were less likely to be working in a higher-level occupation after ten years. It may be that women and workers of color do not have access to the same networks or information as White men, resulting in fewer moves to higher-level, higher-paying jobs. Programs may be able to provide career counseling and training in career development, including further information on future career options and how to find relevant opportunities to help mitigate those gaps.

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[30] In the Descriptive and Analytical Career Pathways Project's meta-analysis, half of programs evaluated had a formal relationship with employers (Peck et al., 2021).

[31] Findings from previous studies on the effects of salary negotiation are mixed. As Recalde and Vesterlund (2020) summarize, some studies find that women face a backlash when they request pay increases but other studies have found that some negotiation strategies lessen that backlash. Overall, however, much of the literature regarding salary negotiations is focused on workers in higher level occupations and there may be differences in how these processes play out in mid-level occupations.

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