Gender Wage Gap of Utah Workforce and Post-secondary Graduates

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Abstract

The gender wage gap has narrowed significantly from the late 1970s to the 1990s; progress to close the gap has been relatively stagnant since then. Vertical segregation, horizontal segregation, legislative challenges, educational segregation, and societal norms contribute to the stagnation of the gender wage gap. This study aims to investigate the gender wage gap experienced by Utahns.

Using the American Community Survey (ACS) data, a comparison of Utah's gender wage gap and the national gap demonstrates that Utah consistently falls behind between 2005 and 2018. This study then combines wage data obtained from the Utah Department of Workforce Services (DWS) with graduates who received a degree from a technical college or a degree-granting institution from the Utah System of Higher Education (USHE) for cohorts from 2012 to 2014. The gender wage gap experienced by these graduates is decomposed by the highest educational attainment, age group, and Classification of Instructional Program (CIP) studied.

The wage gap is between 61% and 78% for workers with strong attachment to the workforce from all three cohorts. Furthermore, the difference-in-differences models illustrate that men experience higher wage gains from one year to five years post-graduation. The differences in wage gains are statistically significant for all educational attainments and each cohort year.

Finally, with Blinder-Oaxaca decomposition, this research breaks down the wage differences into explained and unexplained portions. Higher wages can partially be explained by having more work experience before graduation. However, human capital measures for all cohorts cannot explain over 70% of the difference. Overall, this study suggests a widening gender wage gap as more time is spent in the workforce. The gap cannot be explained entirely by prior work experience, age, or highest educational attainment.

1 | Introduction

1.1 | Background

In classical economics, wage is determined by the market theory of wage determination. Like other inputs, wage is influenced by supply and demand factors (Borjas, 2020). Alongside these factors is the output a laborer can produce (productivity). In some sectors, such as manufacturing, this output is easy to measure. With other fields, such as service, output becomes more difficult to measure. Human capital measures aid in determining the value of an individual's labor. Some of these measures include educational attainment, skill, and experience (Miller, 2018). With all other variables remaining constant, if output between men and women are equal, expected wage should likewise be equal. However, this expected equal wage is not the case. Wage inequality between genders has been a subject of socio-economic study and activism since the 1940s when women supported the war effort on the factory lines. In 1942, the National War Labor board supported policy endorsing equal pay for women factory workers. In 1945, the Women's Equal Pay Act was introduced but ultimately failed to pass. Efforts continued after the war, which led to the passage of the Equal Pay Act of 1963. This act made wage discrimination illegal in the United States (Sha, 2019).

Since that time, Utah has consistently ranked with one of the widest gender wage gaps in the nation. The gender wage gap is generally defined as the average (either median or mean) difference between men's and women's wages. This difference can also be expressed as an earnings ratio, where women's wages are represented as a percentage of men's. Most recently, Utah ranked 48th (tied with Rhode Island) in pay inequality as a dollar figure in income, and 50th for the largest gap in hours worked between men and women (Jacobs, 2020). Wage inequality presents a problem from a normative perspective under the concept that equal pay should be given for equal work; it can also create inefficiencies in the labor market.

In neo-classical labor market theory, equilibrium wage is paid to individuals where labor supplied is equal to the labor demanded. Shifts and movements along the demand curve are influenced by education, knowledge, technology, government policy, the price of inputs, available labor, and the number of companies competing in the labor market, among other factors. Individuals are then faced with the choice of competing interests where companies are willing to pay them enough to outweigh the opportunity costs of other activities such as leisure (Borjas, 2020).

One assumption of the labor market model is that bias does not exist within the market and that employers hire based on human capital measures. If this assumption is violated, firms without selection bias have an advantage over firms that base employment decisions on factors outside of human capital. Furthermore, those subjected to selection bias are limited to which employers they choose to earn wages from (Goldin, 1992). One such issue in employment and wage selection is gender bias.

Pay inequality between genders presents both ethical and economic problems that can be addressed by policy changes. This study examines the gender wage gap in Utah one- and five-years following graduation from a USHE institution. The research objectives address the following questions: 1) What is the historical progression or retrogression of the gender wage gap in Utah over time? 2) What predictors or explanatory variables contribute to the gender wage gap? 3) What changes and differences in wage occur over time between men and women in Utah? 4) To what degree do human capital measures explain the gender wage gap compared to possible gender wage bias?

Understanding the history, predictors, and changes in the gender wage gap can lead to data informed policy changes in the public and private sectors.

1.2 | Literature Review

A considerable amount of literature has been published on the gender wage gap (Mandel, 2014; Semyonov, 2014). Researchers from multiple academic disciplines have investigated the gap using economics, social psychology, and public policy approaches, among others. The purpose of this review is to provide a historical and social science perspective of the gender wage gap and to provide context for the methodology and analysis of wage data for this report.

1.3 | Historical Methodologies

In his book *The Economics of Discrimination*, economist Gary Becker (1957) introduced a taste-based model of discrimination. He argued that employers, workers, and customers may have a "taste for discrimination." This taste affects preferences for hiring, working with, or conducting business with a particular group of individuals. With the neo-classical assumption that all tastes are exogenous to economic models, Becker viewed the "taste for discrimination" to be determined outside of the market. Those who have a "taste for discrimination" are willing to pay a premium in order to discriminate; while those who belong in the less desirable group are willing to produce more to compensate their employers or to accept a lower wage for equivalent productivity. Becker further

suggested wage discrimination cannot persist as an equilibrium phenomenon in competitive labor markets (Becker, 1957).

Classical studies on gender wage inequality (Oaxaca, 1973; Blinder, 1973) use separate regressions for men and women with the natural logarithm of hourly wage as the dependent variable, while the independent variables include education, occupation, on-the-job training, region, and others. The regression coefficients serve as estimates of how wages change with respect to one unit of change in the independent variables. The raw difference in wages between men and women can then be decomposed into a portion that can be attributed to differences in the independent variables, a part that can be attributed to differences in the coefficients, and an unexplained portion of the difference. The wage difference due to differences in independent variables is called "endowment," or differences in skills; conversely, the remaining wage difference is called "wage discrimination" in classical literature, representing the portion of difference that cannot be explained.

Economist Jacob Mincer (1974) formalized the human capital model, which views human capital as investments and wages earned as return on investment. Education and work experience are seen as capitals that could potentially increase productivity, and therefore increase wages earned, a summary statistic for economic output. Mincer proposed the Mincer earnings function, which models the logarithm of wage income as a function of education and a quadratic function of work experience for a given individual. It is important to note that Mincer implied the assumption that men and women had the same freedom to choose their education and employment opportunities. Men and women are assumed to participate in the labor market under equal conditions without biases or prejudice.

Because so many variables influence the labor market's composition, methodologies to define gender bias and the gender wage gap vary tremendously. Simple methods generalize wages into summary statistics of median or mean wage and calculate the difference between the genders. More commonly, reports decompose and group individuals by industry, hours worked, educational attainment, and experience. By decomposing the labor market with human capital measures, this approach seeks to explain the gender wage gap by differences in employment investment rather than biases faced by individuals. According to Claudia Goldin, one of the leading scholars on the gender wage gap, this method in large part (but not in all cases) explains the majority of the gender wage gap in the United States (Goldin, 2014).

To fully understand the variables that lead to the gender wage gap, a historical study of wage differences between men and women is imperative, and insightful. Before the industrial revolution, agrarian occupation dominated much of the workforce. The physical demands of farm work gave men an advantage in efficiency and output. Societal norms directed women to occupations that required less physical strength and increased temporal flexibility to care for children (Humpries, 2009). As the labor market shifted in the early 18th century to manufacturing, women often found work in textile mills or as seamstresses. When roles were shared with men, it was estimated that they made one-third to one-half of men's earnings. Men often took on higher-paying jobs and supervisory positions (Berg, 1991).

Following World War II, when data became more accessible, many of the perceptions from past generations regarding women in the workforce influenced gender wage structures. When comparing wages of full-time, year-round employees from 1955-1970, the gender wage gap was approximately 36 – 40%. Progress since that time, using the same metric, has shrunk the wage gap to less than 20% today. Blau and Khan, prominent researchers of the history of the gender wage gap, noted a significant narrowing of the gender wage gap in the late 1970s; however, the convergence slowed in the 1990s. It has since stagnated between 75% and 79% without notable progress (Blau and Kahn 2000, Blau and Kahn 2007).

Progress of gender pay equity (1979– 2018) is seen in Figure 1 below, in which women's earnings are represented as an earnings ratio.
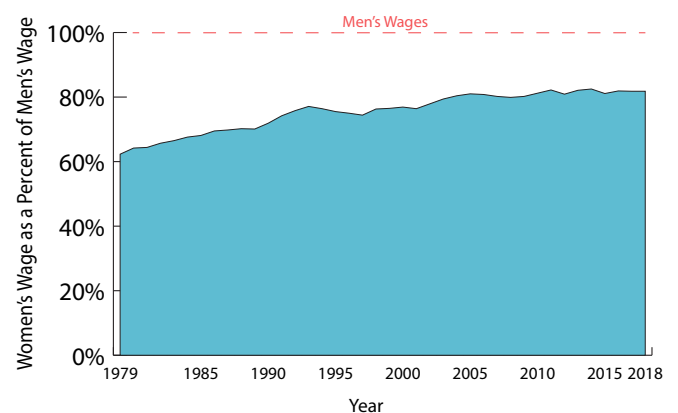

Figure 1: Women's earnings as a percentage of men's, median usual weekly earnings of full-time wage and salary workers, 1979-2018 (Bureau of Labor Statistics, 2018)

As a percentage of men's wages, the minimum of women's earnings came in 1979, where women made 62.3% of men's wages. By comparison, the maximum came in 2014, when women earned 82.5% of men's wages.

This literature review will not attempt to capture every variable leading to the progression of pay equality; however, educational opportunities and attainment contribute to the rise of women's wages. In 1974, the Women's Education Equity Act was passed, which "promote[d] educational equity for girls and women" (Women's Education Equity Act, 1974). The act has since been expanded to include publicly funded primary, secondary, and post-secondary education programs. Since the 1981 – 82 academic year, more women in the United States have earned bachelor's degrees than men (NCES, 2020).

Women surpassed men in the number of individuals holding a master's degree or higher in 2011 (U.S. Census Bureau, 2011). Progression of women's bachelor's degree attainment as a percentage of the labor force (ages 25 -64) longitudinally is seen in Figure 2 below (Bureau of Labor Statistics, 2019). The methodology for this measure changed in 1992. Before 1992, bachelor's degrees were defined as four years of college or more; the definition was changed after 1992 to a bachelor's degree or higher.
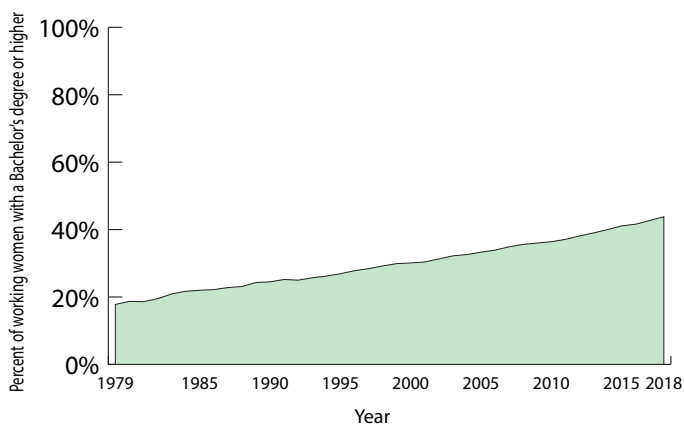
Figure 2: Percent of women in the workforce aged 25 - 64 who hold a bachelor's degree and higher, 1979 – 2018 (Bureau of Labor Statistics, 2018)

The lowest percentage of women with a bachelor's degree or higher came in 1979, the first year available, with 17.8%. The highest was in 2018 (the last year available at the time of this study), with 43.8% women with a bachelor's degree or higher. This figure compares to men in 2018, where 37.5% have a bachelor's degree or higher.

Despite educational attainment and wage progression, gender pay inequality persists as an issue often making headlines and garnering new studies. The figure of today's gender wage gap can vary substantially depending on which methodology is used and the variables chosen for decomposition. When using general techniques without accounting for part-time or full- time work, (aged 16 and older) women's wage is 80% of men's on average (IWPC, 2019). Pew Research used age parameters to

estimate the gap in pay for the workforce 16 and older, as well as the workforce ages 25-34. Using data for both part- and full-time workers, they found that women 16 and older made 85% of what men earned. Controlling for ages 25-34, women made 89% of what men earned (Graf, Brown, and Patten, 2019). Investigating the gender pay-gap by race reveals larger pay inequality between men and women in Asian and white communities than in Black and Hispanic communities (International Women's Policy Center, 2019).

The gap can widen by filtering to individuals with a Ph.D., in which women make 24% less than men with doctorate degrees (Gender Pay Persists, 2018). However, filtering for women who do not take on any caretaking responsibilities, the gap shrinks to just 5%. In many industry-specific studies, applying the filter of no caretaking responsibility removes the gap altogether (Waldfogel, 1997).

While the number can fluctuate, in most cases, a gap still exists. Historically, Utah has lagged behind the progress made by the United States. Using equal parameters, the International Women's Policy Center found women made 20% less than men in the United States. Women in Utah, by comparison, made 31.2% less. In terms of dollars, women made $36,300 annually in Utah compared to the $40,000 national average. This difference in wages is especially striking as women in Utah tend to earn lower wages than the national average, while men in Utah tend to make more. Men in Utah with less education often earn more than women with higher levels of educational attainment. In 2012, when comparing median annual earnings for full-time, year-round workers aged 25 and older, Utah men with some college or an associate degree earned more than women with bachelor's degrees. Furthermore, men with a bachelor's degree earned more than women with graduate degrees. This wage gap exists despite women nationally making up a higher percentage of bachelors, masters, and doctorate degrees (NCES, 2020).

Since 2015, the gender wage gap in Utah has grown worse (IWPC, 2019). This retrogression is especially concerning as Utah has experienced significant economic growth during that time period, combined with women's high labor force participation rate of 60% (Utah Department of Workforce Services, 2019). Unemployment in 2019 was at a nation-leading low of 2.6% (FRED Unemployment Rate in Utah, 2020) and gross domestic product growth was $10.4 billion (FRED Total Gross Domestic Product in Utah, 2020). Utah has the seventh highest median household income and is 38th in per capita income (Kem C. Gardner Policy Institute, 2020).

The field where women account for the largest

percentage in Utah is healthcare support, in which women account for 82% of the workforce and earn around $24,326 a year. Men working in healthcare support, by comparison, earn $28,891 a year (Israelsen-Hartley, 2017). Other fields with high representation of women include an 82% share of the personal care service industry, and 72% of the office support sector (Utah Department of Workforce Services, 2020). Utah is also unique in that women have the highest rate of part-time work. On average, women in Utah work 33.1 hours per week compared to men, who work an average of 40.4 hours (Utah Department of Workforce Services, 2020). This trend may be explained by the high fertility rate, which was 2nd in the nation as of 2019. Time spent as the primary caretaker of children often comes at the opportunity cost of time in the workforce (Kem C. Gardner Policy Institute, 2020). The wage gap in Utah has not gone entirely unnoticed. Utah's Department of Commerce recognized the larger-than-average gender wage gap, and attributed it to "the result of a unique set of cultural norms and business practices and policies (Salt Lake Chamber of Commerce, 2020)." A study to understand gender pay equity was proposed in legislation in 2018, but was met with resistance and was ultimately not pursued (Romboy, 2018). This work may serve those who seek more understanding of the differences in wages between the genders in the state of Utah.

1.4 | Social Science Approach

Hilary Lips, an emerita professor of psychology at Radford University, argued that the human capital models ignore "soft variables" and choice. Human capital models do not account for decisions such as education and hours-worked that are not based on economic principles of rational choice, but rather responses from societal expectations for women to be primary caretakers in families. Alternatives to such models would explore factors such as motivation, values, cultural norms, and expectations. When using the human capital models to explain the gender wage gap, there is an implicit assumption that there are no confounding variables, which may influence both the dependent variable, wage, and the independent variables, education and experience. Inequality may be embedded in the independent variables of the human capital models in selecting majors, hiring practices, or promotion process, to name a few (Lips, 2013).

Education is seen as a driving force behind wage by human capital models, both nationally and in Utah, and has narrowed the wage difference over time as women obtained higher education. Although the wage gap closed significantly in the 1970s, progress has stagnated between the 1990s and now (Blau and Kahn, 2000; Blau and Kahn, 2007). Researchers cite

factors outside of education that explain today's gender wage gap (Goldin, 2014; Lips, 2013). Below is a list of some variables commonly explored in existing literature.

1.5 | Occupational Segregation

Occupational segregation "is the distribution of workers across and within occupations, based upon demographic characteristics, most often gender" (Bergmen, 1981). In a study of American wages from 1970 to 2010, researchers collected wage information and then separated across 80 different job categories. They found occupational segregation to be the second most significant factor in explaining the gender wage gap (the first being hours worked). Occupational segregation significance has increased from the 1970s into the early 2000s, while human capital measures have become less significant in their study. This comparative difference is likely due to women's increased educational attainment. The attributes of male-dominated, higher-paying jobs include careers that focus on the value of overtime work and competitive pay structures such as commission and bonuses (Madel & Semyonovs, 2014).

When examining the 2018 earnings data (U.S. Bureau of Labor Statistics, 2019, table 18), women outnumbered men in low-paid occupations such as maids and housekeeping cleaners. In these careers, women made up 87.6% of the workforce when the median weekly earnings were $467. Laundry and dry-cleaning workers made the lowest median weekly earnings, $432, and 70.4% of the workers were women. By comparison, among the highest median weekly earnings occupations, such as Chief Executives making $2,291, architectural and engineering managers making $2,226, women made up only 28.0% and 12.8% of the workers, respectively. Among the highest-paying positions, chief executives, women were earning 70.0% of what men earned in the position.

1.6 | Vertical Segregation

Vertical segregation is the overrepresentation (or under) of a particular group of people in leadership positions of a firm. In law, women represent 22.7% of partners in firms. In medicine, women fill 16% of medical school dean positions. In academia, women constitute 32% of full-time professor roles. In financial services, women CFOs represent only 12.5% of the industry (Warner, Ellman & Boesch, 2018). As recent as August 2020, only 7.6% of the CEOs in Fortune 500 are women (Connley, 2020).

A study conducted by Cook found that when

women directly influence compensation decisions, the gender wage gap shrinks. Furthermore, if women can break through to managerial positions, they do make as much as men in management (Cook, 2019). Women often face the "glass ceiling," a term coined by Marilyn Loden in 1978, referring to an invisible barrier preventing women from being promoted to the highest positions in the career ladder. The term was such a well-known metaphor that Hilary Clinton referred to it in her concession speech to Barack Obama in 2008 (Wulfhorst, 2018).

In addition, a phenomenon named "sticky floor" is experienced by many women, who hold low-paying positions with low upward mobility. Coined by sociologist Catherine White Berheide in 1992, using data collected from local and state governments, Berheide argues that the employees in the federal government and large corporations face similar upward mobility obstacles (Noble, 1992).

1.7 | Horizontal Segregation

Horizontal segregation is the segregation that occurs in specific fields by attributes like gender or race. While similar to occupational segregation, horizontal segregation can affect a group of people's wages due to perceived societal norms that one gender is better at the job than another. For example, men are often segregated to jobs that require physical strength, while women may be segregated to jobs that require more compassion (Oxford Reference, 2020).

1.8 | Legislative Challenges

Legislative challenges refer to the difficulty of enforcing equal pay law. In the United States, the Equal Pay Act of 1963 requires employers to offer equal pay for equal work (Sha, 2019). In 2009, the Lilly Ledbetter Act was passed, which extended the amount of time an employee has to file a discrimination claim (Sorock, 2010).

However, other laws protect the privacy of sensitive information, such as wages. Lilly Ledbetter only learned about the pay disparity after receiving an anonymous note after 20 years of employment. Internationally, some countries, such as the United Kingdom, require employers of larger sizes to report wages based on gender (Sha, 2019). In the United States, a survey conducted in 2010 found that 19% of employees reported being formally prohibited from discussing salaries, while another 31% were discouraged from discussing pay (Institute for Women's Policy Research, 2010). Without legislation to make wages public, it is often difficult to know if you are making fair pay or enforce laws that prohibit wage discrimination.

1.9 | Temporal Flexibility

Temporal flexibility is the ability to choose when

and how many hours you work. Goldin (2014) argues that increasing temporal flexibility may lead to closing the gender wage gap. Working a flexible schedule is linked to lower professional commitment. Women working a flexible schedule are perceived as less motivated when compared to others with the same qualifications and less likely to receive a promotion (Rogier and Padgett, 2004). Employed women are more likely to return home at the end of the workday to "the second shift," a term coined by sociologist Arlie Hochschild, which refers to the unpaid household labor such as cleaning, food preparation, and caregiving for children and other family members. Because women are more likely to take on unpaid labor at home, they are less likely to commit to long hours at work (Hochschild & Machung, 1989) and more likely to choose occupations that do not require higher time commitments.

1.10 | Societal Norms

Societal norms are a set of expectations for a gender to fulfill specific roles. These roles found roots in a historical context when men performed physical labor in agrarian occupations while women raised children (Humphreys, 2009). As women enter the workforce, they are expected to behave differently from men. Women often face implicit biases which judge them more harshly than men when they display authoritative or directive behaviors (Eagly et al., 1992).

Psychologist Alice Eagly continued the study of societal norms and proposed the role congruity theory with her colleague Karau (Eagly and Karau, 2002), highlighting the prejudice that women leaders face due to the different social expectations associated with leadership and femininity. Women in leadership are perceived less positively when compared to men. Women also have to work harder to achieve high-status positions at work and maintain these high-status positions. Another study suggests women who assertively demonstrate leadership are viewed as less "nice," conflicting with the stereotypical gender role, and therefore judged as socially incompetent (Rudman & Glick, 2001).

Virginia Schein and her colleagues (Schein et al., 1996) document a global phenomenon known as "think manager—think male," which refers to most people's tendency to think of managers as men when given a description without specifying the gender of the manager. This distinction is because stereotypical traits associated with managers—dominant, strong, forceful—are also associated as attributes of men.

1.11 | Salary Negotiation

It is often implied that women do not negotiate

wages as often or as effectively as men. In a survey of recent graduates, one-half of male MBA students stated they negotiated their wage when offered a job, compared to just one-eighth of women (Small, 2007). Societal norms have steered women to not ask for higher wages as "they have learned that they may ultimately lose more than they gain (Wade, 2001)." As women begin their careers at a lower starting wage, the gap balloons as more time is spent in the workforce.

Women within all levels of educational attainment are less likely to negotiate their first job offer than men. Even when women do negotiate, they are still likely to receive less than men (Babcock & Laschever, 2009). Women were also more often penalized for initiating negotiations. Those who negotiate are perceived as socially incompetent, as they are perceived as demanding (Bowles et al., 2006).

1.12 | Caretaking

Caretaking is related to societal norms, or perhaps biology, where women are expected to be the primary caretakers for families. This caretaking extends to both motherhood and caring for elderly parents (Goldin, 2016). These expectations often steer women away from higher-paying fields that would not allow them to fulfill this responsibility (Schnieder, 2016). Due to the cost of family care, having a stay-at-home parent makes financial sense for some families.

In her book, *The Price of Motherhood*, author Ann Crittenden coined the term "mommy tax" and states that an average college-educated woman loses over a million dollars in lifetime income if she has just one child. She argues that mothers are the producers and caregivers of children who will become "human capital" for future economic growth. Yet mothers receive a penalty for raising children. Longitudinal studies (Waldfogel, 1997; Budig & England 2001) found a wage penalty of 6% for women with one child and 13% for women with two or more children, or approximately 7% per child. Another study (Miller, 2009) found that delaying motherhood by one year leads to an increase of 9% in earnings for women.

1.13 | Educational Segregation

Education is often cited as an attribute related to a difference in pay due to the notion that higher educational attainment leads to higher wage. The education gap in the United States is closed and now favors women achieving post-secondary education more than men (U.S. Bureau of Labor Statistics, 2019). However, some studies still show more men in high paying jobs in science, technology, engineering, and math (STEM) fields. Women represent only 28% of the STEM workforce, resulting in an important aspect of the gender wage gap as these fields tend to offer higher wage (U.S. National Science Foundation, 2018).

A classic psychology experiment in the 1960s found that teachers' expectations can highly influence students' performance when the teachers set their own expectations based on randomly assigned test score (Rosenthal & Jacobson, 1968). As an example of the self-fulfilling prophecy, when teachers expect a student to do well, the student in turn does better than his or her peers. A more recent study (Moss-Racusin et al., 2012) highlights the biases against female students at science faculty from research-intensive universities. Female students make up a disproportionally low share of STEM majors. Not only do female students face prejudice that male students do not in STEM disciplines, but women with STEM degrees are also less likely to enter a STEM career after graduating. They are more likely to leave their STEM career even if they hold a STEM degree. Multiple studies have cited reasons such as hostile environment, a lack of female role models, and gender stereotyping as reasons for women leaving STEM related work (Hewlett et al., 2008; Beede et al., 2011).

Explanatory variables from many studies illustrate the complexity of the gender wage gap. Individuals' choices and the biases they face are intricately intertwined. This study seeks to add to current literature by researching the causes that may explain why Utah's gender wage gap might be higher than the national average. The objective of the study is to build an understanding of Utah's history and progression of the gender wage gap. Afterward, data is then decomposed, modeled, and statistically evaluated to understand which variables may best explain this gap after graduation from a public post-secondary institution in Utah.

By understanding the progression and reasons behind differences in pay between the genders, policymakers in education, business, and legislation can make data-informed decisions to assist in the progression toward equal pay between genders.

2 | Methods

2.1 | Software

Analyses and visualizations for this study were performed in Python (v 3.7) with libraries including pandas (v0.25.1), NumPy (v1.16.5), seaborn (v0.9.0), and Matplotlib (v3.1.1). The R software environment 3.6.1 (R Core Team, 2013) was also utilized, along with the following libraries: dplyr (v0.8.3, Wickham, Francois, Henry, & Müller, 2015), magrittr (v1.5, Bache & Wickham, 2014), readr (v1.3.1, Wickham, Hester, & Francois, 2017), and Oaxaca (v0.1.4, Hlavac, 2014).

2.2 | Data

To provide a more detailed background on the history of the gender wage gap in Utah, data from the American Community Survey (ACS) is used. The U.S. Bureau of Labor Statistics (BLS) conducts the ACS annually. The survey complements the work conducted decennially by the U.S. Census Bureau and is sent to 295,000 households each month. Questions about race, ethnicity, educational attainment, migration, and disability are recorded. Weights are then applied to each respondent group to be representative of the population in their area. At the time of this study, ACS data was immediately available from 2005 – 2018. The one-year ACS data is used for both Utah and national metrics. ACS uses a standard confidence interval of 90% (U.S. Census Bureau, 2019). Wage data is used from this survey for Utah and is compared to the national average.

As the survey includes all working individuals, including working children, wages were filtered to exclude those under age 18. Those with no reportable wages are also excluded from each annual sample. National metrics are used in coordination with Utah metrics to contextualize how wages in the state compare to the national average. The number of housing units interview respondents each year nationally was approximately 2,200,000, while the number of Utah housing units interview respondents was approximately 17,000 annually. The ACS weights were applied, both nationally and statewide, to be representative of the working population. Objective one of this report is divided into three parts: all adult wages including part-time workers, wages of only full-time workers, and wages separated by educational attainment. Median wage figures are then divided with women's wages as the numerator, and men's wages as the denominator, to calculate the earnings ratio that women earn compared to men. To calculate the gender wage gap, this figure can be subtracted from one.

From the Utah Data Research Center (UDRC) data warehouse, graduation records from USHE for cohort years 2012 to 2014 were obtained. The Utah System of Higher Education recently merged with the Utah System of Technical Colleges. To differentiate the two, universities and community colleges in USHE are referred to as academic institutions throughout the study. Institutions formerly associated with the Utah System of Technical Colleges are referred to as technical colleges. Please see appendix Supplementary Information One for complete lists of academic institutions and technical colleges of the USHE. The academic cohort years are used to be in better conformity with research conducted by USHE. Cohort years follow the USHE academic calendar, which begins during the Summer semester of

the previous year and ends the Spring semester calendar year. For technical institutions, cohort years begin July 1st of the previous year and end on July 30th of the calendar year.

The sample size from academic institutions included 67,013 graduates, while 35,190 were women and 31,823 were men. The sample size from technical colleges included 10,788 graduates, while 5,713 were women and 5,075 were men.

Records from the Utah DWS were matched with USHE graduates' one- and five-calendar years post-graduation. Wage records were collected from the Unemployment Insurance (UI) program, a division of the Utah DWS. Employers across the state of Utah are required to report wages for employees quarterly. If an individual has wages from multiple employers in any given quarter, these wages were summed to compute individuals' quarterly wages. These quarterly wages were then summed to produce the annual wage.

For this study, only the highest educational attainment for a given student was considered. If a student obtained a technical degree, followed by a bachelor's degree, this student's educational attainment was classified as a bachelor's degree. If a student completed a degree but returned to an academic institution or technical college, they were excluded from the study. The five groups of educational attainment from the lowest to highest are the following: technical certificate, associate degree, bachelor's degree, master's degree, or higher. Additionally, if a student took a course at an academic or technical institution after their graduating academic year, they were excluded from the study. Students who reported "general education" as CIP were excluded as they were likely to have continued with their academic career. If a student obtained multiple degrees with the same educational attainment on the same day from different CIP code families (commonly known as "double majors"), the area studied was coded to be "multiple." Although all students were recent graduates, students' ages at graduation were used as a proxy for work experience and time in the workforce before graduating. The first workforce quarter available for this study is 2001.

Graduation records were matched with wage data from the Utah DWS. As opposed to the academic year, the calendar year is used to match wage records one- and five-years after graduating. Because number of hours worked for each individual is not available in wage records, a 40-hour work week full-time status for the graduates are not available. To overcome this limitation, calculations from wages and quarters worked were used to indicate workers who were strongly attached to the workforce. A worker who is strongly attached to the workforce is defined as

a graduate who has UI wages no less than wages for individuals working 40 hours a week, earning at least the federal minimum wage of $7.25 per hour for all four quarters of the calendar year. An individual is considered "strongly attached to the workforce" if all four quarterly wages exceed this full-time threshold. For example, if an individual has more than $15,080 (7.25*40*52) annual wages reported for a given year, but one of the quarters shows less than $3,770 (7.25*40*52/4) in wages, this individual would not be considered strongly attached to the workforce for this calendar year in this study. An individual's wages at one- and five-years post-graduation are snapshots of the individual's earning, and does not capture continuous work history. For this research, the earnings ratio is defined as the ratio between female graduates' annual median income and the male graduates' annual median income. Earnings ratios were calculated one year and five years after graduation.

2.3 | Data Limitations

The ACS is a cross-sectional study weighted to represent the labor force each year. As such, results from this section of the study should not be used to observe the progression of wages of one group or cohort, as different individuals were surveyed each year. Respondents of the ACS are residents of the state at the time of the survey. They may have received education outside of the USHE.

Data used in objectives two, three, and four only include graduates from the USHE. Wage information for high school graduates cannot be obtained for the Utah State Board of Education (USBE) graduates. They do not have variables available to match with Workforce Services' UI records. Included cohorts of the study are limited to the 2012 – 2014 cohort years. Education obtained before 2011 is not considered in this study. In some cases, graduates before 2011 may have enrolled in a new program. The prior degree, in this case, would not be considered. Data were not available for individuals obtaining education outside of the state of Utah or the USHE. Exclusions include some post-secondary institutions in Utah, such as Brigham Young University, Westminster College, and Western Governors University.

Therefore, data are only generalizable to graduates of USHE institutions. Those with some college but no degree are not considered in these objectives, only those with a technical certificate or degree are considered. These individuals may be attached to employment, where the gender wage gap is different than those with a USHE degree.

This study includes wage data one- and five-years post-graduation. Due to timeline requirements, the most recent graduation cohort was 2014, while the oldest complete graduation data available to the

UDRC were from the 2012 academic year. Wage data are not complete for the 2020 calendar year at the time of this study. The 2014 cohort was the most recent with five-year post-graduation wage data available, resulting in a distribution of data skewing to the younger age groups. As age was used as a proxy for work experience, results for older graduates were often not publishable in accordance with the methodological requirement of 30 individuals in an age bin and the UDRC disclosure protocol to preserve the identities of all individuals in research.

Number of quarters worked while an individual is strongly attached to the workforce before graduation is also used as a proxy for experience. Prior work experience may not apply to the field of occupation following graduation. UI records stored at the UDRC begin in the first quarter of 2001. Any wage records before 2001 are not considered in this study. The exclusion of wages prior to 2001 may inadvertently result in a lack to demonstrate the decades-long cumulative effect of applicable industry experience on wage. A wider gap for those with experience could be related to women not negotiating as frequently as men, women tend to prioritize schedule flexibility over monetary gains to allow for caregiving, or other factors.

Wage data from UI records do not capture all income by graduates. For example, income from self-employment, federal agencies, black market transactions, non-profit employment, and agriculture may not be subject to UI wage reporting requirements. Income derived outside of the workforce (dividends, real estate, etc.) is not recorded in wage records. Any income earned outside of the state of Utah is also not available. While results drawn from DWS data may not be generalized to all income, the U.S. BLS (2018) indicates that over 90% of workers are included in UI records. The findings from this research are significant.

UI wage records provide no detail on hours worked. Seasonal workers may also be excluded from the consideration of attachment to the workforce due to not having met the wage criteria for all four quarters. Further research would be required to gain more insight into hourly wages for those in the same industry, as employers report quarterly UI wages only. In certain high-earning occupations, workers may be classified as strongly attached to the workforce in this study even when workforce participation is less than 40 hours a week. In addition, hourly pay would paint a more accurate picture of the monetary reward difference between men and women for the same unit of labor. Though CIP codes are used to organize fields of study and program completions, they do not denote the field or occupation that a graduate enters. As a result,

some graduates may not work in their field of study.

In classic economic theory, wage is a function of an individual's output or productivity (Borjas, 2020). Educational attainment, experience, hours worked, and field of study may be related to output but are not perfect estimates of productivity. As a result, some misspecification may exist in models. Finally, the graduates' parenthood status was not available at the time of this study. Yet parenthood status is an important variable that could potentially explain parts of the wage gap. Being a parent impacts earnings differently for men and women. While women experience a "mommy tax" (Crittenden, 2002), men experience a "daddy bonus" which is the increased earnings men experience when they become parents (Hodges & Budig, 2010). The missing data of parenthood hinders the ability to examine the effect of having children on the gender wage gap.

3 | Results

3.1 | Objective One - A Historical Comparison of the U.S. and Utah's Gender Wage Gap (2005 -2018)

To understand income differences and trends between men and women, historical wage records will be compared using data from sampled households from the ACS. This survey was used to better represent the labor force of Utah as a whole. The survey receives responses from heads of households of all ages, unlike graduation data used later in the study that is more biased toward younger individuals who are likely at the beginning of their careers. Data is immediately available from the BLS online from 2005 – 2018, and all available years are used for this research.

Median wage is examined by decomposing ACS data nationally and for Utah in three parts. Wage is then divided (women's wage / men's wage) to present an earnings ratio so different years can be compared without inflation adjustment. The first decomposition investigates all adults (18 years or greater) with wages greater than 0, the second decomposition excludes adults that typically work less than 35 hours a week, and the last decomposition groups these individuals by their highest level of educational attainment.

To better understand the general workforce wage, both part-time and full-time workers are included prior to any decomposition or grouping. This sample is meant as the baseline for wages and can be used to better understand the impact of later decompositions. The group does not include working non-adults or those who had no wages. Women typically occupy more part-time work than men, especially in Utah (Kem C. Gardner Policy Institute, 2020), so a higher wage gap is expected. As shown in Figure 3, the median wage is used as the measure as it is less sensitive to outliers. In addition, the mean, median,
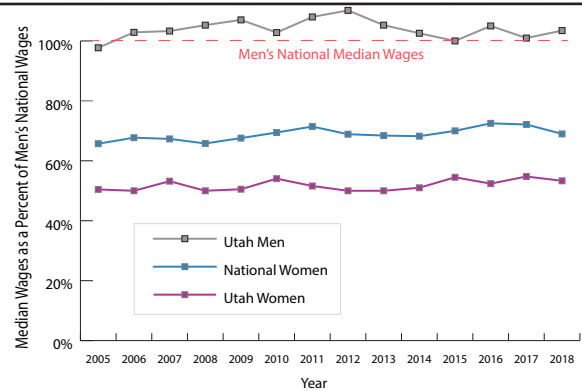
Figure 3: Utah women's median wage earnings ratio full-time and part-time (2005 – 2018)

and wage figures used to compute the wage gap can be reviewed in Appendix Table 1.

In this figure (Fig. 3), Utah is represented with dark purple, while the national median wage gap is represented with blue. The average difference between Utah's wage gap from the national gap is 17.02% from 2005 - 2018.

Next, individuals who worked part-time are excluded, so the sample only includes full-time workers. Only respondents who reported 35 hours or more usual work hours in the past 12 months are included (typical hours worked per week (WKHP)). By excluding part-time workers from this sample, the portion of the wage-gap caused by part-time work can be evaluated. The results of this decomposition are seen in Figure 4 below. Full results of mean, median, and the wage figures used to compute the wage gap can be reviewed in Appendix Table 2.

In this figure (Fig. 4), Utah's earnings ratio is again represented in dark purple, while the blue line represents the national median earnings ratio. The difference between Utah's wage gap from the national average is 10.97% from 2005 – 2018.
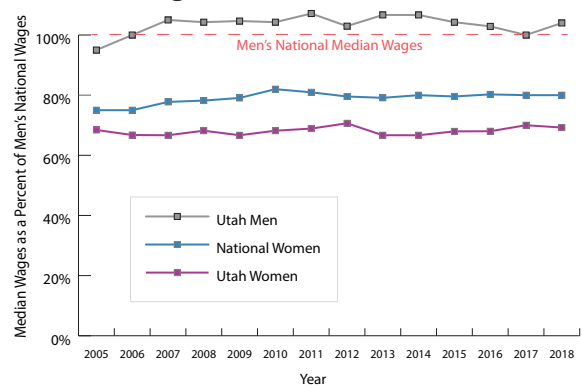
Figure 4: Utah women's median wage earnings ratio (>= 35 hours a week) (2005 – 2018)

To better understand the impact of education, the workforce is grouped by the highest level of educational achievement of the respondent. Similar to other reports published by the U.S. Bureau of Labor Statistics, self-reported education is segregated into five groups: high school graduates, some college, associate degree, bachelor's degree,

and master's degree or higher. Those grouped in high school education or equivalent include those who received a regular high school diploma, GED, or equivalent credential. Those grouped in some college with no degree include those with less than one year, and more than one year of college education, with no degree awarded, as well as those with sub-associate certificates or non-degree awards. Those grouped with associate degrees and bachelor's degrees are exclusive to those degree designations. Those with a master's degree or higher include individuals with a master's degree, professional degree beyond a bachelor's degree, and all other professional and doctorate degrees. For convenience in table formatting, this group is referred to as "Advanced Degrees." For a full list of national and Utah averages from 2005 – 2018, refer to Appendix Table 3. Figure 5 below shows the median wage after decomposing with regard to the highest level of educational attainment. Similar to the previous two decompositions, wage is available from 2005 – 2018. Figure 5 shows the historical earnings ratio of women over time. To simplify the results of Figure 5, Table 1 calculates the median of the earnings ratio from 2005 – 2018. Groups not included are those with less education than a high school diploma or equivalent in the workforce.

For this figure (Fig. 5), higher values of earnings ratios are colored darker on a continuous scale from the maximum of the set (77.16%) to the minimum (60.29%). Table 1 shows the average percent of Utah women's wage as a percent of men's over time (2005-2018) to supplement Figure 5.

Those with a high school degree or equivalent have the most equity in wage, while those with a bachelor's

degree, some college, and an advanced degree experience the largest gender wage gaps in Utah.

Table 1: Utah women's average median wage earnings ratio from 2005 – 2018

Educational Attainment	Women's Wage as a Percentage of Men's
High School	73.33%
Some College	67.38%
Associate Degree	69.32%
Bachelor's Degree	64.73%
Advanced Degree	68.90%

3.2 | Objective Two – Decomposition of Wage from Recent USHE Graduates (Cohorts 2012 – 2014)

Following the pattern from objective one, the second objective decomposes wages for recent graduates from USHE. All tables are sorted by academic year and gender. The decomposition investigates wages by all graduates regardless of attachment to workforce status, age at the time of graduation, educational attainment, or program of study. First, to understand the gender wage gap for all graduates, including those who were not strongly attached to the workforce, the gender wage gap is studied for all graduates regardless of attachment to workforce status. Results are separated into two tables. Table 2 shows that those with a degree from academic institutions, and Table 3, are individuals from technical colleges. The results of the first decomposition are seen on the next page.

Year	High School Only	Some College	Associate's Degree	Bachelor's Degree	Graduate Degree
2005	73.33%	63.89%	67.50%	68.00%	67.15%
2006	75.66%	65.10%	69.25%	64.15%	73.85%
2007	74.77%	62.50%	63.64%	65.45%	69.44%
2008	69.71%	64.00%	69.89%	63.33%	75.71%
2009	71.43%	65.00%	68.89%	62.07%	70.67%
2010	77.16%	70.00%	72.73%	68.71%	66.67%
2011	71.43%	70.00%	75.00%	63.33%	71.25%
2012	70.00%	70.00%	73.33%	66.67%	70.06%
2013	77.14%	68.50%	66.21%	66.67%	65.00%
2014	72.22%	65.48%	68.00%	66.12%	66.27%
2015	76.53%	75.00%	72.68%	61.54%	68.97%
2016	71.05%	68.65%	68.09%	67.69%	70.59%
2017	73.68%	71.43%	67.31%	60.29%	64.52%
2018	72.50%	63.83%	68.00%	62.14%	64.52%

Figure 5: Utah women's median wage earnings ratio by educational attainment (2005 – 2018)

Table 2: Median wages and earnings ratio by gender of the 2012-2014 graduation cohorts from *all academic institutions* in the Utah System of Higher Education (regardless of workforce attachment, annual wages)

Graduation Year	Gender	Median Wage (One-Year Post)	Earnings Ratio (One-Year Post)	Median Wage (Five-Years Post)	Earnings Ratio (Five-Year Post)
2012	F	$10,232.00	59.44%	$1,522.00	6.39%
2012	M	$17,214.00		$23,828.00	
2013	F	$9,744.00	53.89%	$920.00	3.63%
2013	M	$18,080.00		$25,323.00	
2014	F	$10,725.00	58.26%	$2,037.00	8.13%
2014	M	$18,408.00		$25,042.00	

Table 3: Median wages and earnings ratio by gender of the 2012-2014 graduation cohorts from *all technical colleges* in the Utah System of Higher Education (regardless of workforce attachment, annual wages)

Graduation Year	Gender	Median Wage (One-Year Post)	Earnings Ratio (One-Year Post)	Median Wage (Five-Years Post)	Earnings Ratio (Five-Year Post)
2012	F	$5,796	43.31%	$1,925	13.50%
2012	M	$13,384		$14,263	
2013	F	$6,074	44.28%	$3,039	19.21%
2013	M	$13,716		$15,823	
2014	F	$8,290	48.36%	$7,246	36.00%
2014	M	$17,142		$20,128	

To better understand the wage gap for graduates who were strongly attached to the workforce, only those who meet attachment to the workforce requirements are considered in the next stage of decomposition. All decomposition following these tables only considers those who were strongly attached to the workforce. Graduates of academic institutions are considered in Table 4, while those graduating from a technical college are considered in Table 5. The results of this decomposition are seen below.

Table 4: Median wages and earnings ratio by gender of the 2012-2014 graduation cohorts from *all academic institutions* in the Utah System of Higher Education (strongly attached to the workforce only)

Graduation Year	Gender	Median Wage (One-Year Post)	Earnings Ratio (One-Year Post)	Median Wage (Five-Years Post)	Earnings Ratio (Five-Year Post)
2012	F	$35,228	78.30%	$43,726	69.94%
2012	M	$44,990		$62,518	
2013	F	$35,888	77.78%	$46,804	72.38%
2013	M	$46,140		$64,668	
2014	F	$36,455	77.36%	$48,038	72.10%
2014	M	$47,125		$66,626	

Table 5: Median wages and earnings ratio by gender of the 2012-2014 graduation cohorts from *all technical colleges* in the Utah System of Higher Education (strongly attached to the workforce only)

Graduation Year	Gender	Median Wage (One-Year Post)	Earnings Ratio (One-Year Post)	Median Wage (Five-Years Post)	Earnings Ratio (Five-Year Post)
2012	F	$23,038	50.38%	$28,452	57.36%
2012	M	$45,724		$49,601	
2013	F	$23,502	61.94%	$29,779	64.45%
2013	M	$37,942		$46,208	
2014	F	$24,126	58.18%	$30,914	61.03%
2014	M	$41,470		$50,654	

Next in Tables 6 and 7, graduates from academic institutions and technical colleges are decomposed by age at the time of graduation. Age values are binned following the same pattern used by the U.S. BLS. Cells marked with an asterisk in the tables indicate subgroups that did not meet the study criteria of at least 30 individuals. Purpose of the study criteria is to protect individual wage information and decrease possible outliers' bias in wage data. Though individuals under 18 are binned in the 16-24 age group, they are likely to be excluded due to the strong workforce attachment requirement in the case that they continued to pursue education. Graduates of academic institutions are considered in Table 6 on this page and the next page, while those graduating from a technical college are considered in Table 7.

Table 6: Median wages and earnings ratio by gender and age of the 2012-2014 graduation cohorts from *all academic institutions* in the Utah System of Higher Education (strongly attached to the workforce only)

Graduation Year	Gender	Age Bin	Median Wage (One-Year Post)	Earnings Ratio (One-Year Post)	Median Wage (Five-Years Post)	Earnings Ratio (Five-Years Post)
2012	F	under 16	*		*	
2012	F	16-24	$30,458	86.37%	$39,565	77.89%
2012	F	25-34	$36,992	82.74%	$46,618	71.39%
2012	F	35-44	$42,702	78.47%	$51,614	78.20%
2012	F	45-54	$43,216	70.88%	$48,688	76.99%
2012	F	55-64	$55,124	92.28%	$58,943	114.69%
2012	F	65 +	*		*	
2012	M	under 16	*		*	
2012	M	16-24	$35,265		$50,797	
2012	M	25-34	$44,710		$65,296	
2012	M	35-44	$54,415		$66,000	
2012	M	45-54	$60,970		$63,238	
2012	M	55-64	$59,738		$51,394	
2012	M	65 +	*		*	

Subgroups did not meet the study criteria of at least 30 individuals.

Table 6 (continued): Median wages and earnings ratio by gender and age of the 2012-2014 graduation cohorts from *all academic institutions* in the Utah System of Higher Education (strongly attached to the workforce only)

Graduation Year	Gender	Age Bin	Median Wage (One-Year Post)	Earnings Ratio (One-Year Post)	Median Wage (Five-Years Post)	Earnings Ratio (Five-Years Post)
2013	F	under 16	*		*	
2013	F	16-24	$31,504	86.40%	$42,132	80.88%
2013	F	25-34	$37,400	81.52%	$48,774	72.78%
2013	F	35-44	$41,124	74.42%	$51,783	72.40%
2013	F	45-54	$45,838	75.92%	$55,158	86.11%
2013	F	55-64	$46,274	86.75%	$56,509	88.41%
2013	F	65 +	*		*	
2013	M	under 16	*		*	
2013	M	16-24	$36,464		$52,090	
2013	M	25-34	$45,880		$67,018	
2013	M	35-44	$55,256		$71,525	
2013	M	45-54	$60,380		$64,053	
2013	M	55-64	$53,339		$63,916	
2013	M	65 +	*		*	
2014	F	under 16	*		*	
2014	F	16-24	$31,906	85.60%	$43,912	80.81%
2014	F	25-34	$38,382	81.73%	$49,799	72.21%
2014	F	35-44	$42,569	71.78%	$54,439	72.25%
2014	F	45-54	$43,754	76.21%	$51,886	76.26%
2014	F	55-64	$37,102	66.80%	$46,421	83.62%
2014	F	65 +	*		*	
2014	M	under 16	*		*	
2014	M	16-24	$37,275		$54,340	
2014	M	25-34	$46,960		$68,966	
2014	M	35-44	$59,304		$75,344	
2014	M	45-54	$57,412		$68,042	
2014	M	55-64	$55,540		$55,514	
2014	M	65 +	*		*	

Subgroups did not meet the study criteria of at least 30 individuals.

Table 7: Median wages and earnings ratio by gender and age of the 2012-2014 graduation cohorts from *all technical colleges* in the Utah System of Higher Education (strongly attached to the workforce only)

Graduation Year	Gender	Age Bin	Median Wage (One-Year Post)	Earnings Ratio (One-Year Post)	Median Wage (Five-Years Post)	Earnings Ratio (Five-Years Post)
2012	F	under 16	*		*	
2012	F	16-24	$21,923	55.18%	$27,954	67.53%
2012	F	25-34	$24,688	51.30%	$28,452	47.40%
2012	F	35-44	$24,841	50.31%	$31,967	63.19%
2012	F	45-54	$22,970	59.38%	$28,326	64.21%
2012	F	55-64	*		*	
2012	F	65 +	*		*	
2012	M	under 16	*		*	
2012	M	16-24	$39,731		$41,394	
2012	M	25-34	$48,128		$60,026	
2012	M	35-44	$49,371		$50,590	
2012	M	45-54	$38,680		$44,115	
2012	M	55-64	*		*	
2012	M	65 +	*		*	
2013	F	under 16	*		*	
2013	F	16-24	$21,781	72.63%	$29,045	72.78%
2013	F	25-34	$24,650	58.11%	$29,779	57.65%
2013	F	35-44	$24,309	58.52%	$33,396	71.49%
2013	F	45-54	$27,518	69.02%	$31,267	67.23%
2013	F	55-64	*		*	
2013	F	65 +	*		*	
2013	M	under 16	*		*	
2013	M	16-24	$29,988		$39,906	
2013	M	25-34	$42,422		$51,658	
2013	M	35-44	$41,540		$46,714	
2013	M	45-54	$39,871		$46,506	
2013	M	55-64	*		*	
2013	M	65 +	*		*	

Subgroups did not meet the study criteria of at least 30 individuals.

Table 7 (continued): Median wages and earnings ratio by gender and age of the 2012-2014 graduation cohorts from *all technical colleges* in the Utah System of Higher Education (strongly attached to the workforce only)

Graduation Year	Gender	Age Bin	Median Wage (One-Year Post)	Earnings Ratio (One-Year Post)	Median Wage (Five-Years Post)	Earnings Ratio (Five-Years Post)
2014	F	under 16	*		*	
2014	F	16-24	$22,731	72.41%	$29,862	68.24%
2014	F	25-34	$25,498	57.99%	$33,266	58.30%
2014	F	35-44	$25,607	45.19%	$34,946	60.44%
2014	F	45-54	$27,846	51.70%	$33,408	63.86%
2014	F	55-64	*		*	
2014	F	65 +	*		*	
2014	M	under 16	*		*	
2014	M	16-24	$31,393		$43,763	
2014	M	25-34	$43,971		$57,060	
2014	M	35-44	$56,660		$57,819	
2014	M	45-54	$53,862		$52,311	
2014	M	55-64	$46,319		$40,540	
2014	M	65 +	*		*	

Subgroups did not meet the study criteria of at least 30 individuals.

The fourth decomposition separates graduates by educational attainment. Only academic institutions are considered for this portion of decomposition, as those with a technical certificate are grouped regardless of classroom hours. Like the ACS, all graduate degrees are combined in metric. The results of wage by educational attainment are shown in Table 8 below.

Table 8: Median wages and earnings ratio by gender and educational attainment of the 2012–2014 graduation cohorts from *all academic institutions* in the Utah System of Higher Education (strongly attached to the workforce only)

Graduation Year	Gender	Educational Attainment	Median Wage (One-year Post)	Earnings Ratio (One-year Post)	Median Wage (Five-years Post)	Earnings Ratio (Five-years Post)
2012	F	Associate Degree	$30,409	78.31%	$37,947	75.32%
2012	F	Bachelor's Degree	$33,477	79.38%	$42,516	69.46%
2012	F	Graduate Degree	$47,612	81.92%	$60,094	72.84%
2012	M	Associate Degree	$38,832		$50,384	
2012	M	Bachelor's Degree	$42,172		$61,213	
2012	M	Graduate Degree	$58,121		$82,498	
2013	F	Associate Degree	$30,363	77.82%	$38,416	74.75%
2013	F	Bachelor's Degree	$34,424	78.69%	$45,827	72.27%
2013	F	Graduate Degree	$47,332	78.65%	$62,971	73.40%
2013	M	Associate Degree	$39,016		$51,391	
2013	M	Bachelor's Degree	$43,747		$63,412	
2013	M	Graduate Degree	$60,177		$85,796	
2014	F	Associate Degree	$31,288	77.70%	$39,832	74.96%
2014	F	Bachelor's Degree	$34,869	78.05%	$47,395	71.68%
2014	F	Graduate Degree	$48,912	80.35%	$66,981	76.33%
2014	M	Associate Degree	$40,267		$53,136	
2014	M	Bachelor's Degree	$44,675		$66,123	
2014	M	Graduate Degree	$60,877		$87,749	

The last decomposition explores the difference in wage between genders by area of study. A standardized CIP is used since majors can vary in definition at each institution. For parity in educational attainment, only bachelor's degrees are considered for academic institutions for this portion of decomposition.

The rank of CIP codes was determined by individuals who were strongly attached to the workforce in both years one and five after graduating. Like the age decomposition, cells marked with an astrisk in the tables indicate the subgroup size did not meet the 30-person threshold, and the wage information was not considered. Graduates of academic institutions are considered in Table 9, while those graduating from a technical college are considered in Table 10.

Table 9: Median wages and earnings ratio by gender and top areas of study of the 2012-2014 graduation cohorts from *all academic institutions* in the Utah System of Higher Education (strongly attached to the workforce and bachelor's degree holder only)

Grad Year	Rank	CIP (Area of Study)	Gender	Median Wage (One-Year Post)	Earnings Ratio (One-Year)	Median Wage (Five-Years Post)	Earnings Ratio (Five-Years)
2012	1	Business management marketing and related support services	F	$35,280	81.82%	$50,951	76.28%
2012	2	Health professions and related programs	F	$44,104	87.51%	$53,256	83.76%
2012	3	Education	F	$33,525	94.81%	$41,051	87.86%
2012	4	Social sciences	F	$33,233	86.23%	$41,183	72.49%
2012	5	Psychology	F	$28,594	82.79%	$37,662	73.47%
2012	1	Business management marketing and related support services	M	$43,120		$66,792	
2012	2	Health professions and related programs	M	$50,397		$63,578	
2012	3	Education	M	$35,362		$46,723	
2012	4	Social sciences	M	$38,540		$56,812	
2012	5	Psychology	M	$34,540		$51,261	

Table 9 (continued): Median wages and earnings ratio by gender and top areas of study of the 2012-2014 graduation cohorts from *all academic institutions* in the Utah System of Higher Education (strongly attached to the workforce and bachelor's degree holder only)

Grad Year	Rank	CIP (Area of Study)	Gender	Median Wage (One-Year Post)	Earnings Ratio (One-Year)	Median Wage (Five-Years Post)	Earnings Ratio (Five-Years)
2013	1	Business management marketing and related support services	F	$37,752	82.64%	$55,000	81.54%
2013	2	Health professions and related programs	F	$43,591	89.21%	$54,193	81.04%
2013	3	Education	F	$34,303	94.86%	$44,493	93.31%
2013	4	Social sciences	F	$32,998	85.53%	$44,001	77.41%
2013	5	Communication journalism and related programs	F	$33,218	87.34%	$48,460	88.64%
2013	1	Business management marketing and related support services	M	$45,681		$67,450	
2013	2	Health professions and related programs	M	$48,863		$66,874	
2013	3	Education	M	$36,163		$47,682	
2013	4	Social sciences	M	$38,582		$56,840	
2013	5	Communication journalism and related programs	M	$38,033		$54,670	
2014	1	Business management marketing and related support services	F	$37,483	80.74%	$54,725	73.32%
2014	2	Health professions and related programs	F	$44,467	86.05%	$54,821	77.92%
2014	3	Education	F	$34,490	94.37%	$46,177	85.28%
2014	4	Social sciences	F	$32,717	80.09%	$47,919	82.45%
2014	5	Psychology	F	$30,228	89.94%	$42,346	90.13%
2014	1	Business management marketing and related support services	M	$46,424		$74,641	
2014	2	Health professions and related programs	M	$51,674		$70,354	
2014	3	Education	M	$36,549		$54,150	
2014	4	Social sciences	M	$40,850		$58,116	
2014	5	Psychology	M	$33,608		$46,981	

Table 10: Median wages and earnings ratio by gender and top areas of study of the 2012-2014 graduation cohorts from *all technical colleges* in the Utah System of Higher Education (strongly attached to the workforce only).

Grad Year	Rank	CIP (Area of Study)	Gender	Median Wage (One-Year Post)	Earnings Ratio (One-Year)	Median Wage (Five-Years Post)	Earnings Ratio (Five-Years)
2012	1	Health professions and related programs	F	$22,751	84.16%	$28,340	81.16%
2012	2	Transportation and materials moving	F	*		*	
2012	3	Personal and culinary services	F	*		$29,030	
2012	4	Construction trades	F	*		*	
2012	5	Mechanic and repair technologies/technicians	F	*		*	
2012	1	Health professions and related programs	M	$27,034		$34,920	
2012	2	Transportation and materials moving	M	$51,205		$46,973	
2012	3	Personal and culinary services	M	*		*	
2012	4	Construction trades	M	$53,848		$66,213	
2012	5	Mechanic and repair technologies/technicians	M	$38,148		$43,682	
2013	1	Health professions and related programs	F	$23,210	87.60%	$29,004	78.97%
2013	2	Personal and culinary services	F	$21,862		$30,543	
2013	3	Transportation and materials moving	F	*		*	
2013	4	Mechanic and repair technologies/technicians	F	*		*	
2013	5	Precision production	F	*		*	
2013	1	Health professions and related programs	M	$26,495		$36,730	
2013	2	Personal and culinary services	M	*		*	
2013	3	Transportation and materials moving	M	$46,773		$48,662	
2013	4	Mechanic and repair technologies/technicians	M	$32,530		$45,575	
2013	5	Precision production	M	$37,751		$45,980	

Subgroups did not meet the study criteria of at least 30 individuals.

Table 10 (continued): Median wages and earnings ratio by gender and top areas of study of the 2012-2014 graduation cohorts from *all technical colleges* in the Utah System of Higher Education (strongly attached to the workforce only).

Grad Year	Rank	CIP (Area of Study)	Gender	Median Wage (One-Year Post)	Earnings Ratio (One-Year)	Median Wage (Five-Years Post)	Earnings Ratio (Five-Years)
2014	1	Health professions and related programs	F	$23,448	79.49%	$30,290	73.88%
2014	2	Engineering technologies and engineering-related fields	F	*		*	
2014	3	Personal and culinary services	F	$24,372		$29,858	
2014	4	Mechanic and repair technologies/technicians	F	*		*	
2014	5	Precision production	F	*		*	
2014	1	Health professions and related programs	M	$29,499		$41,001	
2014	2	Engineering technologies and engineering-related fields	M	$75,711		$67,615	
2014	3	Personal and culinary services	M	*		*	
2014	4	Mechanic and repair technologies/technicians	M	$36,837		$49,572	
2014	5	Precision production	M	$40,945		$51,214	

Subgroups did not meet the study criteria of at least 30 individuals.

3.3 | Objective Three - Wage Growth Using a Difference-in-Differences Model (USHE Cohorts 2012 - 2014)

The gender wage gap has historically grown wider with more time in the workforce. This phenomenon may be due to vertical segregation (Wulfhurst, 2018), salary negotiation (Small, 2007), or other reasons. To explore this trend in the dataset, a difference-in-differences model was used.

In most cases, difference-in-differences models are used to measure the effect of a given program or policy. A treatment group that participated in the program is then compared with a control group to measure what difference that occurred as a result of the program or policy. Applying the model to wages over time will show if being a man affects wage growth from year one to the fifth year after graduation, and if so, by what dollar amount.

Data for each group are sorted by cohort year and educational attainment for those with strong attachment to the workforce one and five years after graduation. Cohorts for the years 2012, 2013, and 2014 were considered. Educational attainment was grouped into the four levels from the decomposition portion described earlier in this paper. Groups include those with a technical certificate, associate degree, bachelor's degree, and master's degree or higher. Individuals must be strongly attached to the workforce, as defined earlier in Section 2.2, for both one- and five-years following graduation to be included in their respective sample. Wages from

the fifth year were then subtracted from wages earned one year after graduating. Finally, men were assigned a dummy variable of 1, while women are assigned a 0.

The difference in wages is the dependent variable regressed against mens' dummy variable.

$$\Delta Y_{MF} = \beta_0 + X_1(\Delta Men) + e$$

Where Y_{MF} is the difference between the two time periods of $wage_{t+5}$ and $wage_{t+1}$ for both men and women in their respective group of educational attainment, β_0 represents the intercept of the wage difference on the vertical axis for the sample, X_1 represents the coefficient when the treatment group dummy variable is equal to one (observation is a man), and e is the residual term.

To measure if both populations, men and women, are equal in wage growth, a student's t-table assuming unequal variance was considered in each cohort, grouped by educational attainment. The p-value (rounded to the nearest thousandth) of Δwages for men and women is shown with the results of the difference-in-differences model below.

In each case except one (technical certificate recipients in 2012) of educational attainment, the differences in wages (change in wages from year one to year five) between men and women is statistically significant ($\alpha = .05$). Each p-value shows wage growth is not equal between men and women who are strongly attached to the workforce.

Table 11: Difference-in-differences model results by educational attainment (2012-2014 cohorts, strongly attached to the workforce only)

Cohort Year	Educational Attainment	Intercept	Male Coefficient	P-Value (Men, Women)	Std. Error (Men)
2012	Technical Certificate	$8,361.00	$2,129.00	0.057	$1,259.00
2012	Associate Degree	$11,922.10	$7,108.70	<0.001***	$1,299.60
2012	Bachelor's Degree	$14,679.20	$10,136.00	<0.001***	$1,223.40
2012	Graduate Degree	$16,995.00	$11,037.00	<0.001***	$2,012.00
2013	Technical Certificate	$8,991.60	$4,669.80	<0.001***	$1,085.50
2013	Associate Degree	$12,868.70	$5,181.90	<0.001***	$961.80
2013	Bachelor's Degree	$15,442.00	$10,613.10	<0.001***	$1,076.50
2013	Graduate Degree	$22,104.00	$9,567.00	0.004**	$2,935.00
2014	Technical Certificate	$10,048.00	$2,315.00	0.018*	$1,252.00
2014	Associate Degree	$11,988.40	$7,728.80	<0.001***	$1,114.00
2014	Bachelor's Degree	$16,577.00	$12,773.00	<0.001***	$1,429.00
2014	Graduate Degree	$21,596.00	$15,900.00	<0.001***	$3,370.00

Statistical significance: ***p<0.001; **p<0.01; *p<0.05
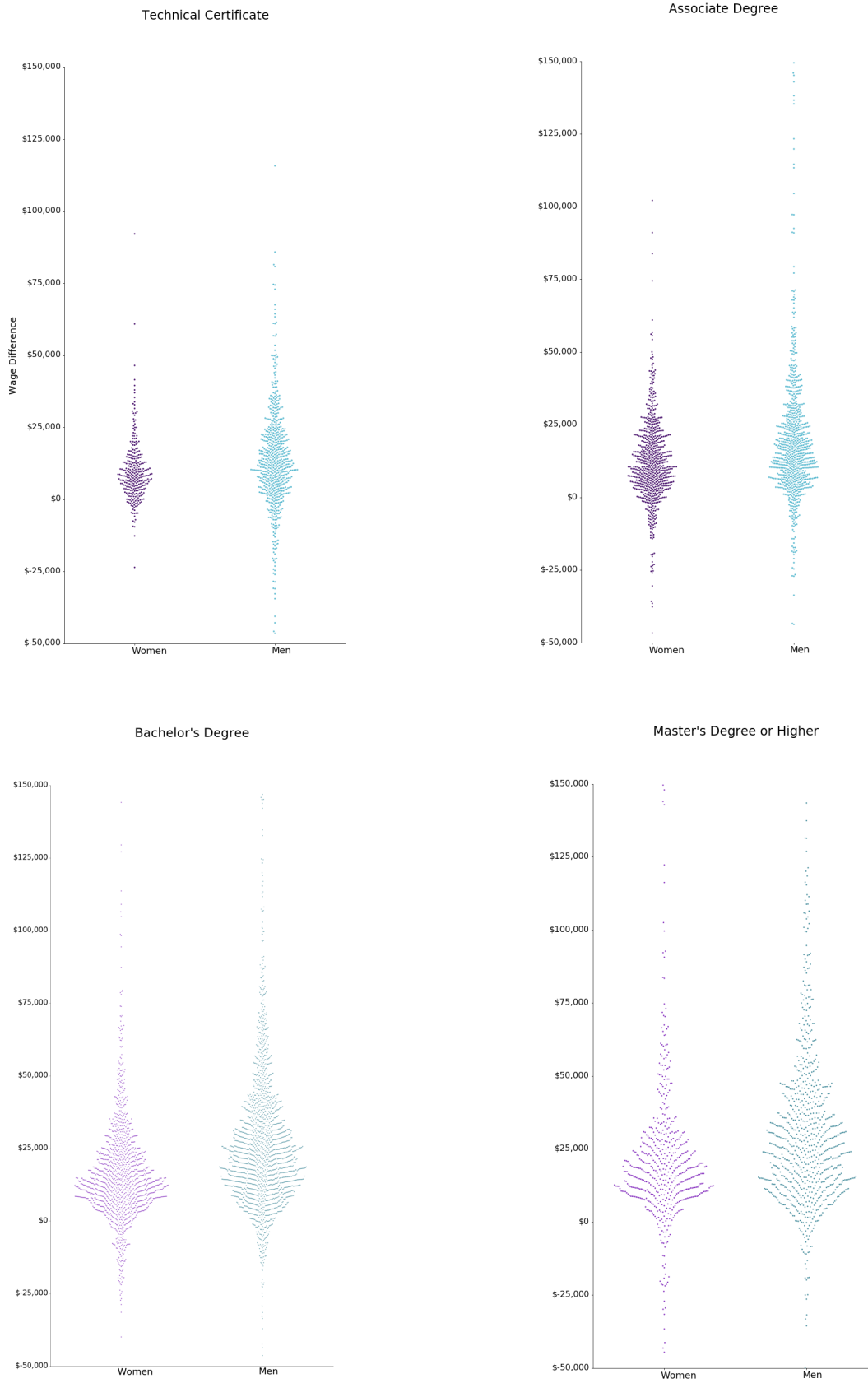
Figure 6: Wage differences from one-year post-graduation to five-years post-graduation (2012 – 2014 cohorts, strongly attached to the workforce only)

The coefficient of being a man in each case is also positive from one year after graduating to five years. To visualize these changes, results from the most recent cohort year (2014) were plotted in a swarm plot. A swarm plot is useful as it shows the relative size, distribution, and outliers for each level of educational attainment. To accommodate for the large number of graduates with a bachelor's degree, the point size was reduced by 43.3%. The scale for this visualization is limited to -$50,000 to $150,000. The y-axis represents the change in wage from one year after graduation to five years after graduation. The x-axis separates women in purple and men in teal and can be seen in Figure 6 on the previous page.

3.4 | Objective Four - Blinder-Oaxaca Wage Gap Decomposition (USHE Cohorts 2012 - 2014)

The mean wage difference between the genders is further examined using the Blinder-Oaxaca decomposition, aiming to explain how much of the difference is due to group differences in the levels of explanatory variables and how much is due to differences in the magnitude of regression coefficients.

Using the Oaxaca package in R (Hlavac, 2014), the explanatory variables include age, prior work experience, and highest educational attainment. Gender is used as an indicator variable to indicate whether a graduate wage record belongs to a man or woman. Age is first transformed into a quadratic term of the age at the time a student graduates. As there is no evidence that wage growth is linear with the worker's age, a quadratic relationship is more appropriate when modeling wage as a function of age (Mincer, 1974). Prior work experience is defined as the number of quarters an individual was strongly attached to the workforce before graduation for each student. As highlighted in the data limitation

section, only wages reported to the Utah DWS are considered. Education is transformed into a categorical variable that indicates which of the four educational attainments the student achieved. For each cohort, one- and five- year post-graduation wage differences were studied using only those who were strongly attached to the workforce at those intervals post-graduation, respectively. Table 12 summarizes the findings from the Blinder-Oaxaca decomposition.

At one-year post-graduation, the portion of the wage difference that can be explained by the explanatory variables range between 25% - 29%, while the portion that cannot be explained range between 71% - 75%. At five years after graduation, the portion of the wage difference can be explained by the explanatory variables ranges between 20% - 23%, while the portion that cannot be explained ranges between 77% - 80%. This observation suggests that not only is the size of the wage gap growing as more time is spent in the workforce, but the unexplained portion of the difference also increases. Parts of the explained and unexplained wage gap one-year post-graduation are illustrated in Figure 7. In contrast, portions of the explained and unexplained wage gap five-years post-graduation are shown in Figure 8.

When the explained portion of the wage difference is further studied, the most significant explanatory variable is work experience. With each additional quarter of work experience while being strongly attached to the workforce before graduation, graduates experienced a $523 to $547 increase in annual wage at one-year post-graduation. At five years after graduation, each additional quarter of being strongly attached to the workforce before graduation results in a $665 to $778 increase in annual wage. For the cohorts studied in this research, male students generally had four more quarters of being strongly attached to the workforce prior to graduation when compared to women.

Table 12: Blinder–Oaxaca decomposition results for one-year post-graduation to five-years post-graduation (*All academic institutions* in the Utah System of Higher Education, 2012 - 2014 cohorts, strongly attached to the workforce only)

Graduation Year	Time after graduation	Wage Gap	Explained (Dollars)	Explained (Percentage)	Unexplained (Dollars)	Unexplained (Percentage)
2012	one year	$13,021.14	$3,649.45	28.03%	$9,371.68	71.97%
2012	five years	$22,370.14	$5,013.82	22.41%	$17,356.31	77.59%
2013	one year	$12,617.85	$3,255.00	25.80%	$9,362.85	74.20%
2013	five years	$22,318.55	$4,959.20	22.22%	$17,359.30	77.78%
2014	one year	$13,168.12	$3,793.94	28.81%	$9,374.18	71.19%
2014	five years	$23,082.39	$4,770.03	20.67%	$18,312.36	79.33%
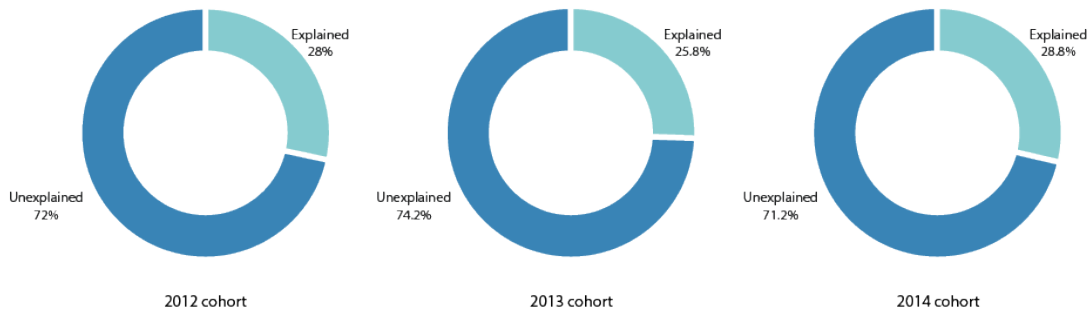
Figure 7: Explained and unexplained portions of the wage gap one-year post-graduation (2012 – 2014 cohorts, strongly attached to the workforce only)
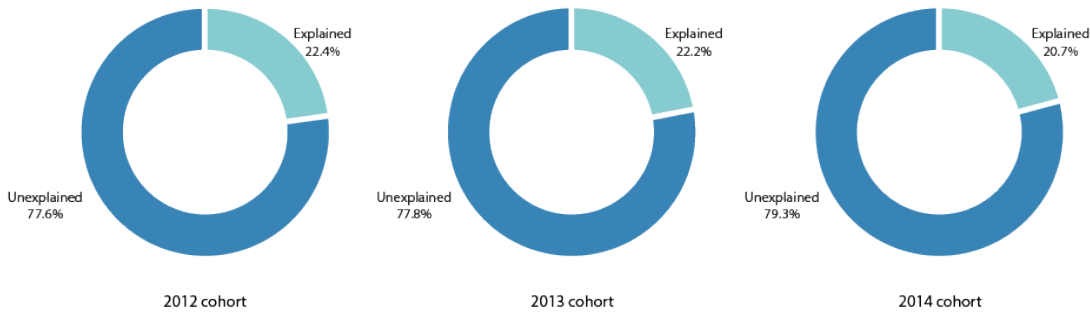
Figure 8: Explained and unexplained portions of the wage gap five-year post-graduation (2012 – 2014 cohorts, strongly attached to the workforce only)

4 | Discussion

Historically, Utah has trailed the U.S. in gender pay equality since 2005, the first year available for this study using ACS data. On average, without regard to full-time working status, Utah women made 17.02% less than the U.S. between 2005- 2018 (Fig. 3). This figure equates to Utah women's average earnings ratio of 51.83% of men's pay as compared to the national average of 68.85% (2005 - 2018). In 2018, for example, men made a median wage of $45,000 compared to women's wage of $24,000 in the same year.

Some of the difference is likely explained by the gap in hours worked between men and women. Women in Utah's labor force worked an average of 33.1 hours compared to men, who worked 40.4 hours on average in 2018 (Utah Department of Workforce Services, 2019). In connection, women in Utah rank first for the highest percentage of part-time workers in the nation (Kem C. Gardner Policy Institute, 2020).

The decomposition of full-time workers is then restricted to individuals who work at least 35 hours per week to account for the difference in hours (Fig. 4). Even with this consideration, Utah consistently

has a larger wage gap than the national average. From 2005 – 2018 Utah's median wage gap was 10.97% worse than the U.S. In 2018, the median gender wage gap for full-time workers was $16,000. This narrows the gap compared with workers without regard to full-time status, but still leaves Utah women with a 2018 median earnings ratio of 69.23% as compared to 80% nationally. The trend of trailing the national gender wage gap has been relatively uniform for all years of the study for both groups (full-time and all workers).

The difference in the gap is likely due, among other variables, to societal expectations for women to be primary caretakers. In 2018, Utah mothers participated in the workforce less with additional child-rearing responsibilities. 61% of women with children under six years old participated in the workforce. This number decreases to 50% when children are under six, and at least one child is between the ages of 6 and 17. The figure rises as children get older, as 71% of mothers participated in the workforce when all children were between 6 and 17 (Utah Department of Workforce Services, 2019).

In 2019, Utah ranked second in fertility rates in the nation (Kem C. Gardner Policy Institute, 2020). Being the primary caretaker of children may take some women away from the workforce, while others

may only be able to accept part-time work. This time away from the labor force may give men, who did not take on primary caretaking responsibility, an advantage which leads to higher wage over women who did.

When considering wages by full-time worker status and educational attainment (Fig. 5 and Table 1), all earnings ratios were between 60% and 78% for all years using ACS data (2005- 2018). On average, the highest level of pay equality exists for those with a high school diploma, with an average earnings ratio of 73.33%, and a maximum earnings ratio of 77.16% in 2010. Those with a bachelor's degree, followed by those with a master's degree or higher, had lower earnings ratios at 64.73% and 68.9%, respectively.

This larger gap is in line with national trends, where the wage gap increases for those with a bachelor's degree or higher (Day, 2019). Much of the difference nationally is explained by occupational segregation. Utah's highest female-dominated sectors include healthcare support, personal care services, and office support. By contrast, the highest male-dominated sectors include computer engineering, transportation, and construction (Utah Department of Workforce Services, 2019). Men's prevalence in higher-paying workspaces may be due to the long hours and time in the office, which conflicts with the flexibility needed for primary caretaking responsibilities.

The data used for recent graduates tell a similar story as the ACS. Recent graduate data is useful as it can be used to help understand when the wage gap occurs and what variables explain the wage differences. Wage is decomposed using demographic and human capital measures. For this decomposition, attachment to the workforce, age, educational attainment, and field of study are considered.

Without regard to attachment to the workforce or degree, women who graduated from an academic institution in the 2014 cohort made 58.26% of men's salary one year after graduating (Table 2). This figure is fairly consistent across all years of the study. Women graduating from a technical college saw an even lower earnings ratio of 48.36% in the same cohort year (Table 3), which was also fairly consistent in all years of the study. A dramatic drop from the first year to fifth year after graduating occurs without consideration to attachment to the workforce. This dramatic decrease is likely linked to more women spending less time in the workforce five years after graduating to fulfill alternate pursuits such as marriage and motherhood.

Another contributing factor may be occupational segregation, as the most popular degrees pursued by women generally have lower median pay. The change in wage is investigated in more detail

and can be found in Appendix Supplementary Information II section of this report. As hours worked were not available at the time of this study, future studies on hours of labor worked longitudinally in Utah are recommended.

The wage gap begins to shrink when considering those with strong attachment to the workforce only. For graduates from an academic institution, the earnings ratio was 77.36% for the 2014 cohort year (Table 4). Following the same pattern as workers without regard to status of attachment to the workforce, women with a technical certificate had a wider gap than those who attended an academic institution. Women who received a technical certificate in 2014 made 58.18% wage when compared to men with a certificate (Table 5). For academic institutions, the gender wage gap widens five years after graduation for all cohort years. This increase in wage gap over time suggests graduates may have a more similar starting wage immediately after graduation. Yet women with a degree receive slower monetary progression as they advance their careers. Those with a technical certificate still have a higher gap five years after graduation, but do not show the same magnitude of earnings ratio decrease over time as those who graduated from academic institutions.

When considering the wage gap by age, generally, the wage gap increases five years after graduating between men and women at academic institutions (Table 6). More pay equality tends to exist when graduates are in the youngest and oldest observed age groups, while graduates falling in middle age bins tend to experience a higher wage gap. This growth in the wage gap suggests that for the same cohort of graduates, women earn less over time as a percentage of men's wage as they grow older. These findings are consistent with the literature that suggest men are more likely to receive promotions (Rogier and Padgett, 2004; Blau and Devaro, 2007). It is also possible that women are more likely to engage in caretaking responsibilities for their families as they age (Schnieder, 2016).

For technical institutions, the wage gap is generally higher, but does not experience the same increase in gender wage gap over time (Table 7). Like academic institutions, more pay equality occurs during the first age bin of 16-24. After the age of 24, the gap tends to be higher for new graduates. This larger gap for older graduates may result from experienced individuals returning to receive a technical certificate or obtain continuing education credits as technology evolves within their fields. Wages were further decomposed by the type of degree obtained from an academic institution (Table 8). Similar to the ACS data (Table 1), the most wage equality occurs with an associate degree. Compared

with graduate and bachelor's degrees, the gap is on average 1.56% less one year after graduation and 2.35% less after five years. The highest average wage gap observed was from bachelor's degree recipients. Those with bachelor's degrees and advanced degrees experience a larger wage gap than those with a high school diploma or associate degree. This trend is consistent with national studies conducted by the U.S. Census Bureau, which found "more education leads to higher earnings, but the gender wage gap is wider among men and women with a bachelor's degree than among those without." (Day, 2019).

Finally, the gender wage gap was decomposed by the five most popular CIP families for academic institutions and technical colleges. Across all fields of study for academic institutions, the same general trend of a loss in income equality occurred over time (Table 9). The most equality occurs in education, where women made on average 94.68% of men's wage after one year in the workforce, while after five years that figure dwindled to 88.82%. The field with the highest pay inequality was business management, where women made 81.73% of men's wage one year after graduating and 77.05% after five years. Business management typically values long hours of work and does not offer as much temporal flexibility as other career paths.

When examining the CIP families for technical education, many fields did not meet the study requirement of 30 observations for each CIP (Table 10). This trend shows occupational segregation within technical and career training. Men tended to be attracted to fields like mechanical work, transportation, and construction. Women were more likely to choose fields like healthcare and personal culinary services. However, enough data for the healthcare profession were observed and showed similar trends in academic education where less wage equality occurs five years after graduating. Additional study on occupational segregation in technical education is suggested.

Using the data from decomposition, a difference-in-differences model was implemented to measure wage growth over time (Table 11). The model illustrates statistically significant unequal wage growth for men and women with strong attachment to the workforce for all three cohorts and all degree types. The largest average growth over all cohorts in dollar figures is attributed to men graduating with a graduate degree or higher. The coefficient for men is lowest for graduates completing a technical certificate and associate degree. Generally, as education went up, the coefficient for men also increased. This increase may illustrate more career advancement experienced by men over time. Alternatively, it is possible that women are more

likely than men to prioritize family or caretaking responsibilities five years after graduation.

When the wage difference between one- and five-years post-graduation is illustrated using a swarm plot (Figure 6), a smoother shape for men is visible as the wage difference increases along the y-axis. This shape is especially apparent when looking at the wage difference bachelor's and graduate degrees. When compared to women's wage gain, the shape tends to bottleneck as wage change increases. This illustrative difference may suggest that women experience a "glass ceiling" with wage growth compared to men.

The gender wage gap experienced by the graduates was also modeled using Blinder-Oaxaca decomposition (Table 12). This model split the gender wage gap into a difference in endowments and a difference in coefficients. Given the same endowments, or skills, the difference in coefficients or wage difference is unexplained. With age, prior experience, highest educational attainment being the same, wage differences between men and women are observed and unexplained by the model. Not only does the gap grow wider from one-year post-graduation to five-years post-graduation, the unexplained portion also grows as those with strong attachment to the workforce continue their professional life. Even at one-year post-graduation, the unexplained difference accounts for over 70% of the wage gap (Fig. 7 and 8). This may reflect the deeply embedded biases and societal expectations for men and women in the workforce.

Human capital models, like those used in this work, are efficient tools to examine wage as a function of variables such as age, education, prior work experience, and industry. It is important to reiterate that not all explanatory variables, such as worker skills or characteristics, were included or considered in this study. Soft variables are much harder to measure than human capital variables. Furthermore, endogeneity of the explanatory variables must be examined. A graduate's ability to obtain strong attachment to the workforce before graduation may be endogenous to the highest degree obtained rather than exogenous. It is also possible that societal bias serves as a cofounding variable that affects one's selection of major, ability to maintain prior work experience, as well as highest educational attainment.

Substantial research has documented that women tend to enter occupations that offer lower earnings; however, evidence was also found that as more women enter traditionally masculine occupations, those occupations' earnings declined (England et al., 2007). This practice may reflect an erroneous perception in society that a woman's labor is inherently worth less than a man's. Hence,

the selection of occupation or industry may have less effect on the gender wage gap than assumed. Nonetheless, college-aged students may be motivated by societal expectations or advisors to choose certain majors or programs to pursue their career paths. Though generally well-intended, gender biases may be hidden behind the encouragement from family members or advisors.

In addition, the role of employee engagement on the gender wage gap is not explicitly studied. Those who violate the advice received may later suffer a penalty for not conforming to societal norms. In addition, those who are engaged at work are more productive. Women who perceive that they are not being paid equal wages for equal work as men may become detached from their work life. These explanations among others demonstrate the inextricably intertwined relationship between societal expectations and individuals functioning in society.

4.1 | Future Research

Should additional wage data and birth data become available, research should focus on parenthood impacts on the gender wage gap and workforce outcomes for mothers in Utah, considering the high fertility rate in Utah. Women are more likely to be the caretaker in the family or choose to stay home after giving birth. Women's split roles at home and work impact the number of hours they are likely to participate in the workforce.

Future research should also examine long-term effects from the COVID-19 pandemic in 2020 on the gender wage gap. Women are more likely to leave employment when children stay home from school or camps (Collins et al., 2020). The industries women tend to work in were also affected more severely by the pandemic (Alon et al., 2020). A recent study found that jobs in occupations held by Utah women declined at more than twice the rate of Utah men from 2019 to 2020 (Kem C. Gardner Policy Institute, 2021). Future research could investigate the ramifications women face as a result of the pandemic.

Lastly, future studies could investigate the gender wage gap between companies with family-friendly policies compared to those without. The availability of on-site daycare or paternity leave of individual companies were not examined in this study. Paternity leave enables fathers to play a bigger role in childcare and share the responsibility of childcare with mothers. The ability to attain affordable childcare may also play a role in womens' decisions about their careers when they become mothers. Further exploration could provide valuable insights to inform future policy decisions.

5 | Conclusion

Utah has generally trailed the United States in pay equality between men and women. On average, from 2005 – 2018, the difference in pay equality is 10.97% less equitable in Utah than in the U.S. for full-time workers. This difference in pay begins immediately when new graduates enter the workforce. Women made less than men even after decomposing human capital and demographic considerations such as educational attainment, field of study, experience proxies, and age. Measures that reduced the wage gap in this study included consideration for attachment to the workforce, education, and selected field of study.

After graduation, the wage gap grows significantly worse from the first year of graduation to the fifth year. Each level of educational attainment showed a statistically significant difference in how wage changes over time between genders. The largest pay difference occurs from those with a bachelor's degrees or higher. The smallest change occurred from those with a technical certificate.

The difference in wages for recent graduates in Utah cannot be explained by human capital measures alone. Although this study did not have measures such as output or hours worked available, over 70% of the wage gap of recent graduates cannot be explained by education, experience and age.

This study illustrates that women in Utah consistently make less than men regardless of decomposition, educational attainment, or field of study. It is the hope of both authors that this research can be used to drive policy toward equal pay between men and women in the state.

Data Partners

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Appendix

Appendix Table 1 – Utah and national wage gap
(2005 – 2018, regardless of attachment to workforce)

Year	Level	Median Wage Men	Mean Wage Men	Median Wage Women	Mean Wage Women	Median Wage Gap	Mean Wage Gap
2005	Utah	$34,200	$42,771	$17,250	$21,856	50.44%	51.10%
2005	National	$35,000	$47,184	$23,000	$29,217	65.71%	61.92%
2006	Utah	$36,000	$44,377	$18,000	$23,138	50.00%	52.14%
2006	National	$35,000	$47,776	$23,700	$29,905	67.71%	62.59%
2007	Utah	$37,600	$47,450	$20,000	$24,746	53.19%	52.15%
2007	National	$36,400	$50,240	$24,500	$31,523	67.31%	62.74%
2008	Utah	$40,000	$49,194	$20,000	$25,754	50.00%	52.35%
2008	National	$38,000	$51,859	$25,000	$32,830	65.79%	63.31%
2009	Utah	$39,600	$48,500	$20,000	$25,193	50.51%	51.94%
2009	National	$37,000	$51,315	$25,000	$33,150	67.57%	64.60%
2010	Utah	$37,000	$47,069	$20,000	$25,684	54.05%	54.57%
2010	National	$36,000	$50,444	$25,000	$33,450	69.44%	66.31%
2011	Utah	$37,800	$48,482	$19,500	$25,772	51.59%	53.16%
2011	National	$35,000	$49,606	$25,000	$33,066	71.43%	66.66%
2012	Utah	$40,000	$49,677	$20,000	$27,302	50.00%	54.96%
2012	National	$36,300	$51,655	$25,000	$34,142	68.87%	66.10%
2013	Utah	$40,000	$52,082	$20,000	$26,849	50.00%	51.55%
2013	National	$38,000	$53,856	$26,000	$35,442	68.42%	65.81%
2014	Utah	$40,000	$53,573	$20,400	$28,075	51.00%	52.41%
2014	National	$39,000	$54,689	$26,600	$36,319	68.21%	66.41%
2015	Utah	$40,000	$53,518	$21,800	$29,173	54.50%	54.51%
2015	National	$40,000	$56,958	$28,000	$37,604	70.00%	66.02%
2016	Utah	$42,000	$56,454	$22,000	$29,929	52.38%	53.01%
2016	National	$40,000	$58,738	$29,000	$39,083	72.50%	66.54%
2017	Utah	$42,000	$56,788	$23,000	$30,191	54.76%	53.16%
2017	National	$41,600	$60,440	$30,000	$40,550	72.12%	67.09%
2018	Utah	$45,000	$60,531	$24,000	$31,587	53.33%	52.18%
2018	National	$43,500	$62,631	$30,000	$41,907	68.97%	66.91%

Year	Level	Median Wage Men	Mean Wage Men	Median Wage Women	Mean Wage Women	Median Wage Gap	Mean Wage Gap
2005	Utah	$38,000	$47,492	$26,000	$29,300	68.42%	61.69%
2005	National	$40,000	$51,937	$30,000	$35,900	75.00%	69.12%
2006	Utah	$40,000	$48,984	$26,700	$30,959	66.75%	63.20%
2006	National	$40,000	$52,880	$30,000	$36,894	75.00%	69.77%
2007	Utah	$42,000	$52,320	$28,000	$33,216	66.67%	63.49%
2007	National	$40,000	$55,673	$31,100	$38,908	77.75%	69.89%
2008	Utah	$44,000	$54,479	$30,000	$34,760	68.18%	63.80%
2008	National	$42,200	$57,937	$33,000	$40,756	78.20%	70.35%
2009	Utah	$45,000	$55,285	$30,000	$34,695	66.67%	62.76%
2009	National	$43,000	$58,215	$34,000	$41,736	79.07%	71.69%
2010	Utah	$44,000	$53,874	$30,000	$35,444	68.18%	65.79%
2010	National	$42,200	$57,671	$34,600	$42,300	81.99%	73.35%
2011	Utah	$45,000	$56,330	$31,000	$36,698	68.89%	65.15%
2011	National	$42,000	$57,301	$34,000	$42,380	80.95%	73.96%
2012	Utah	$45,300	$56,890	$32,000	$38,244	70.64%	67.22%
2012	National	$44,000	$59,456	$35,000	$43,636	79.55%	73.39%
2013	Utah	$48,000	$60,061	$32,000	$37,947	66.67%	63.18%
2013	National	$45,000	$62,010	$35,600	$45,353	79.11%	73.14%
2014	Utah	$48,000	$61,324	$32,000	$39,416	66.67%	64.27%
2014	National	$45,000	$62,841	$36,000	$46,372	80.00%	73.79%
2015	Utah	$49,000	$62,324	$33,300	$41,277	67.96%	66.23%
2015	National	$47,000	$65,196	$37,400	$47,720	79.57%	73.19%
2016	Utah	$50,000	$65,088	$34,000	$41,595	68.00%	63.91%
2016	National	$48,600	$67,103	$39,000	$49,308	80.25%	73.48%
2017	Utah	$50,000	$65,843	$35,000	$41,983	70.00%	63.76%
2017	National	$50,000	$68,822	$40,000	$50,963	80.00%	74.05%
2018	Utah	$52,000	$69,047	$36,000	$44,371	69.23%	64.26%
2018	National	$50,000	$71,116	$40,000	$52,548	80.00%	73.89%

APPENDIX TABLE 3 - UTAH AND NATIONAL WAGE GAP BY EDUCATIONAL ATTAINMENT (2005 - 2018, STRONGLY ATTACHED TO THE WORKFORCE ONLY)

Year	Level	Educational Attainment	Median Wage Men	Median Wage Women	Median Wage Gap
2005	Utah	High School	$30,000	$22,000	73.33%
2005	Utah	Some College	$36,000	$23,000	63.89%
2005	Utah	Associate Degree	$40,000	$27,000	67.50%
2005	Utah	Bachelor's Degree	$50,000	$34,000	68.00%
2005	Utah	Advanced Degree	$68,500	$46,000	67.15%
2005	National	High School	$31,000	$23,000	74.19%
2005	National	Some College	$38,000	$27,000	71.05%
2005	National	Associate Degree	$42,000	$32,000	76.19%
2005	National	Bachelor's Degree	$55,000	$40,000	72.73%
2005	National	Advanced Degree	$75,000	$50,000	66.67%
2006	Utah	High School	$30,400	$23,000	75.66%
2006	Utah	Some College	$38,400	$25,000	65.10%
2006	Utah	Associate Degree	$40,000	$27,700	69.25%
2006	Utah	Bachelor's Degree	$53,000	$34,000	64.15%
2006	Utah	Advanced Degree	$65,000	$48,000	73.85%
2006	National	High School	$31,500	$23,000	73.02%
2006	National	Some College	$38,000	$27,000	71.05%
2006	National	Associate Degree	$43,000	$32,000	74.42%
2006	National	Bachelor's Degree	$58,000	$40,000	68.97%
2006	National	Advanced Degree	$78,000	$52,000	66.67%
2007	Utah	High School	$32,100	$24,000	74.77%
2007	Utah	Some College	$40,000	$25,000	62.50%
2007	Utah	Associate Degree	$44,000	$28,000	63.64%
2007	Utah	Bachelor's Degree	$55,000	$36,000	65.45%
2007	Utah	Advanced Degree	$72,000	$50,000	69.44%
2007	National	High School	$32,500	$24,000	73.85%
2007	National	Some College	$40,000	$28,000	70.00%
2007	National	Associate Degree	$45,000	$34,000	75.56%
2007	National	Bachelor's Degree	$60,000	$42,000	70.00%
2007	National	Advanced Degree	$80,000	$55,000	68.75%

Year	Level	Educational Attainment	Median Wage Men	Median Wage Women	Median Wage Gap
2008	Utah	High School	$35,000	$24,400	69.71%
2008	Utah	Some College	$40,000	$25,600	64.00%
2008	Utah	Associate Degree	$45,000	$31,450	69.89%
2008	Utah	Bachelor's Degree	$60,000	$38,000	63.33%
2008	Utah	Advanced Degree	$70,000	$53,000	75.71%
2008	National	High School	$34,000	$25,000	73.53%
2008	National	Some College	$40,000	$29,100	72.75%
2008	National	Associate Degree	$46,000	$35,000	76.09%
2008	National	Bachelor's Degree	$60,000	$42,000	70.00%
2008	National	Advanced Degree	$83,000	$57,000	68.67%
2009	Utah	High School	$35,000	$25,000	71.43%
2009	Utah	Some College	$40,000	$26,000	65.00%
2009	Utah	Associate Degree	$45,000	$31,000	68.89%
2009	Utah	Bachelor's Degree	$58,000	$36,000	62.07%
2009	Utah	Advanced Degree	$75,000	$53,000	70.67%
2009	National	High School	$34,000	$25,000	73.53%
2009	National	Some College	$40,000	$30,000	75.00%
2009	National	Associate Degree	$40,000	$35,000	87.50%
2009	National	Bachelor's Degree	$60,000	$44,900	74.83%
2009	National	Advanced Degree	$85,000	$60,000	70.59%
2010	Utah	High School	$32,400	$25,000	77.16%
2010	Utah	Some College	$40,000	$28,000	70.00%
2010	Utah	Associate Degree	$44,000	$32,000	72.73%
2010	Utah	Bachelor's Degree	$58,000	$39,850	68.71%
2010	Utah	Advanced Degree	$78,000	$52,000	66.67%
2010	National	High School	$33,200	$25,000	75.30%
2010	National	Some College	$40,000	$30,000	75.00%
2010	National	Associate Degree	$46,000	$35,000	76.09%
2010	National	Bachelor's Degree	$60,000	$45,000	75.00%
2010	National	Advanced Degree	$85,000	$60,000	70.59%

APPENDIX TABLE 3 (CONTINUED) - UTAH AND NATIONAL WAGE GAP BY EDUCATIONAL ATTAINMENT (2005 - 2018, STRONGLY ATTACHED TO THE WORKFORCE ONLY)

| Year	Level	Educational Attainment	Median Wage Men	Median Wage Women	Median Wage Gap
2011	Utah	High School	$35,000	$25,000	71.43%
2011	Utah	Some College	$40,000	$28,000	70.00%
2011	Utah	Associate Degree	$44,000	$33,000	75.00%
2011	Utah	Bachelor's Degree	$60,000	$38,000	63.33%
2011	Utah	Advanced Degree	$80,000	$57,000	71.25%
2011	National	High School	$33,000	$25,000	75.76%
2011	National	Some College	$39,000	$29,800	76.41%
2011	National	Associate Degree	$45,000	$35,000	77.78%
2011	National	Bachelor's Degree	$60,000	$45,000	75.00%
2011	National	Advanced Degree	$85,000	$60,000	70.59%
2012	Utah	High School	$36,000	$25,200	70.00%
2012	Utah	Some College	$40,000	$28,000	70.00%
2012	Utah	Associate Degree	$45,000	$33,000	73.33%
2012	Utah	Bachelor's Degree	$60,000	$40,000	66.67%
2012	Utah	Advanced Degree	$78,500	$55,000	70.06%
2012	National	High School	$34,000	$25,800	75.88%
2012	National	Some College	$40,000	$30,000	75.00%
2012	National	Associate Degree	$47,000	$36,000	76.60%
2012	National	Bachelor's Degree	$62,000	$45,000	72.58%
2012	National	Advanced Degree	$89,000	$60,000	67.42%
2013	Utah	High School	$35,000	$27,000	77.14%
2013	Utah	Some College	$40,000	$27,400	68.50%
2013	Utah	Associate Degree	$47,800	$31,650	66.21%
2013	Utah	Bachelor's Degree	$60,000	$40,000	66.67%
2013	Utah	Advanced Degree	$80,000	$52,000	65.00%
2013	National	High School	$35,000	$26,000	74.29%
2013	National	Some College	$40,000	$30,000	75.00%
2013	National	Associate Degree	$47,100	$36,000	76.43%
2013	National	Bachelor's Degree	$65,000	$45,000	69.23%
2013	National	Advanced Degree	$90,000	$60,000	66.67%

APPENDIX TABLE 3 (CONTINUED) – UTAH AND NATIONAL WAGE GAP BY EDUCATIONAL ATTAINMENT (2005 – 2018, STRONGLY ATTACHED TO THE WORKFORCE ONLY)

Year	Level	Educational Attainment	Median Wage Men	Median Wage Women	Median Wage Gap
2014	Utah	High School	$36,000	$26,000	72.22%
2014	Utah	Some College	$42,000	$27,500	65.48%
2014	Utah	Associate Degree	$50,000	$34,000	68.00%
2014	Utah	Bachelor's Degree	$60,500	$40,000	66.12%
2014	Utah	Advanced Degree	$84,500	$56,000	66.27%
2014	National	High School	$35,000	$26,400	75.43%
2014	National	Some College	$40,000	$30,000	75.00%
2014	National	Associate Degree	$48,000	$36,000	75.00%
2014	National	Bachelor's Degree	$65,000	$47,000	72.31%
2014	National	Advanced Degree	$90,000	$61,000	67.78%
2015	Utah	High School	$36,000	$27,550	76.53%
2015	Utah	Some College	$40,000	$30,000	75.00%
2015	Utah	Associate Degree	$44,100	$32,050	72.68%
2015	Utah	Bachelor's Degree	$65,000	$40,000	61.54%
2015	Utah	Advanced Degree	$87,000	$60,000	68.97%
2015	National	High School	$35,600	$27,000	75.84%
2015	National	Some College	$40,500	$30,000	74.07%
2015	National	Associate Degree	$50,000	$36,800	73.60%
2015	National	Bachelor's Degree	$65,000	$48,000	73.85%
2015	National	Advanced Degree	$92,000	$63,000	68.48%
2016	Utah	High School	$38,000	$27,000	71.05%
2016	Utah	Some College	$43,700	$30,000	68.65%
2016	Utah	Associate Degree	$47,000	$32,000	68.09%
2016	Utah	Bachelor's Degree	$65,000	$44,000	67.69%
2016	Utah	Advanced Degree	$85,000	$60,000	70.59%
2016	National	High School	$36,000	$28,000	77.78%
2016	National	Some College	$42,000	$31,000	73.81%
2016	National	Associate Degree	$50,000	$38,000	76.00%
2016	National	Bachelor's Degree	$68,000	$50,000	73.53%
2016	National	Advanced Degree	$95,000	$65,000	68.42%

| Year	Level	Educational Attainment	Median Wage Men	Median Wage Women	Median Wage Gap
2017	Utah	High School	$38,000	$28,000	73.68%
2017	Utah	Some College	$42,000	$30,000	71.43%
2017	Utah	Associate Degree	$52,000	$35,000	67.31%
2017	Utah	Bachelor's Degree	$68,000	$41,000	60.29%
2017	Utah	Advanced Degree	$93,000	$60,000	64.52%
2017	National	High School	$37,900	$28,500	75.20%
2017	National	Some College	$43,500	$32,000	73.56%
2017	National	Associate Degree	$50,000	$38,000	76.00%
2017	National	Bachelor's Degree	$70,000	$50,000	71.43%
2017	National	Advanced Degree	$96,000	$67,000	69.79%
2018	Utah	High School	$40,000	$29,000	72.50%
2018	Utah	Some College	$47,000	$30,000	63.83%
2018	Utah	Associate Degree	$50,000	$34,000	68.00%
2018	Utah	Bachelor's Degree	$70,000	$43,500	62.14%
2018	Utah	Advanced Degree	$93,000	$60,000	64.52%
2018	National	High School	$39,000	$29,300	75.13%
2018	National	Some College	$45,000	$32,800	72.89%
2018	National	Associate Degree	$50,000	$39,500	79.00%
2018	National	Bachelor's Degree	$70,000	$50,000	71.43%
2018	National	Advanced Degree	$100,000	$69,000	69.00%
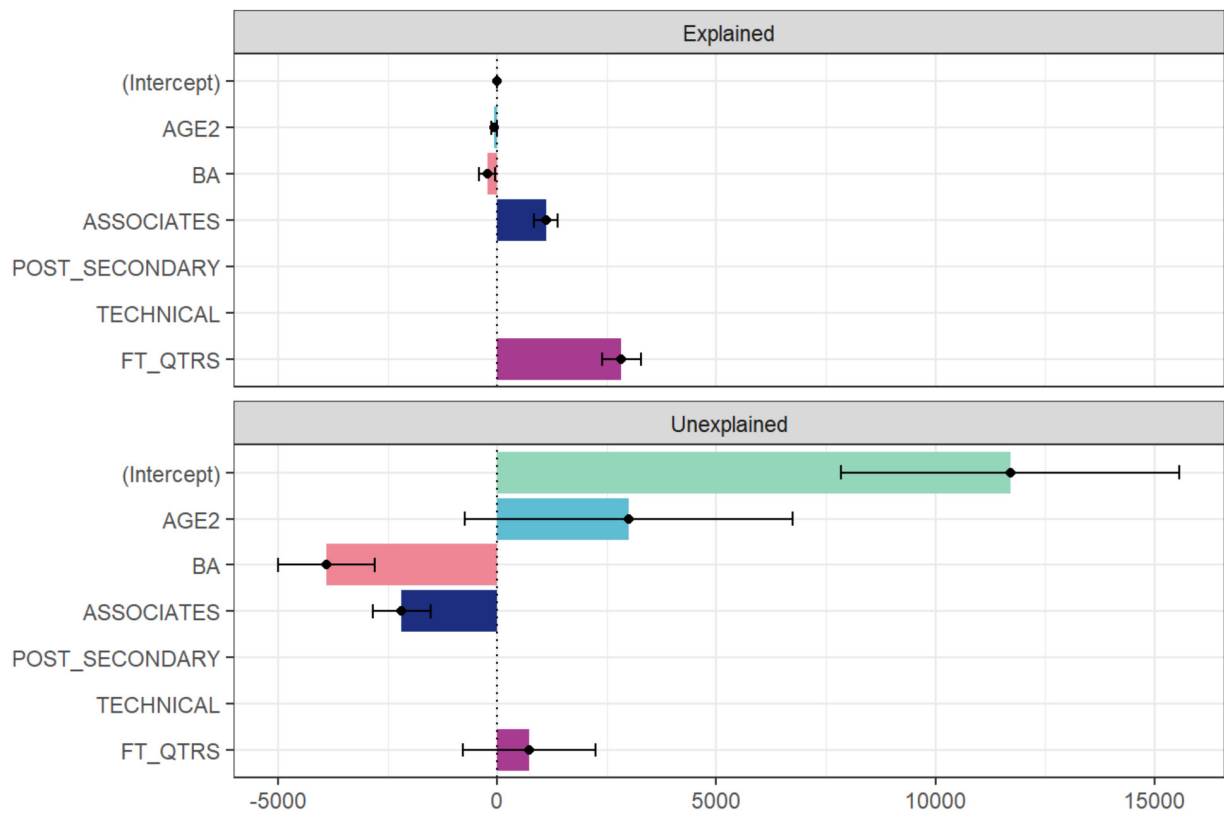
Appendix Figure 1: Blinder-Oaxaca decomposition twofold, 2012 cohort one-year post-graduation, strongly attached to the workforce only
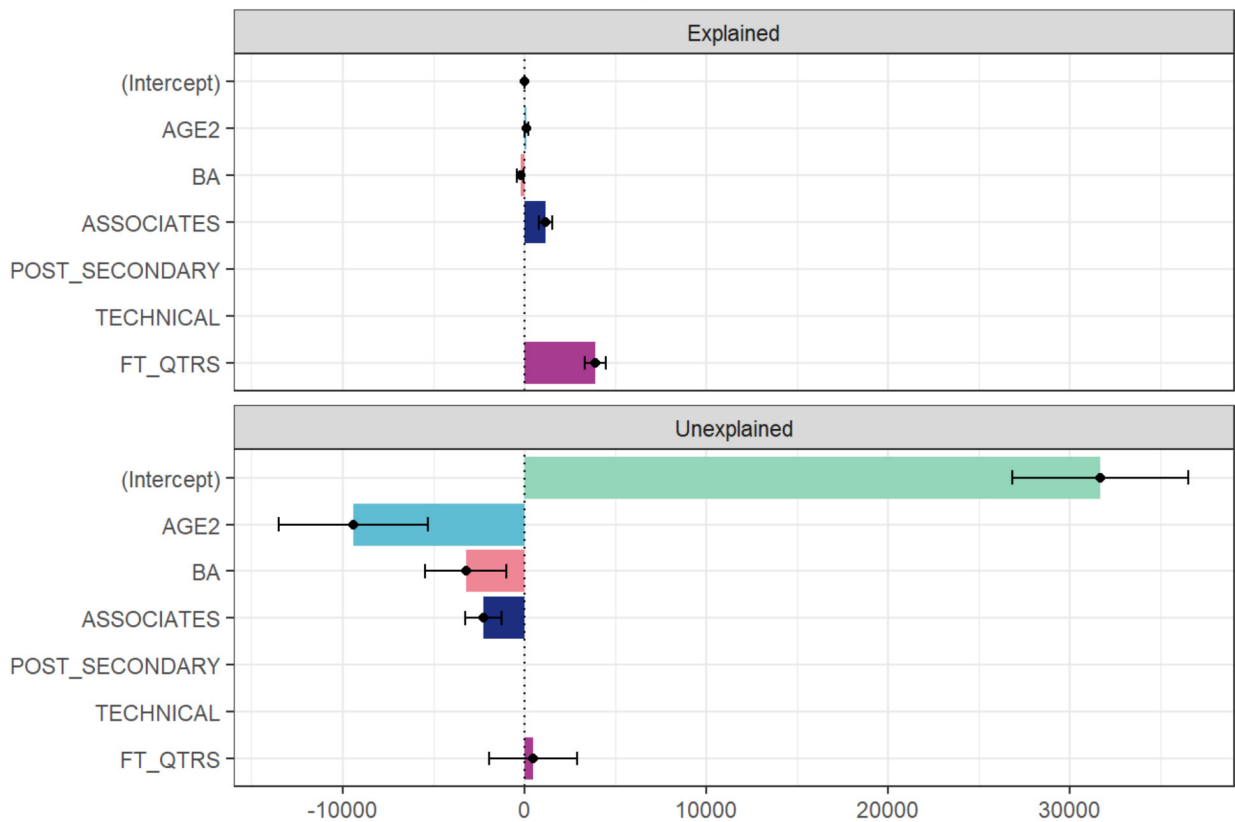
Appendix Figure 2: Blinder-Oaxaca decomposition twofold, 2012 cohort five-year post-graduation, strongly attached to the workforce only
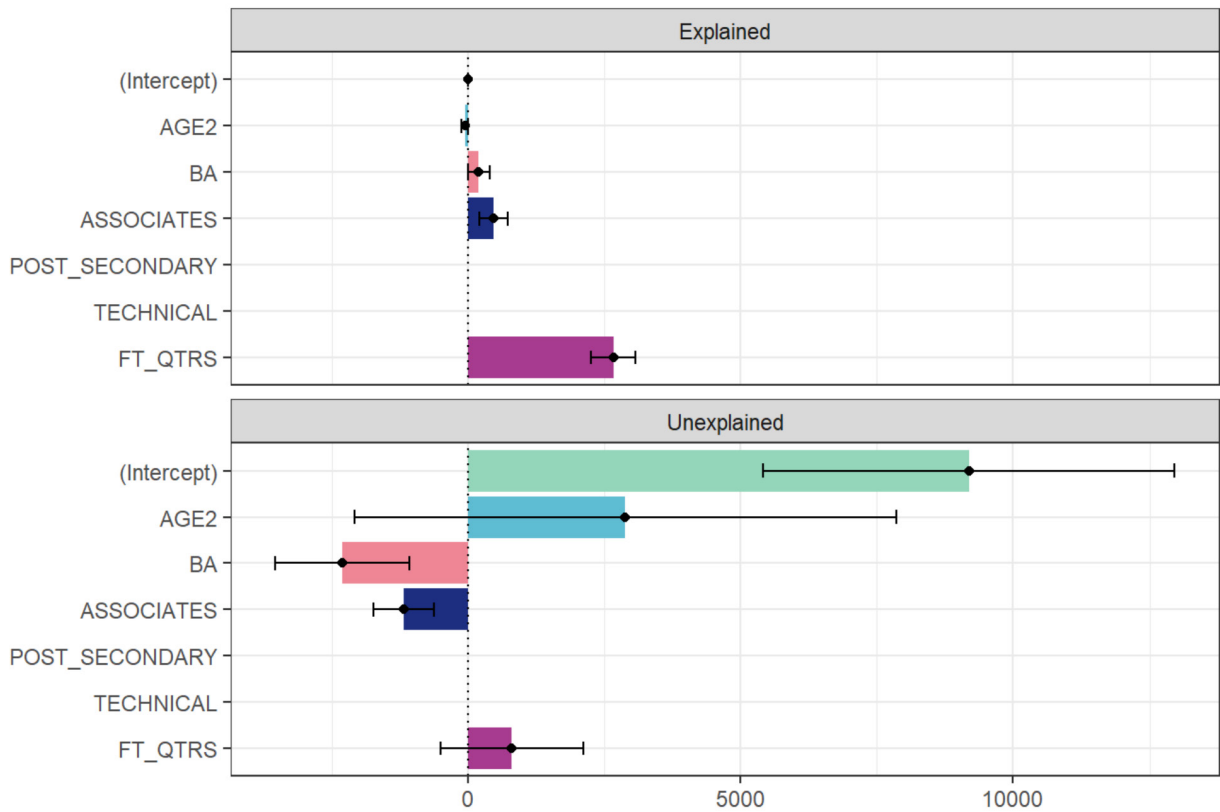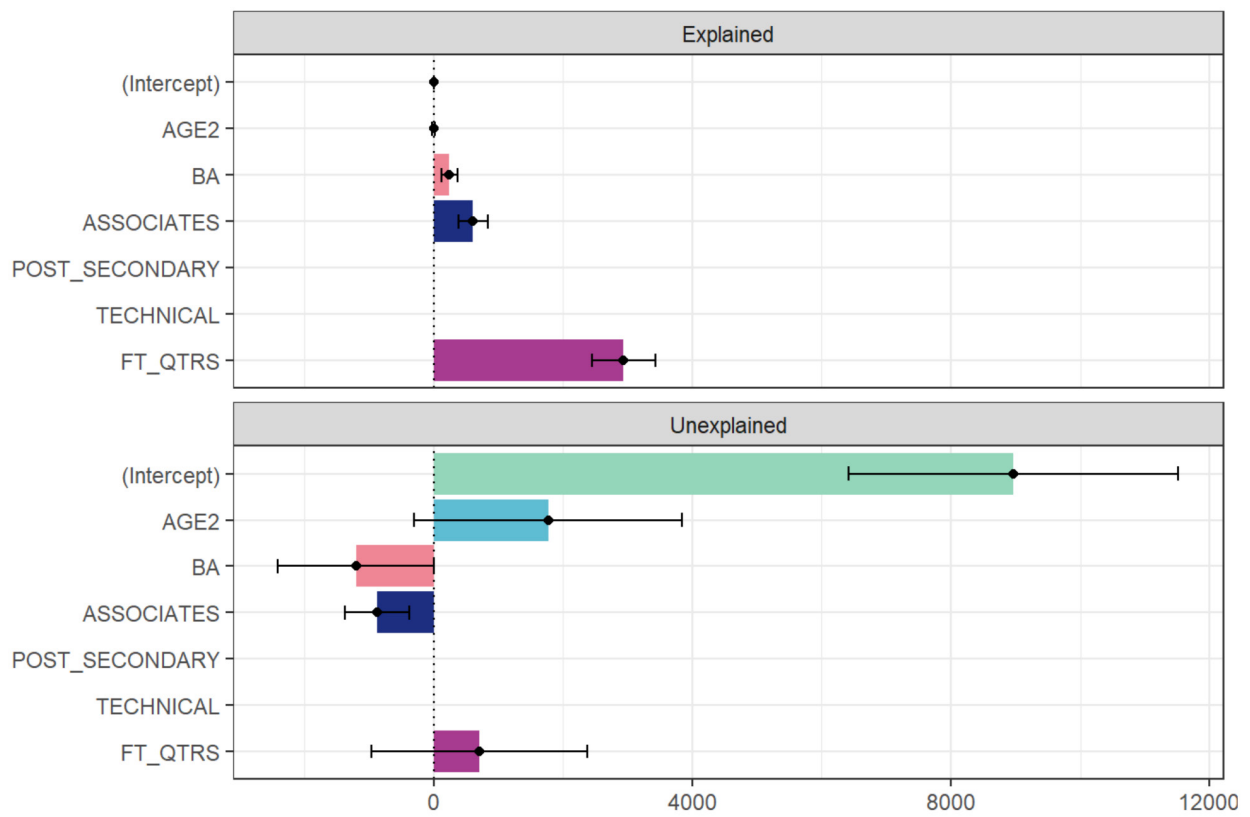
Appendix Figure 3: Blinder-Oaxaca decomposition twofold, 2013 cohort one-year post-graduation, strongly attached to the workforce only
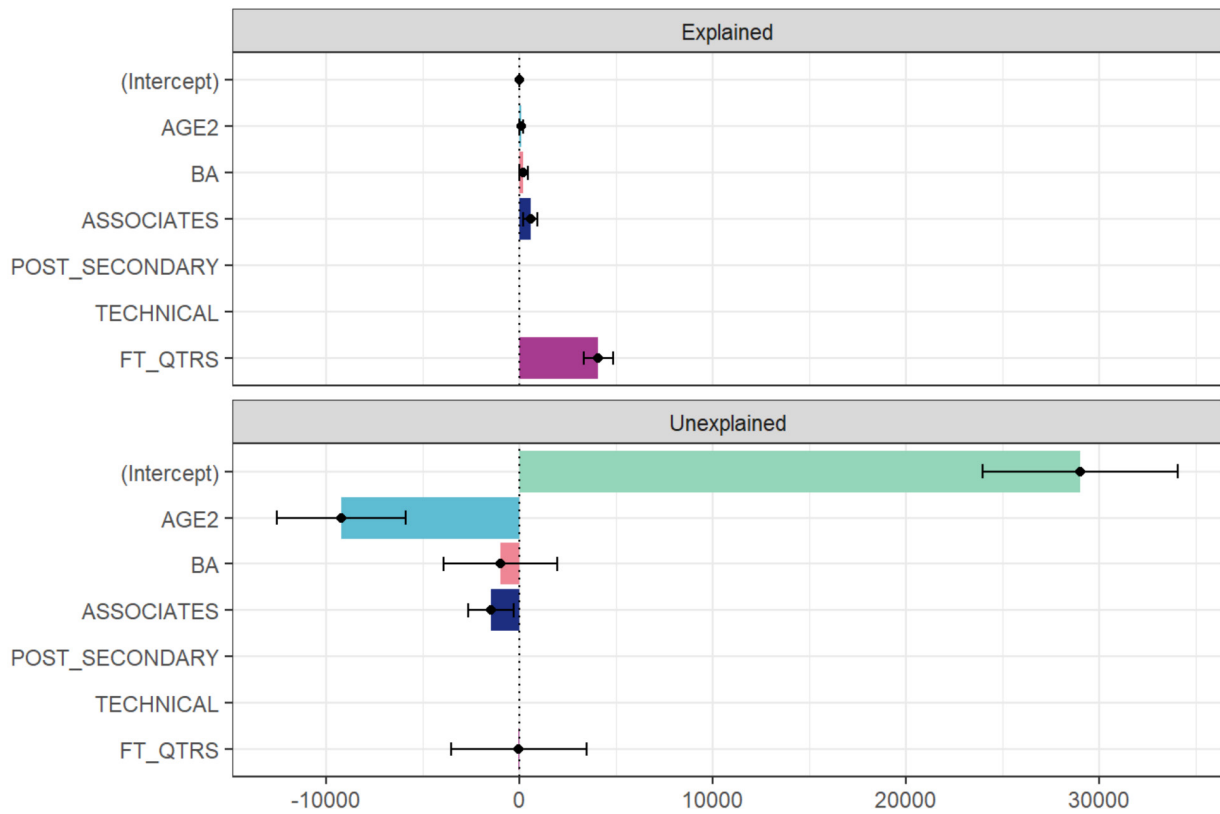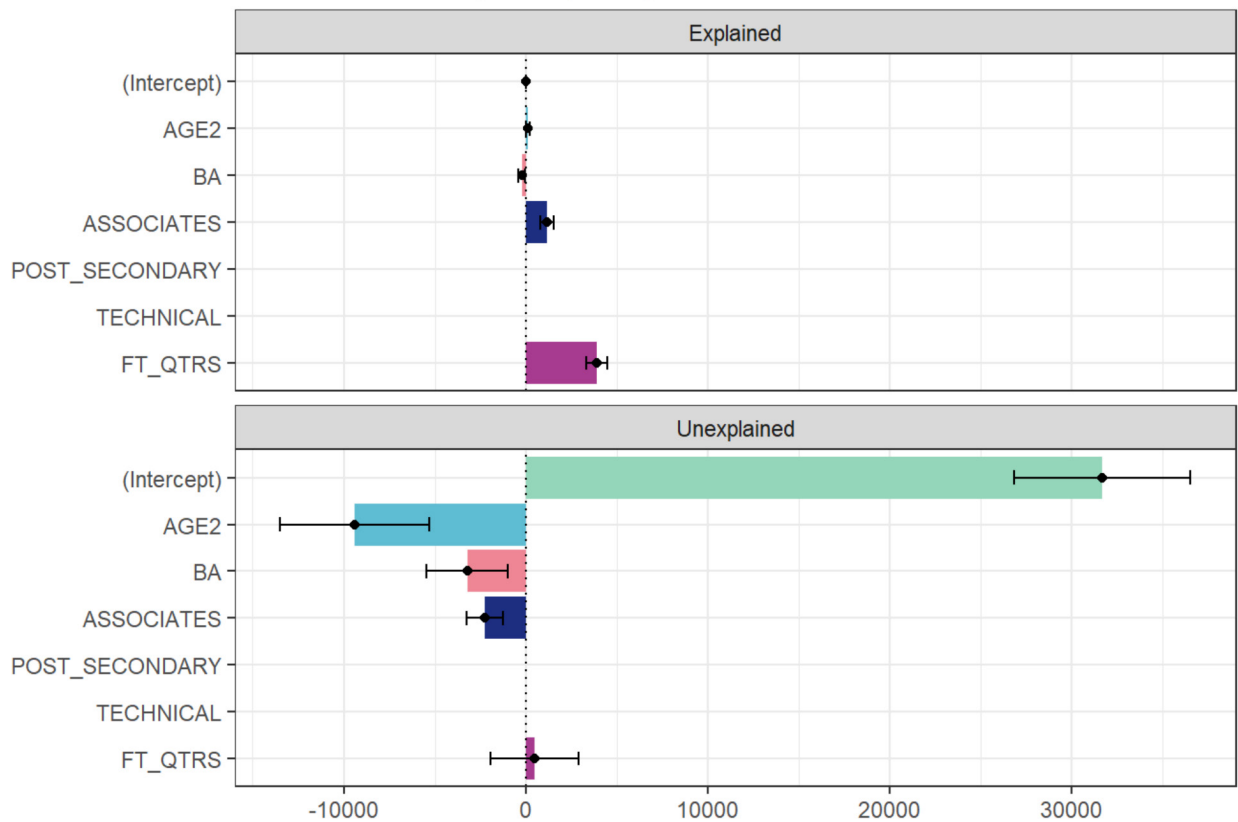

Appendix Figure 4: Blinder-Oaxaca decomposition twofold, 2013 cohort five-year post-graduation, strongly attached to the workforce only

Appendix Figure 5: Blinder-Oaxaca decomposition twofold, 2014 cohort one-year post-graduation, strongly attached to the workforce only

Appendix Figure 6: Blinder-Oaxaca decomposition twofold, 2014 cohort five-year post-graduation, strongly attached to the workforce only

The academic institutions of USHE include: University of Utah, Utah State University, Weber State University, Southern Utah University, Dixie State University, Snow College, Utah Valley University, and Salt Lake Community College.

The technical colleges of USHE include: Bridgerland Technical College, Davis Technical College, Dixie Tech, Mountainland Technical College, Ogden-Weber Technical College, Southwest Technical College, Tooele Technical College, and Uintah Basin Technical College.

## APPENDIX SUPPLEMENTARY INFORMATION II

To better understand the large wage gap with no filter five years after graduating, each cohort is separated by female graduates only. Wages are then visualized on a histogram with 25 bins representing $4,000 per bin. Wages one year after graduation is shown in teal, while wages five years after graduation are shown in purple.
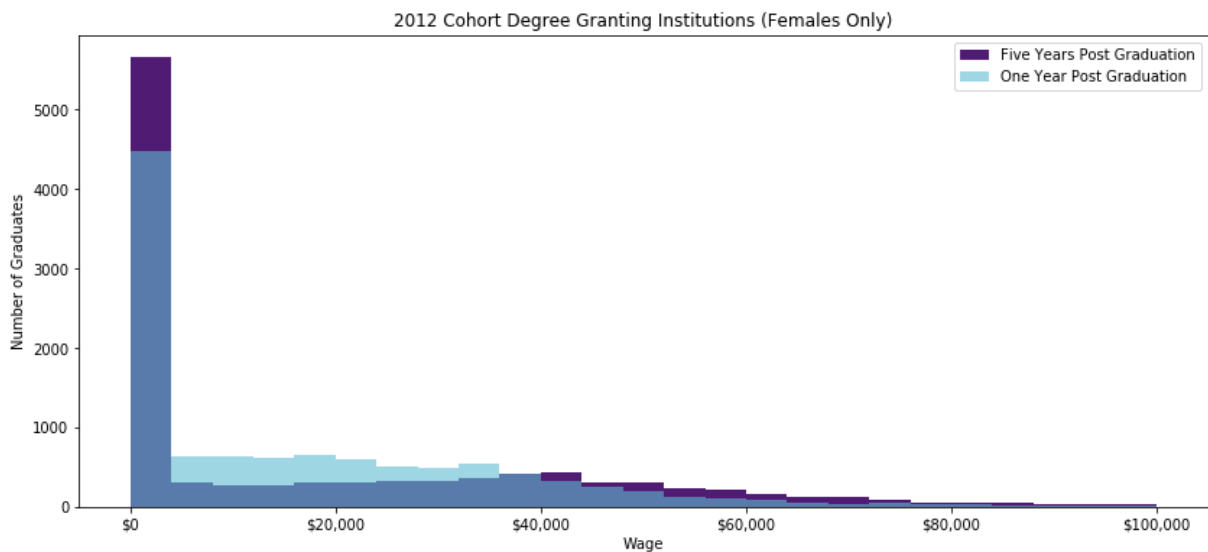
Appendix Figure 7: One-year and five-year post-graduation wages of the 2012 female graduation cohort from degree-granting institutions
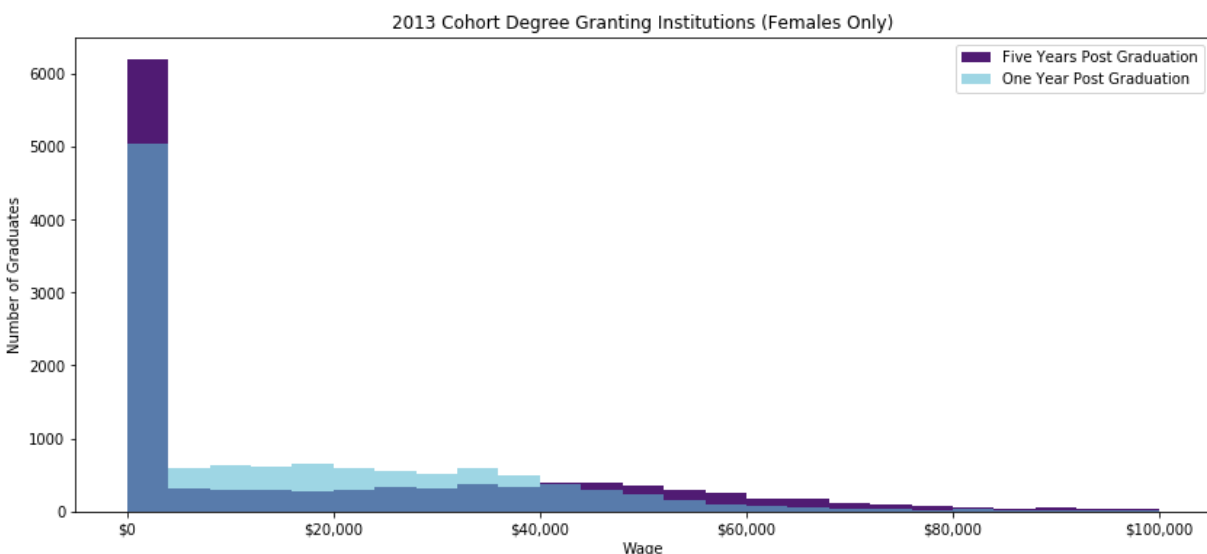
Appendix Figure 8: One-year and five-year post-graduation wages of the 2013 female graduation cohort from degree-granting institutions
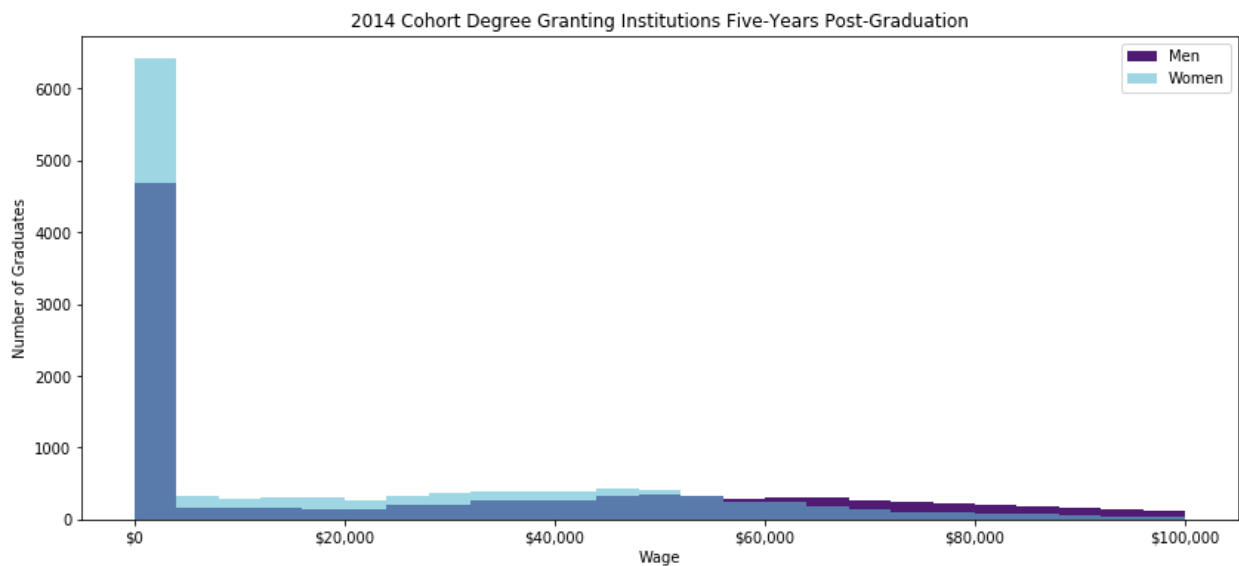
2014 Cohort Degree Granting Institutions (Females Only)
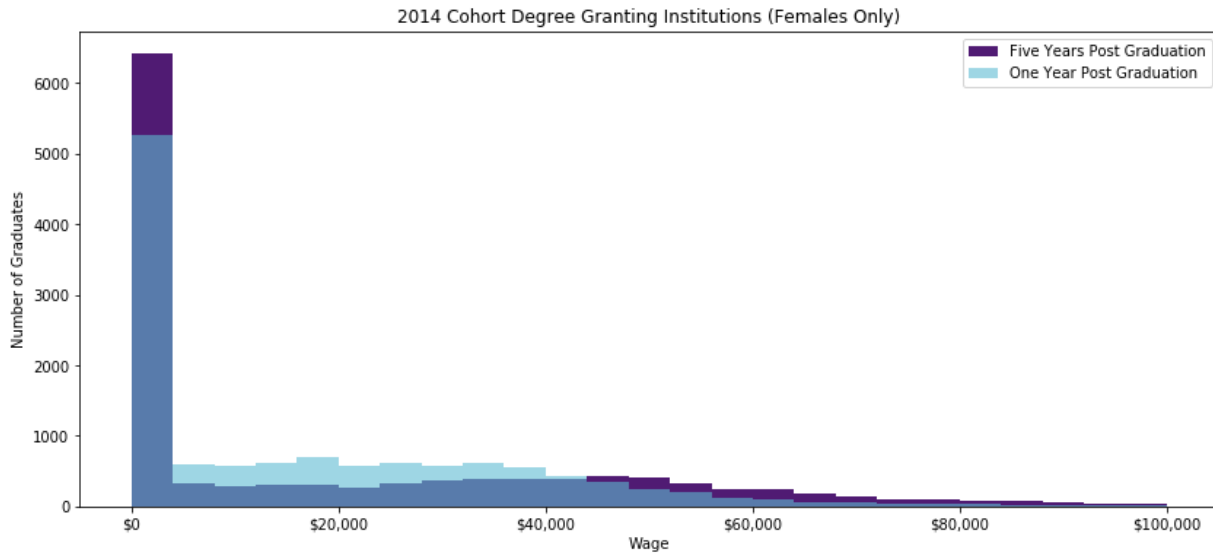
Appendix Figure 9: One-year and five-year post-graduation wages of the 2014 female graduation cohort from degree-granting institutions

All cohort years in the study tell the same two distinct stories for female graduates. The first, which is one that is to be expected, is that more women begin to experience wages higher than $40,000 five years after graduating. This would support the idea that as human capital increases (with experience), employers are willing to pay a higher wage.

The second story is that about 20% more women fall into the first bin of wage ($0 - $4,000 annually) five years after graduation. This increase may be due to being the primary care taker of children five years after obtaining a degree from an academic institution in Utah. This may be a choice by women to maximize utility or a societal expectation.

To further illustrate this responsibility, shown below are histograms of both male and female graduates from the 2014 cohort five years after graduation.

2014 Cohort Degree Granting Institutions Five-Years Post-Graduation

Appendix Figure 10: Five-year post-graduation wages of the 2014 graduation cohort from degree-granting institutions

While men occupy the first bin representing wages of $0 - $4000, women outnumber them by over 1,000 in the 2014 cohort. In addition, more women occupy jobs paying less than $50,000 than men. When wages exceed $50,000, more men earn higher wage than women in the same graduating cohort.

Due to this primary care taking responsibility, or personal preference, women may choose careers that generally do not require the same hourly commitment of men. Because certain fields demand more time than others, pay is generally higher. In addition, they may choose careers that are not reported in the UI Program. This includes those that are self-employed, federal employees, or military personnel. For this study, it also includes those that had a record one year after graduation and no record five years after graduating.

To investigate program choices for the 2014 cohort, certification of instructional programs (CIPs) are ranked by gender, and median wages for both men and women in that given program five years after graduation are shown below.

APPENDIX TABLE 4 - WOMEN'S TOP AREAS OF STUDY AND MEDIAN WAGES OF BOTH GENDERS FIVE YEARS AFTER GRADUATION FROM THE 2014 COHORT (STRONGLY ATTACHED TO THE WORKFORCE)

Rank	Women's Top Areas of Study (CIP)	Median Wage of Both Genders (Five-Years Post)
1	Health professions and related programs	$57,616
2	Education	$51,032
3	Business management marketing and related support services	$75,607
4	Psychology	$46,974
5	Visual and performing arts	$46,053

APPENDIX TABLE 5 - MEN'S TOP AREAS OF STUDY AND MEDIAN WAGES OF BOTH GENDERS FIVE YEARS AFTER GRADUATION FROM THE 2014 COHORT (STRONGLY ATTACHED TO THE WORKFORCE)

Rank	Men's Top Areas of Study (CIP)	Median Wage of Both Genders (Five-Years Post)
1	Business management marketing and related support services	$75,607
2	Health professions and related programs	$57,616
3	Computer and information science and support services	$89,095
4	Engineering	$78,539
5	Social sciences	$55,076

Without consideration to degree type or gender, men in the 2014 cohort consistently choose or are compelled toward degrees that pay higher dollar amounts. This phenomenon may be because of societal expectations, temporal flexibility, or biological preferences.