Gender-Based Pay Disparity Study

FINAL REPORT

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September 27, 2019

Submitted to:
Women's Bureau
U.S. Department of Labor

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In 2009, CONSAD Research Corporation (CONSAD) produced a report summarizing the contributors to the gender-based pay gap in the United States. Using the 2007 U.S. Census Bureau/Bureau of Labor Statistics Current Population Survey (CPS), CONSAD found that most of the pay gap could be explained by gender differences in occupation, human capital, work experience, career interruptions, parenting, and industry sector. Their statistical analysis explained approximately 45 percent of the raw gender wage gap of 20.4 percent.

Since 2009, numerous studies analyzing the gender-based pay gap have been published, making now (2019) an appropriate time to reassess and update the CONSAD study. As a result, 2M Research (2M) was contracted to (a) review and synthesize the literature since the publication of the CONSAD study, (b) update the CONSAD study estimates using a newer version of the CPS data, and (c) make new estimations with variables and econometric techniques as suggested by the latest literature.

The CONSAD study used various statistical models to estimate the contribution of explanatory factors like occupation, human capital, and industry to the raw wage gap. One of CONSAD's models used factors that were proven to explain substantial portions of the gender wage gap in previous studies. This model explained approximately 45 percent of the raw gender wage gap of 20.4 percent, leaving 55 percent unexplained and an adjusted wage gap of approximately 11 percent. A second model used explanatory factors that were surrogates for longitudinal variables that were used in earlier studies. This version explained 65 to 76 percent of the raw gender wage gap, leaving an adjusted wage gap between 5 and 7 percent. The 2M research team identified weaknesses in these models that were addressed in updated analyses.

In the updated study, 2M applied recent methodological advances to examine the decomposition of the overall gender wage gap over the distribution of wages. The 2M research team found that the raw gender wage gap was 17.4 percent at the mean and about 20 percent at the median. The raw wage gap increases between the 50^{th} and 75^{th} percentile and remains greatest at the higher percentiles. In addition, the 2M research team found that the importance of human capital varied across the wage distribution, and part-time work, as well as female-oriented occupations and industries, were crucial in explaining the wage gap at lower percentiles. The updated results explained about 20 to 70 percent of the raw wage gap over the wage distribution, thereby leaving an adjusted wage gap of 10 to 15 percent.

This report is composed of four main sections. In Section 1, we discuss the primary weaknesses of the CONSAD study. These weaknesses were discovered over the course of our research and provide some context for both Section 2 (Replication and Update of CONSAD Estimates) and Section 3 (White Paper: Current Estimates of the Gender Pay Gap from 2018 Current Population Survey Data). Specific concerns with the CONSAD study are presented in Section 2. Section 3 is designed as a "standalone" white paper that can be distributed as is and, therefore, includes some analyses and summaries from other sections of this report. Section 4 (Annotated Bibliography of Literature on the Gender Pay Gap) concludes the report and serves as a standalone reference for future research in this area.

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As the 2M Research Team tried to duplicate and fully document the CONSAD findings (see Section 2 of this Report), we uncovered several specific weaknesses in the study. These weaknesses led to the creation of a standalone white paper (Section 3) that was not constrained to the same models and data definitions used in the CONSAD study. Rather, the research reported in the white paper was driven by our comprehensive review of the literature (Section 4) and currently accepted econometric practices. The specific details of the CONSAD study are presented in the next section of this report. Here, we present the general weaknesses of the study, which provide important context for the rest of the report.

1. The CONSAD study examined factors that explain the gender wage gap using the 2007 Current Population Survey's Outgoing Rotation Group (CPS ORG) data. The data come from a complex sample of segments of the U.S. population and, therefore, include weights to ensure appropriate representation. The CONSAD study failed to use the weights in producing estimates of the relationship between wages and explanatory factors.
2. The derivation of key variables used to generate the empirical findings were not documented. The 2M Research Team had to test various definitions to reproduce the descriptive statistics in the CONSAD study. As documented in Section 2, some definitions were never discovered.
3. The CONSAD study provided a synopsis of economic research on the gender pay gap as of 2007. However, the synopsis excluded prominent existing studies that could have provided more insight into the factors that explain gender wage gap. While the inclusion of older articles dating back to the 1970s helped us understand the persistence of wage gaps, excluding extensive research on wage discrimination resulted in a limited framework for both specifying the empirical models and contextualizing the results. For example, the CONSAD study assumed that the lower wages earned by women with more children reflected either lower skill and experience or wage compensation for family-friendly fringe benefits. They failed to evaluate the existing empirical evidence of discrimination against mothers and, instead, assumed that employers with family-friendly policies pay less.
4. The CONSAD study included variables derived from similar people (in terms of age, marital status, and number of children) who were not working part-time or were out of the labor force. The presence of these variables created biased estimates, resulting in the apparent explanation of the wage gap. Without these variables, much less of the gap can be explained.
5. The CPS data used by CONSAD did not contain a measure of work experience—a key explanatory factor for the gender wage gap. This omission was not noted in the CONSAD study.

These weaknesses call into question the validity of the empirical findings in the CONSAD study. The next three sections of this report explain how the 2M Research Team tested the findings and also created a new set of findings based on the current literature.

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1 INTRODUCTION

This paper presents updated results following the study conducted by CONSAD Research Corporation (the CONSAD study) (CONSAD, 2009). The CONSAD study used data from the Current Population Survey (CPS) Outgoing Rotation Group (ORG) to explain the gender wage gap using Oaxaca-Blinder (OB) decomposition. We present results from the replication of the analysis in the CONSAD study and updated results using ORG data from the current version of CPS (2017). We can replicate the results from the CONSAD study, except for a few descriptive variables that require understanding of the assumptions made in the CONSAD report and that are not available to us. The lack of detailed description has led to certain disparities in results, as well different assumptions in constructing the variables. Using the 2017 CPS ORG data, we find that the gender-based wage gap has narrowed from 20.4 percent in 2007 to 17.6 percent in 2017 for individuals in the age group 23 to 79 years.

In the last section, we present our next steps for the statistical analysis, which extends the methodology from using the OB decomposition to the current methodology and estimation strategies used to estimate gender-based pay gap studies. This extension of methodology is motivated by the recent research identified from the most relevant studies' annotated bibliographies.

2 DATA AND METHODOLOGY

Section 2.1 provides a summary of the data used to analyze the gender-based wage gap in 2007 and 2017, and Section 2.2 provides an overview of the methodology used in the CONSAD study.

2.1 Data

The CONSAD study estimated the gender wage gap using data from the 2007 CPS ORG files. The CPS ORG is a monthly survey, administered by the U.S. Census Bureau, of 50,000 to 60,000 households; it provides data on approximately 105,000 persons ages 16 and older. These interviews are conducted once a month for 4 months; following an 8-month gap, the households are interviewed again for another 4-month period, once each month. Public-use extracts of the CPS ORG files are available through the Center for Economic and Policy Research (CEPR) and the National Bureau of Economic Research (NBER). The 2M Team performed preliminary analysis on data from both sources to replicate the CONSAD study's results. While both CEPR[1,2] and NBER[3] provide a rich set of labor-related variables, geographical identifiers, demographics, and appropriate weights, the NBER data allow for more flexibility in variable definition, which allows researchers to closely follow assumptions in the CONSAD study.[4] Many variables in CEPR have been recoded and do not satisfy the assumptions made by the CONSAD study to define labor force participation status (i.e., individuals not in labor force; those

[1] http://ceprdata.org/cps-uniform-data-extracts/cps-outgoing-rotation-group/cps-org-data/
[2] http://ceprdata.org/cps-uniform-data-extracts/cps-basic-programs/
[3] https://www.nber.org/morg/annual/
[4] Preliminary analysis using CEPR and NBER data showed that certain variables used in the CONSAD study were not included in the primary CEPR dataset. Use of proxy variables helped address this concern. Additionally, the CPR ORG data were merged with the Monthly CPS data to retain variables that could suit the assumptions made in the CONSAD study. NBER provided a more comprehensive dataset with clearly defined variables that matched the CONSAD study's definition of variables.

working part time; and those receiving overtime pay, tips, or commissions). Therefore, we used the NBER dataset to replicate the CONSAD study due to NBER's comprehensive list of variables.

2.2 Methodology

Following previous literature on wages and labor market discrimination, the CONSAD study estimated the 2007 gender wage gap in the United States using OB decomposition (Blinder, 1973; Oaxaca, 1973). The OB method uses the estimates from a linear regression method to construct a counterfactual wage that allows researchers to study differences in outcomes between groups (e.g., men and women). This method decomposes the wage differential between men and women into a part that is "explained" by group differences in factors such as education or work experience and a "residual" or "unexplained" part that cannot be accounted for by such differences in wage determinants. This unexplained part is often used as a measure of discrimination,[5] but it also subsumes the effects of group differences in unobserved predictors.

This analysis begins with estimation of log-wage equations (1) and (2) separately for men and women:

$$(1)\ \ln(W_m) = \alpha_m + \beta_m X_m + \varepsilon_m$$

$$(2)\ \ln(W_f) = \alpha_f + \beta_f X_f + \varepsilon_f.$$

In equations (1) and (2), $\ln(W)$ is the natural logarithm of the wage (e.g., hourly wage, annual earnings); X is a vector of characteristics that impacts wages; α is the intercept; and ε is the error term, in which subscripts m and f represent male and female, respectively. Denoting the coefficient estimates of β as b and means of variables with an over bar (e.g., the mean of X is denoted as $\overline{X}$) represents the impact of a unit change in the characteristics on a percentage increase in wage. To "decompose" the explained and unexplained effects, the male and female mean wages (dependent variable), characteristics (independent variable), and coefficient estimates form equation (3):

$$(3)\ \overline{\ln(W)}_m - \overline{\ln(W)}_f = b_m\left(\overline{X}_m - \overline{X}_f\right) + \overline{X}_f(b_m - b_f).$$

In equation (3), $b_m\left(\overline{X}_m - \overline{X}_f\right)$ is the portion of the decomposition explained by observed differences in the groups (the quantity effect), and $\overline{X}_f(b_m - b_f)$ is the portion that is unexplained. The first term of equation (3) takes the difference between the mean values of men and women on each characteristic and estimates the effect on earnings by using the relationship observed between each characteristic and earnings found among males. This process estimates the difference in earnings, given the observed differences between males and females and assuming each characteristic had the effects on earnings estimated among males, as opposed to among females (using b_m instead of b_f).

The analysis in the CONSAD study was conducted using unweighted observations.[6] Since the CPS ORG is drawn as a multistage sample—stratified by age, gender, and race/ethnicity—within geographically defined Primary Sampling Units, it is important to use weights to provide statistically representative

[5] Discrimination may also affect "explained" components if it reduces entry and retention in particular occupations, industries, and fields of study.

[6] Refer to page 16 of the CONSAD report.

estimates for the population and labor force. The CPS ORG data provides earnings weights,[7] also known as the outgoing rotation weights, which we use to update the results from the CONSAD study and account for the sampling design.

Various combinations of explanatory variables were used to estimate equation (3) in the CONSAD study. Certain combination of variables could be highly correlated leading to confounding results. Therefore, the CONSAD study used only versions that would be independent of such confounding factors. The final two versions chosen, conventional and alternative versions, include variables that can account for factors determining gender-based wage gap indicated in earlier studies. The conventional version includes explanatory variables that have been found to explain gender wage gap in the existing literature using cross-sectional databases up to 2007. The alternative version, on the other hand, is an attempt to accommodate explanatory factors proved to explain the gender wage gap using longitudinal studies. Since the analysis uses the CPS 2007 cross-section in the CONSAD study, the explanatory factors in the alternative version are a proxy to variables traditionally used in longitudinal analysis.

3 RESULTS

This section provides the results of our replication of the CONSAD study, as well as preliminary results for the current study. Section 3.1 compares the results from the CONSAD study to results from using the NBER data for 2007. Following the replication, we update the results from CONSAD study using CPS data from NBER for 2017 in Section 3.2.

3.1 CONSAD Replication

The explanatory factors used in the analysis are listed in Table 1. Table 1 presents three sets of summary statistics for 2007 by gender: (1) estimates from the CONSAD study; (2) replication of the CONSAD study using NBER CPS ORG data, unweighted; and (3) replication of the CONSAD study using NBER CPS ORG data, weighted. Our analysis is based on the assumptions outlined in the CONSAD study. For most characteristics, we find similar estimates across the three sets of summary statistics. For example, factors like the percentage of individuals working part-time, those working part-time due to economic reasons, and those working part-time due to family reasons are identical across the two analyses. However, factors like receiving overtime pay, and the average percentage of similar people working part-time varies between our study and the CONSAD study. The 2M Team investigated plausible reasons for the mismatch in the career interruption variables (average percentage of workers working part-time and not in the labor force) and attempted to match, as closely as possible, the definitions in the CONSAD study. We defined the percentage of people not working in the labor force by taking the average of people not in the labor force by similar age, gender, and number of children. We defined the percentage of people working part-time by taking the average of individuals working part-time by age, gender, and number of children. The averages over the most recent previous years are constructed using the average across the last five cohorts. Our estimates for the average percentage of similar people not in the labor force are slightly lower than the estimates reported in the CONSAD study. However, our

[7] The earnings weight is provided only to adult civilians in the two outgoing rotations (4 and 8) (see page 11 of the report found at https://www.nber.org/morg/docs/cpsx.pdf). The earnings weight is roughly four times the original person weight. The earnings weight makes the data comparable for monthly files.

estimates for the average percentage of male workers and female workers working part-time are much smaller than the CONSAD study estimates, which could affect our replication.

The summary statistics in Table 1 illustrate the differences between male workers and female workers and compare the CONSAD study findings to the replication by the research team. We note that in 2007, the average (unadjusted) hourly wage rate among men is $22.55, which is higher than the hourly wage rate of $18.24 among women. The statistics also indicate that almost 19 percent of female workers work part-time compared to 6 percent of their male counterparts. Additionally, there is a large difference in the share of women not in the labor force compared to the share of men.

The 2M Team's replication of the CONSAD study is presented in Table 2. We replicate the analysis using unweighted explanatory factors for male and female workers, as explained in the CONSAD study. Different combinations of the explanatory variables listed above are used to estimate the gender pay gap. First, we report the conventional approach that uses explanatory factors found to account for substantial portions of the gender wage gap in previous analyses of cross-sectional databases (CONSAD study). Second, we report the alternative version of the analysis, which includes variables that have been developed as proxies for explanatory variables found to account for substantial portions of the wage gap.[8] All coefficient estimates presented in Table 2 are statistically significant. The R^2 of 30 percent and 28 percent for the conventional and alternative models, respectively, indicate that equivalent portions of variation in the log hourly wage rate is explained by the listed characteristics for men and women. Comparing the research team's results with those of the CONSAD study, we find that while the demographic coefficients present equivalent results across the two analyses, there are larger differences in the estimates for factors, such as the average percentage of similar people working part-time; people's level of education; and people receiving overtime pay, tips, or commissions. These differences are a result of assumptions made to define the variables.

[8] The explanatory factors used in the conventional and alternative versions are listed in Table A.1 in Appendix A. As explained in Section 2.1., we also examine the explanatory factors using the earnings weight. Columns 6 and 7 in Table 1 provide a weighted mean of the characteristics.

Table 1 | Descriptive Statistics Comparing CONSAD Study and NBER Data for 2007

Explanatory Variables	CONSAD (Unweighted)		NBER (Unweighted)		NBER (Weighted)	
	Male	Female	Male	Female	Male	Female
Age	42.7	43.3	42.7	43.3	41.9	42.7
Age Squared	1,971.0	2,015.8	1,971.0	2,015.8	1,899.4	1,968.5
# own children in the household	0.703	0.699	0.703	0.698	0.720	0.709
Hourly wage rate	22.55	18.24	22.55	18.24	22.38	18.27
Log (hourly wage rate)	2.95	2.74	2.95	2.74	2.93	2.74
% of female workers in person's industry	39.40%	56.60%	40.5%	57.7%	40.4%	57.6%
% of female workers in person's occupation	35.40%	60.10%	36.2%	61.2%	36.2%	61.1%
Full-time (1,0 indicator variable)	94.3%	81.1%	94.3%	81.1%	91.9%	78.4%
Receiving overtime pay, tips, commissions	27.60%	12.50%	17.6%	10.9%	16.9%	10.8%
Part-time (1,0 indicator variable)	5.7%	18.90%	5.7%	18.9%	5.6%	18.2%
Part-time work for economic reasons	1.1%	1.8%	1.1%	1.9%	1.2%	1.9%
Part-time work for family	0.4%	7.6%	0.4%	7.5%	0.4%	7.2%
Marital status (1 = Married; 0 = Not married)	65.6%	59.0%	65.6%	59.0%	65.0%	57.9%
Union representation	14.3%	12.1%	14.3%	12.1%	14.2%	12.3%
Race (1 = White; 0 = Other races)	84.8%	81.7%	84.8%	81.7%	82.6%	79.5%
Education completed						
Without high school degree	10.0%	6.3%	10.0%	6.3%	11.3%	6.9%
High school degree or GED	30.4%	28.1%	30.4%	28.1%	30.2%	28.1%
Some college but no degree	17.0%	18.7%	17.0%	18.7%	16.9%	18.7%
Occupational/vocational associate	5.1%	5.6%	5.1%	5.6%	4.6%	5.4%
Associate from academic program	4.4%	6.3%	4.4%	6.3%	4.4%	6.2%
Bachelor's degree	21.6%	23.4%	21.6%	23.4%	21.6%	23.4%
Master's degree	7.7%	9.2%	7.7%	9.2%	7.5%	9.1%
Professional degree	1.9%	1.3%	1.9%	1.3%	1.8%	1.3%
Doctoral degree	1.9%	1.1%	1.9%	1.1%	1.7%	1.0%
Percentage of similar people not in the labor force						
In last year*	4.1%	16.3%	4.0%	15.5%	4.2%	15.8%
In last 2 years (average)	4.4%	16.7%	4.2%	15.9%	4.4%	16.1%
In last 3 years (average)	4.6%	17.0%	4.5%	16.2%	4.7%	16.5%
In last 4 years (average)	4.9%	17.5%	4.8%	16.6%	5.0%	16.9%
In last 5 years (average)	5.3%	17.9%	5.1%	17.1%	5.4%	17.4%
Percentage of similar people working part-time						
Last year*	7.1%	20.5%	5.3%	14.4%	5.4%	14.4%
Last 2 years (average)	7.2%	20.6%	5.4%	14.5%	5.5%	14.6%
Last 3 years (average)	7.4%	20.7%	5.6%	14.6%	5.7%	14.7%
Last 4 years (average)	7.6%	21.0%	5.8%	14.7%	5.9%	14.8%
Last 5 years (average)	8.0%	21.3%	6.0%	14.9%	6.1%	15.0%
Weighted *N* (in 1,000s)	**N/A**	**N/A**	**N/A**	**N/A**	**676,000**	**624,000**
Unweighted *N*	**74,919**	**73,536**	**74,919**	**73,536**	**74,919**	**73,536**

Note: Working part-time is defined as a dummy variable with 1 as working < 35 hours, 0 otherwise. Similar people are defined as those of similar age and gender and with a similar number of children. Number of children is a categorical variable with values 0, 1, > = 2. The average value for full-time work in columns 2 and 3 is taken from Tables 5 and 6 in the CONSAD study.

Table 2 | Estimation Results Comparing CONSAD Study and NBER Data for 2007

Explanatory Variables	CONSAD				NBER (Unweighted)			
	Conventional Version		Alternative Version		Conventional Version		Alternative Version	
	Male	Female	Male	Female	Male	Female	Male	Female
Intercept	1.197	1.376	2.293	2.340	1.213	1.365	2.399	2.352
Age	0.043	0.035			0.046	0.036		
Age Squared	-0.00042	-0.00034			-0.00045	-0.00035		
Marital status (1 = Married; 0 = Not married)	0.077	0.034	0.084	0.067	0.081	0.036	0.082	0.073
# Children	0.017	0.002			0.017	0.001		
Union representation	0.119	0.105	0.127	0.115	0.113	0.112	0.121	0.124
Race (1 if White, 0 if Other races)	0.093	0.030	0.097	0.030	0.094	0.030	0.098	0.028
Education completed with:								
High school degree or equivalent (GED)	0.268	0.261	0.275	0.259	0.263	0.261	0.270	0.261
Some college but without degree	0.393	0.392	0.400	0.386	0.387	0.393	0.394	0.392
Occupational/vocational associate degree	0.419	0.478	0.426	0.474	0.413	0.479	0.419	0.481
Associate degree from academic program	0.482	0.511	0.490	0.507	0.476	0.512	0.485	0.515
Bachelor's degree	0.741	0.733	0.747	0.717	0.747	0.742	0.753	0.734
Master's degree	0.886	0.887	0.897	0.875	0.903	0.908	0.913	0.905
Professional degree	1.021	1.050	1.032	1.034	1.046	1.074	1.055	1.066
Doctoral degree	1.041	1.060	1.058	1.050	1.064	1.090	1.081	1.085
% of workers who are female in person's industry[1]	-0.193	-0.118	-0.188	-0.113	-0.190	-0.112	-0.187	-0.109
% of workers who are female in person's occupation[2]	-0.151	-0.127	-0.149	-0.128	-0.155	-0.139	-0.153	-0.143
% of similar people[3] who are not in the labor force[4]			-0.843	-0.274			-0.209	-0.289
% of similar people[3] who are working part-time[5]			-0.489	-0.413			-1.796	-0.664
Working full-time (1,0 indicator variable)	0.251	0.155	0.249	0.146	0.170	0.135	0.169	0.137
Working overtime (1,0 indicator variable)	0.033	0.058	0.034	0.059	0.133	0.128	0.130	0.124
R-squared	0.310	0.291	0.300	0.281	0.314	0.293	0.305	0.281
Observations	**74,919**	**73,536**	**74,919**	**73,536**	**74,919**	**73,536**	**74,919**	**73,536**

Note: The conventional version includes basic demographic factors and the percentage of female workers in a person's occupation and industry. The alternative version includes the variables that explain career interruptions as explanatory variables in addition to education and other demographic variables.

We replicate the CONSAD study's analysis using unweighted observations of male and female workers and present the results in Table 2 above. The coefficient estimates are broadly similar for variables like age, marital status, and education. The coefficient estimates for other variables with calculation of averages over the last 5 years in the alternative version could be a result of a variation in the construction of said variables. We present a summary of the findings across data sources and specifications in Table 3 below.[9] Our estimate of the raw gender wage gap in the sample of 2007 data analyzed is 0.204 or 20.4 percent (Tables A4 through A7 in Appendix A), exactly the same value reported in the CONSAD study. The CONSAD study reports the unexplained portion of the gap as 0.113 based on the male coefficients and 0.145 based on the female coefficients in the conventional version. The explained portion of the raw wage gap is 130 percent when the male coefficient estimates are used in the decomposition and is 74.4 percent when the female estimates are used in the alternative version. The percentage estimated when using male coefficients is very high (more than 100 percent), and this fact can be attributed to the estimated value for the percentage of similar people who are not in the labor force using male coefficients, which is much lower than the estimated value of corresponding female coefficients. As a result of this difference, portion of the raw gender wage gap that is accounted for by the percentage of similar people not in labor force is almost 50 percent (0.106 of 0.204) when using male coefficients, compared to only 17 percent (0.035 of 0.204) when using female coefficients. Our analysis using unweighted observations of male and female workers shows an increase in the unexplained portion of the wage gap using both male and female coefficient estimates in the conventional version, and our analysis shows a decrease in the unexplained portion of the wage gap in the alternative version. The weighted analysis indicates that the unexplained portion of the raw wage gap using male and female coefficients is higher in 2017 compared to 2007 results in the conventional version but lower in the alternative version. The variation in results, as explained in the earlier section, can be attributed to some of the variables' construction. For the 2017 analysis, we use weighted observations to analyze the gender wage gap and compare the 2017 outcomes to the weighted outcomes of 2007.

[9] Coefficient estimates presented in Table 3 are reported in Tables 4 through 7 in Appendix A.

Table 3 | Gender-Based Wage Gap in 2007

	Difference in mean value of variable, based on value of coefficient for males	Difference in coefficient value between genders, based on mean value of variable among females	Difference in mean value of variable, based on value of coefficient for females	Difference in coefficient value between genders, based on mean value of variable among males	Difference in mean value of variable, based on value of coefficient for males	Difference in coefficient value between genders, based on mean value of variable among females	Difference in mean value of variable, based on value of coefficient for females	Difference in coefficient value between genders, based on mean value of variable among males
	Conventional Version				Alternative Version			
CONSAD 2007								
Portion of wage gap accounted for statistically by variables included in analysis	0.092	0.113	0.059	0.145	0.265	-0.061	0.152	0.052
Percentage of wage gap accounted for statistically by variables included in analysis	44.9%	55.2%	28.8%	71.3%	130.0%	-30.0%	74.4%	25.6%
NBER 2007 (Unweighted)								
Portion of wage gap accounted for statistically by variables included in analysis	0.087	0.115	0.059	0.143	0.274	--0.069	0.159	0.046
Percentage of wage gap accounted for statistically by variables included in analysis	43.1%	56.9%	29.3%	70.7%	133.6%	-33.6%	77.4%	22.6%
NBER 2007 (Weighted)								
Portion of wage gap accounted for statistically by variables included in analysis	0.076	0.117	0.052	0.141	0.261	-0.067	0.164	0.030
Percentage of wage gap accounted for statistically	39.3%	60.7%	27.2%	72.8%	134.38%	-34.4%	84.4%	15.7%

3.2 CONSAD Study Update Using 2017 CPS Data

This section presents the updated results of the CONSAD study with the 2017 CPS ORG data from NBER. The analysis in this section accounts for weighted observations on male and female workers. As discussed in Section 2.1, we use the earnings weight for further analysis.

In Table 4, we note the ratio of average values among male and female workers for each characteristic. The distribution of male and female workers among occupations and industries is presented in Appendix B. Table 4 below reveals differences in male and female workers in key factors like higher education and part-time work between 2007 and 2017. The average wage rate among men is 19 percent higher than the average wage rate among women in 2017, compared to 22 percent higher in 2007. As seen in Tables 1 and 4, the share of women who have earned professional or doctoral degrees has increased since 2007. In addition, there are fewer women working part-time in 2017 compared to 2007.

In Table 5 below, we summarize and compare the explanatory variables' contribution to explaining the gender wage gap in 2007 and 2017, using the CPS data. The first issue we would like to investigate is whether the higher wages paid to men are a result of the greater advantage of education, experience, and other observable factors or whether, instead, men are paid more even after we account for factors like education, experience, and demographics. If the latter situation holds true, then the wage gap between men and women may, at least in part, be due to labor market discrimination. Wage differentials can be decomposed into human capital and discrimination components. The theories of human capital investment and gender discrimination suggest that differences in wages between men and women can occur due to differences in their skills or productivity characteristics and in the way the labor market treats men or women differently. We determine this gap in wages using the OB decomposition explained in Section 2.2. Once we determine the wage gap due to explained and unexplained factors, we compare the estimates between 2007 and 2017.

Table 4 | Descriptive Statistics for 2017 CPS Data

Explanatory Variables	Mean		Male to Female Ratio	
	Male	Female	2017	2007
Age	43.11	43.52	0.99	0.98
Age squared	2023.31	2061.32	0.98	0.96
Number of children	0.654	0.640	1.02	1.02
Hourly wage rate	27.137	22.893	1.19	1.22
Log (hourly wage rate)	3.125	2.956	1.06	1.06
% of workers who are female in persons industry	40.6%	57.7%	0.70	0.70
% of workers who are female in persons occupation	37.4%	60.2%	0.62	0.59
Receiving overtime pay, tips, or commissions	16.2%	10.8%	1.50	1.56
Part-time	7.1%	18.3%	0.39	0.31
Full-time	90.6%	78.5%	1.15	1.17
Part-time for economic reasons	1.9%	2.8%	0.68	0.63
Part-time for family reasons	0.5%	6.2%	0.08	0.06
Married	61.5%	54.7%	1.12	1.12
Union representation	12.2%	10.9%	1.12	1.15
Race (1 = White; 0 = Others)	79.2%	76.0%	1.04	1.04
Education completed				
Without high school degree	8.2%	5.2%	1.58	1.64
High school degree or GED	28.2%	22.6%	1.25	1.07
Some college but without degree	16.1%	16.5%	0.98	0.90
Occupational/vocational associate degree	4.5%	4.8%	0.94	0.85
Associate from academic program	5.5%	7.8%	0.71	0.71
Bachelor's degree	24.3%	27.1%	0.90	0.92
Master's degree	9.5%	12.4%	0.77	0.82
Professional degree	1.5%	1.6%	0.94	1.38
Doctoral degree	2.3%	2.0%	1.15	1.70
Percentage of similar people not in the labor force				
In last year*	5.4%	15.6%	0.35	0.27
In last 2 years (average)	5.6%	16.0%	0.35	0.27
In last 3 years (average)	6.0%	16.4%	0.37	0.28
In last 4 years (average)	6.3%	16.9%	0.37	0.30
In last 5 years (average)	6.8%	17.5%	0.39	0.31
Percentage of similar people working part-time				
Last year	6.2%	13.8%	0.45	0.38
Last 2 years (average)	6.4%	14.1%	0.45	0.38
Last 3 years (average)	6.6%	14.3%	0.46	0.39
Last 4 years (average)	6.8%	14.5%	0.47	0.40
Last 5 years (average)	7.0%	14.6%	0.48	0.41
Weighted *N* (in 1,000s)	**735,283**	**682,450**		
Unweighted *N*	**71,561**	**69,796**		

Note: Male to female ratio for 2007 is calculated using descriptive statistics from Table 1, columns 6 and 7.

Table 5 | Gender-Based Wage Gap in 2007 and 2017 (Conventional Approach)

	Difference in mean value of variable, based on value of coefficient for males	Difference in coefficient value between genders, based on mean value of variable among females	Difference in mean value of variable, based on value of coefficient for females	Difference in coefficient value between genders, based on mean value of variable among males
NBER 2007				
Portion of wage gap accounted for statistically by variables included in analysis	0.076	0.117	0.052	0.140
Percentage of wage gap accounted for statistically by variables included in analysis	39.31%	60.69%	27.17%	72.83%
NBER 2017				
Portion of wage gap accounted for statistically by variables included in analysis	0.062	0.109	0.037	0.134
Percentage of wage gap accounted for statistically by variables included in analysis	36.43%	63.57%	21.74%	78.26%

Table 5 indicates that differences between the average attributes of male and female workers statistically account for 36.4 percent of the raw gender wage gap when the male coefficients are used in the decomposition, but these differences only account for 21.7 percent of the gap when the female coefficients are used instead. While the portion of the wage gap accounted for by variables included in the conventional version of the analysis is 0.076 (39 percent) in 2007, that portion decreases to 0.062 (36 percent) in 2017 when using the value of coefficient for males. For the raw gender wage gap of 0.17 (i.e., average hourly wages of female workers that are 17 percent lower than those of male workers), the portion of the raw gap that remains unexplained is estimated to be 0.109 (64 percent) based on the male coefficients and about 0.134 (78 percent) based on the female coefficients in 2017. On the other hand, using the alternative version of equation (1) presented in Table 6, we find that differences between the average characteristics of male and female workers statistically account for 119.8 percent of the raw gender wage gap in 2017 when the male coefficients are used in the decomposition, and differences account for 85.4 percent of the gap when female coefficients are used instead. The percentage accounted for using the male coefficients is larger than the percentage for using the female coefficients, primarily because the estimated value of the male coefficient for percentage of similar people not in the labor force (-0.822) is much lower than the estimated value of the corresponding female coefficient (-0.272). The primary observation is that the unexplained portion of the raw wage gap increases when using coefficient estimates for male workers but decreases when using coefficient estimates for female workers between 2007 and 2017 in the alternative version of the analysis.

Table 6 | Gender-Based Wage Gap in 2007 and 2017 (Alternative Approach)

	Difference in mean value of variable, based on value of coefficient for males	Difference in coefficient value between genders, based on mean value of variable among females	Difference in mean value of variable, based on value of coefficient for females	Difference in coefficient value between genders, based on mean value of variable among males
NBER 2007				
Portion of wage gap accounted for statistically by variables included in analysis	0.261	-0.067	0.164	0.030
Percentage of wage gap accounted for statistically by variables included in analysis	134.38%	-34.38%	84.35%	15.65%
NBER 2017				
Portion of wage gap accounted for statistically by variables included in analysis	0.203	-0.034	0.145	0.025
Percentage of wage gap accounted for statistically by variables included in analysis	119.84%	-19.84%	85.44%	14.56%

3.3 CONSAD Study Limitations

The observed difference between wages paid to women and men, or the gender wage gap, is examined in the CONSAD study using the OB decomposition method. While CONSAD's literature review provides insight into factors that explain the gender wage gap, there are certain concerns related to endogeneity that have not been addressed appropriately. Another limitation of the study is the measure of career interruption used by the authors in the alternative specification of the analysis. The authors have taken percentages of workers not participating in the labor force or working part-time as surrogates for potential career interruptions and used these to infer the role that career interruption plays in explaining gender wage gap. However, doing so could lead to potential ecological fallacy, by interpreting the results that come from the analysis of aggregate data for all individuals who make up these groups. Additionally, factors like work experience, industry, and occupation are not appropriately controlled for. We will address these issues and others as discussed in Section 4.

4 DISCUSSION AND NEXT STEPS

The study's primary purpose is to explain how much of the gender-based wage gap is due to observable factors like worker skills, education, and experience and how much is due to unobservable characteristics (possibly labor market discrimination). The research team has explored various datasets to replicate the CONSAD study's results and has updated the analysis using the 2017 CPS ORG data from NBER. A related literature review provided insights into new methodologies that could be used to update the analysis and provide stronger evidence on the change in the gender pay gap over time. This stronger evidence would also involve the exploration of longitudinal datasets that have an advantage over cross-sectional data, although sample size could restrict the use of longitudinal datasets. In addition to the CPS ORG data from CEPR and NBER, Integrated Public Use Microdata Series CPS could provide more flexibility to choose and redefine variables to address the study's objective.

While the OB decomposition method decomposes differences in mean wages across two groups, recent studies have developed decomposition methods for distributional statistics other than the mean (Fortin, Lemieux, & Firpo, 2011; Lemieux, 2002). These new methods focus on the statistics such as quantiles, Gini coefficient, or the variance. Variance decomposition is one such method in which the analysis of variance approach is based on a between-within group approach (Freeman, 1980). Additional methods include the Juhn, Murphy, and Pierce (1993) residual imputation method; DiNardo, Fortin, and Lemieux (1996) reweighting method; Machado and Mata's (2005) conditional quantile regression method; Firpo, Fortin, and Lemieux' (2009) unconditional quantile regression method; and Chernozhukov, Fernandez-Val, and Melly's (2009) direct distributional regression method. These methods take into account the distribution of wages and explore the source of the variation. Each of these methods could provide a deeper understanding of the gender-based wage gap, as specific points of the distribution may have specific implications. We will explore these new methods in the literature, as decomposition for various quantiles or differences between quantiles such as the 90–10 gap of the distribution will help improve understanding of the source of wage inequality across the distribution.

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APPENDIX A GENDER-BASED PAY GAP FOR 2007

Table A.1 | Explanatory Factors in Conventional and Alternative Versions

Conventional Version	Alternative Version
Age	X
Age squared	X
Number of children	X
Marital status	Marital status
Union representation	Union representation
Race	Race
Education completed	Education completed
Percentage of female workers in a person's industry	Percentage of female workers in a person's industry
Percentage of female workers in a person's occupation	Percentage of female workers in a person's occupation
X	Percentage of similar people who are not in the labor force
X	Percentage of similar people who are working part-time
Full-time work	Full-time work
Overtime work	Overtime work

Table A.2 | Distribution of Workers Among Occupations in 2007

	CONSAD		NBER (Unweighted)		NBER (Weighted)	
	Male	Female	Male	Female	Male	Female
Management occupations	11.33%	8.74%	11.33%	8.74%	11.01%	8.61%
Business and financial operations occupations	3.63%	5.63%	3.63%	5.63%	3.59%	5.68%
Computer and mathematical science occupations	3.85%	1.55%	3.85%	1.55%	3.96%	1.54%
Architecture and engineering occupations	3.87%	0.72%	3.87%	0.72%	3.81%	0.76%
Life, physical and social science occupations	1.31%	1.01%	1.31%	1.01%	1.17%	0.96%
Community and social service occupations	1.41%	2.43%	1.41%	2.43%	1.33%	2.34%
Legal	0.95%	1.38%	0.95%	0.87%	1.32%	13.22%
Education, training and library	3.69%	10.52%	3.69%	10.52%	3.50%	10.45%
Arts, design, entertainment, sports and media	1.55%	1.51%	1.55%	1.51%	1.55%	1.48%
Healthcare practitioner and technician	2.34%	9.03%	2.34%	9.03%	2.34%	8.98%
Healthcare support	0.43%	4.16%	0.43%	4.16%	0.45%	4.23%
Protective support	3.56%	0.99%	3.56%	0.99%	3.60%	1.07%
Food preparation and serving-related occupations	3.16%	5.00%	3.16%	5.00%	3.37%	4.94%
Building and grounds cleaning and maintenance	3.90%	3.09%	3.90%	3.09%	3.98%	3.10%
Personal care and service	1.03%	3.69%	1.03%	3.69%	1.02%	3.78%
Sales and related occupations	9.45%	9.72%	9.45%	9.72%	9.53%	9.92%
Office and administrative support	6.53%	23.69%	6.53%	23.69%	6.68%	23.50%
Farming, fishing and forestry occupations	0.93%	0.26%	0.93%	0.26%	0.86%	0.24%
Construction and extraction occupations	10.81%	0.29%	10.81%	0.29%	10.90%	0.28%
Installation, maintenance and repair occupations	7.09%	0.32%	7.08%	0.32%	7.05%	0.31%
Production occupations	9.62%	4.33%	9.62%	4.33%	9.76%	4.46%
Transportation and material moving occupations	9.58%	1.95%	9.58%	1.95%	9.68%	2.03%
Armed forces	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Weighted N (in '000s)	**N/A**	**N/A**	**N/A**	**N/A**	**676,000**	**624,000**
Unweighted N	**74,919**	**73,536**	**74,919**	**73,536**	**74,919**	**73,536**

Table A.3 | Distribution of Workers Among Industries

	CONSAD		NBER (Unweighted)		NBER (Weighted)	
	Male	Female	Male	Female	Male	Female
Agriculture	1.04%	0.30%	1.04%	0.30%	0.95%	0.27%
Forestry, logging, fishing, hunting and trapping	0.21%	0.05%	0.21%	0.05%	0.16%	0.03%
Mining	1.27%	0.19%	1.27%	0.91%	0.16%	0.16%
Construction	11.64%	1.45%	11.64%	1.45%	11.86%	1.44%
Nonmetallic mineral product manufacturing	0.66%	0.15%	0.66%	0.15%	0.69%	0.17%
Primary metals and fabricated metal products	2.28%	0.59%	2.28%	0.59%	2.36%	0.63%
Machinery manufacturing	1.62%	0.46%	1.62%	0.46%	1.57%	0.45%
Computer and electronic product manufacturing	1.50%	0.84%	1.50%	0.84%	1.54%	0.92%
Electrical equipment, appliance manufacturing	0.56%	0.28%	0.56%	0.28%	0.54%	0.30%
Transportation equipment manufacturing	2.50%	0.84%	2.50%	0.84%	2.71%	0.94%
Wood products	0.63%	0.16%	0.63%	0.16%	0.61%	0.16%
Furniture and fixtures manufacturing	0.61%	0.24%	0.61%	0.24%	0.64%	0.24%
Miscellaneous and not specified manufacturing	1.05%	0.84%	1.05%	0.84%	1.04%	0.82%
Food manufacturing	1.57%	0.97%	1.57%	0.97%	1.43%	0.96%
Beverage and tobacco products	0.24%	0.09%	0.24%	0.09%	0.26%	0.09%
Textile, apparel and leather manufacturing	0.44%	0.62%	0.44%	0.62%	0.46%	0.70%
Paper and printing	1.19%	0.55%	1.19%	0.55%	1.20%	0.54%
Petroleum and coal products manufacturing	0.20%	0.05%	0.20%	0.05%	0.20%	0.06%
Chemical manufacturing	1.19%	0.70%	1.19%	0.70%	1.25%	0.75%
Plastics and rubber products	0.76%	0.38%	0.76%	0.38%	0.78%	0.39%
Wholesale trade	4.30%	1.94%	4.30%	1.94%	4.30%	2.07%
Retail trade	9.92%	10.48%	9.92%	10.48%	9.90%	10.42%
Transportation and warehousing	6.23%	2.46%	6.23%	2.46%	6.40%	2.55%
Utilities	1.58%	0.49%	1.58%	0.49%	0.46%	0.55%
Publishing industries	0.75%	0.68%	0.75%	0.68%	0.72%	0.68%
Motion picture and sound recording industries	0.17%	0.11%	0.17%	0.11%	0.21%	0.14%
Broadcasting (except internet)	0.57%	0.39%	0.57%	0.39%	0.58%	0.39%
Internet publishing and broadcasting	0.02%	0.01%	0.02%	0.01%	0.03%	0.01%
Telecommunications	1.14%	0.74%	1.14%	0.74%	1.19%	0.77%
Internet service provider and data processing services	0.16%	0.12%	0.16%	0.12%	0.18%	0.11%
Other information services	0.09%	0.37%	0.09%	0.37%	0.07%	0.35%
Finance	2.79%	4.40%	2.79%	2.93%	4.35%	4.35%

	CONSAD		NBER (Unweighted)		NBER (Weighted)	
	Male	Female	Male	Female	Male	Female
Insurance	1.29%	2.75%	1.29%	2.75%	1.27%	0.01%
Real estate	1.36%	1.55%	1.36%	1.55%	1.41%	0.77%
Rental and leasing services	0.45%	0.24%	0.45%	0.24%	0.48%	0.11%
Professional and technical services	6.05%	5.61%	6.05%	5.61%	6.11%	0.35%
Management of companies and enterprises	0.13%	0.14%	0.13%	0.14%	0.13%	4.35%
Administrative and support services	3.52%	3.18%	3.52%	3.18%	3.80%	2.68%
Waste management and remediation services	0.51%	0.10%	0.51%	0.10%	0.51%	1.62%
Educational services	6.34%	15.00%	6.34%	15.00%	6.01%	0.24%
Hospitals	2.33%	7.89%	2.33%	7.89%	0.13%	5.72%
Health care services, except hospitals	2.16%	10.92%	2.16%	10.92%	2.13%	0.14%
Social assistance	0.66%	3.41%	0.66%	3.41%	0.62%	3.35%
Arts, entertainment and recreation	1.61%	1.56%	1.61%	1.56%	1.57%	0.10%
Accommodation	1.02%	1.43%	1.02%	1.43%	0.91%	14.94%
Food services and drinking places	3.42%	4.17%	3.42%	4.18%	3.69%	7.85%
Repair and maintenance	1.73%	0.28%	1.73%	0.28%	1.80%	10.96%
Personal and laundry services	0.58%	1.32%	0.58%	1.32%	0.66%	3.38%
Membership associations and organizations	1.31%	1.80%	1.31%	1.80%	1.21%	1.49%
Private household	0.07%	0.85%	0.07%	0.85%	0.08%	1.22%
Public administration	6.59%	5.85%	6.59%	5.85%	6.09%	4.28%
Armed forces	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Weighted N (in '000s)					**676,000**	**624,000**
Unweighted N	**74,919**	**73,536**	**74,919**	**73,536**	**74,919**	**73,536**

Table A.4 | Decomposition of Gender Wage Gap Based on Conventional Version of Wage Equation for Male Workers and Female Workers (Unweighted, 2007)

Variable	Mean				Regression coefficient for variable				Portion of wage gap accounted for statistically by			
	Males (Xm)	Females(Xf)	Difference between genders (Xm-Xf)	CONSAD STUDY (Difference in mean between genders)	Males (Bm)	Females (Bf)	Difference between genders (Bm-Bf)	CONSAD STUDY (Difference in coefficient between genders)	Difference in mean value of variable, based on value of coefficient for males (Bm*(Xm -Mf)) [Should be (Bm*(Xm-Xf)]	Difference in coefficient value between genders, based on mean value of variable among females (Xf*(Bm-Bf))	Difference in mean value of variable, based on value of coefficient for females (Bf*(Xm-Mf)) [Should be (Bf*(Xm-Xf)]	Difference in coefficient value between genders, based on mean value of variable among males (Xm*(Bm-Bf))
Log (hourly wage rate)	2.946	2.742	0.204	0.204								
Intercept					1.213	1.365	-0.156	-0.179		-0.152		-0.152
Age	42.747	43.260	-0.513	-0.510	0.0456	0.0364	0.009	0.008	-0.023	0.398	-0.019	0.393
Age Squared	1971.04	2015.78	-44.747	-44.700	-0.00045	-0.00035	-0.00009	-0.00008	0.020	-0.187	0.016	-0.183
# Children	0.703	0.698	0.005	0.005	0.017	0.001	0.015		0.000	0.011	0.000	0.011
Married	0.656	0.590	0.066	0.066	0.081	0.036	0.043	0.043	0.006	0.027	0.003	0.030
Union representation	0.143	0.121	0.022	0.022	0.113	0.112	0.002	0.014	0.002	0.000	0.002	0.000
Race (1 = White; 0 = Non-White)	0.848	0.817	0.031	0.031	0.094	0.030	0.061	0.063	0.000	0.047	0.000	0.047
High school degree or GED	0.304	0.281	0.024	0.024	0.263	0.261	0.006	0.007	0.005	0.001	0.005	0.001
Some college but no degree	0.170	0.187	-0.017	-0.017	0.387	0.393	0.000	0.001	-0.008	-0.001	-0.008	-0.001
Occupational/vocational associate	0.051	0.056	-0.006	-0.006	0.413	0.479	-0.057	-0.06	-0.004	-0.004	-0.005	-0.003
Associate from academic program	0.044	0.063	-0.019	-0.019	0.476	0.512	-0.028	-0.029	-0.010	-0.002	-0.010	-0.001
Bachelor's degree	0.216	0.234	-0.018	-0.018	0.747	0.742	0.012	0.007	-0.007	0.001	-0.007	0.001
Master's degree	0.077	0.092	-0.014	-0.014	0.903	0.908	0.004	-0.001	-0.009	0.000	-0.009	0.000
Professional degree	0.019	0.013	0.005	0.005	1.046	1.074	-0.019	-0.029	0.010	0.000	0.011	-0.001
Doctoral degree	0.019	0.011	0.008	0.008	1.064	1.090	-0.016	-0.02	0.011	0.000	0.011	-0.001
% of female workers in persons industry	0.405	0.577	-0.172	-0.171	-0.190	-0.112	-0.075	-0.074	0.032	-0.045	0.019	-0.032
% of female workers in persons occupation	0.362	0.612	-0.250	-0.248	-0.155	-0.139	-0.010	-0.024	0.039	-0.010	0.035	-0.006
Full-time	0.916	0.778	0.139	0.131	0.170	0.135	0.033	0.096	0.022	0.028	0.018	0.033
Overtime	0.176	0.109	0.067	0.151	0.133	0.128	0.004	-0.025	0.009	0.001	0.009	0.001
Unweighted N	**74,919**	**73,536**										
Portion of wage gap accounted for statistically by variables included in analysis									**0.087**	**0.115**	**0.059**	**0.143**
Percentage of wage gap accounted for statistically by variables included in analysis									**43.06%**	**56.94%**	**29.27%**	**70.73%**

Table A.5 | Decomposition of Gender Wage Gap Based on Conventional Version of Wage Equation for Male Workers and Female Workers (Weighted, 2007)

Variable	Mean				Regression coefficient for variable				Portion of wage gap accounted for statistically by			
	Males (Xm)	Females(Xf)	Difference between genders (Xm-Xf)	CONSAD STUDY (Difference in mean between genders)	Males (Bm)	Females (Bf)	Difference between genders (Bm-Bf)	CONSAD STUDY (Difference in coefficient between genders)	Difference in mean value of variable, based on value of coefficient for males (Bm*(Xm - Mf)) [Should be (Bm*(Xm-Xf)]	Difference in coefficient value between genders, based on mean value of variable among females (Xf*(Bm-Bf))	Difference in mean value of variable, based on value of coefficient for females (Bf*(Xm-Mf)) [Should be (Bf*(Xm-Xf)]	Difference in coefficient value between genders, based on mean value of variable among males (Xm*(Bm-Bf))
Log (hourly wage rate)	2.932	2.739	0.193	0.204								
Intercept					1.175	1.333	-0.158	-0.179		-0.158		-0.158
Age	41.921	42.702	-0.782	-0.510	0.046	0.037	0.009	0.008	-0.036	0.367	-0.029	0.361
Age Squared	1899.43	1968.54	-69.110	-44.700	0.000	0.00045	0.00036	-0.00008	0.031	-0.175	0.025	-0.169
# Children	0.720	0.709	0.011	0.005	0.016	-0.001	0.017	0.015	0.000	0.012	0.000	0.012
Married	0.650	0.579	0.071	0.066	0.083	0.038	0.045	0.043	0.006	0.026	0.003	0.029
Union representation	0.142	0.123	0.019	0.022	0.120	0.118	0.002	0.014	0.002	0.000	0.002	0.000
Race (1 = White; 0 = Non-White)	0.826	0.795	0.030	0.031	0.102	0.037	0.065	0.063	0.003	0.052	0.001	0.054
High school degree or GED	0.302	0.281	0.021	0.024	0.274	0.260	0.014	0.007	0.005	0.004	0.005	0.004
Some college but no degree	0.169	0.187	-0.018	-0.017	0.407	0.401	0.006	0.001	-0.008	0.001	-0.008	0.001
Occupational/vocational associate	0.046	0.054	-0.008	-0.006	0.441	0.491	-0.050	-0.06	0.000	-0.003	0.000	-0.003
Associate from academic program	0.044	0.062	-0.018	-0.019	0.490	0.521	-0.031	-0.029	-0.010	-0.002	-0.010	-0.001
Bachelor's degree	0.216	0.234	-0.018	-0.018	0.778	0.760	0.018	0.007	-0.008	0.004	-0.008	0.004
Master's degree	0.075	0.091	-0.016	-0.014	0.932	0.920	0.012	-0.001	-0.009	0.001	-0.009	0.001
Professional degree	0.018	0.013	0.005	0.005	1.051	1.068	-0.017	-0.029	0.011	0.000	0.011	0.000
Doctoral degree	0.017	0.010	0.007	0.008	1.091	1.095	-0.004	-0.02	0.011	0.000	0.011	0.000
% of female workers in persons industry	0.404	0.576	-0.172	-0.171	-0.173	-0.120	-0.053	-0.074	0.031	-0.031	0.022	-0.021
% of female workers in persons occupation	0.362	0.611	-0.249	-0.248	-0.150	-0.134	-0.016	-0.024	0.038	-0.010	0.034	-0.006
Full-time	0.919	0.784	0.135	0.131	0.168	0.133	0.035	0.096	0.025	0.027	0.020	0.033
Overtime	0.169	0.108	0.061	0.151	0.138	0.135	0.003	-0.025	0.008	0.000	0.008	0.001
Weighted N	**676,000**	**624,000**										
Unweighted N	**74,919**	**73,536**										
Portion of wage gap accounted for statistically by variables included in analysis									**0.076**	**0.117**	**0.052**	**0.140**
Percentage of wage gap accounted for statistically by variables included in analysis									**39.31%**	**60.69%**	**27.17%**	**72.83%**

Table A.6 | Decomposition of Gender Wage Gap Based on Alternative Version of Wage Equation for Male Workers and Female Workers (Unweighted, 2007)

Variable	Mean				Regression coefficient for variable				Portion of wage gap accounted for statistically by			
	Males (Xm)	Females (Xf)	Difference between genders (Xm-Xf)	CONSAD STUDY (Difference in mean between genders)	Males (Bm)	Females (Bf)	Difference between genders (Bm-Bf)	CONSAD STUDY (Difference in coefficient between genders)	Difference in mean value of variable, based on value of coefficient for males (Bm*(Xm - Mf)) [Should be (Bm*(Xm-Xf)]	Difference in coefficient value between genders, based on mean value of variable among females (Xf*(Bm-Bf))	Difference in mean value of variable, based on value of coefficient for females (Bf*(Xm-Mf)) [Should be (Bf*(Xm-Xf)]	Difference in coefficient value between genders, based on mean value of variable among males (Xm*(Bm-Bf))
Log (hourly wage rate)	2.946	2.742	0.204	0.204								
Intercept					2.399	2.352	0.047	-0.048		0.047		0.047
Married	0.656	0.590	0.066	0.066	0.0817	0.0732	0.0085	0.017	0.005	0.005	0.005	0.006
Union representation	0.143	0.121	0.022	0.022	0.121	0.124	-0.003	0.012	0.003	0.000	0.003	0.000
Race (1 = White; 0 = Non-White)	0.848	0.817	0.031	0.031	0.0979	0.0281	0.0698	0.067	0.003	0.057	0.001	0.059
High school degree or GED	0.304	0.281	0.024	0.024	0.27	0.261	0.009	0.017	0.006	0.003	0.006	0.003
Some college but no degree	0.170	0.187	-0.017	-0.017	0.394	0.392	0.002	0.014	-0.007	0.000	-0.007	0.000
Occupational/ vocational associate	0.051	0.056	-0.006	-0.006	0.419	0.481	-0.062	-0.048	-0.002	-0.003	-0.003	-0.003
Associate from academic program	0.044	0.063	-0.019	-0.019	0.485	0.515	-0.03	-0.016	-0.009	-0.002	-0.010	-0.001
Bachelor's degree	0.216	0.234	-0.018	-0.018	0.753	0.734	0.019	0.031	-0.013	0.004	-0.013	0.004
Master's degree	0.077	0.092	-0.014	-0.014	0.913	0.905	0.008	0.022	-0.013	0.001	-0.013	0.001
Professional degree	0.019	0.013	0.005	0.005	1.055	1.066	-0.011	-0.002	0.006	0.000	0.006	0.000
Doctoral degree	0.019	0.011	0.008	0.008	1.081	1.085	-0.004	0.008	0.009	0.000	0.009	0.000
% of female workers in persons industry	0.405	0.577	-0.172	-0.171	-0.187	-0.109	-0.078	-0.075	0.032	-0.045	0.019	-0.032
% of female workers in persons occupation	0.362	0.612	-0.250	-0.247	-0.153	-0.143	-0.01	-0.022	0.038	-0.006	0.036	-0.004
% of similar people who are not in the labor force	0.051	0.171	-0.119	-0.126	-0.209	-0.289	0.08	-0.569	0.025	0.014	0.034	0.004
% of similar people who are working part time	0.060	0.149	-0.089	-0.133	-1.796	-0.664	-1.132	-0.076	0.160	-0.168	0.059	-0.067
Full time	0.916	0.778	0.139	0.131	0.169	0.137	0.032	0.103	0.023	0.025	0.019	0.029
Overtime	0.176	0.109	0.067	0.151	0.13	0.124	0.006	-0.025	0.009	0.001	0.008	0.001
Unweighted N	**74919**	**73536**										
Portion of wage gap accounted for statistically by variables included in analysis									**0.274**	**-0.069**	**0.159**	**0.046**
Percentage of wage gap accounted for statistically by variables included in analysis									**133.60%**	**-33.60%**	**77.44%**	**22.56%**

Table A.7 | Decomposition of Gender Wage Gap Based on Alternative Version of Wage Equation for Male Workers and Female Workers (Weighted, 2007)

Variable	Mean				Regression coefficient for variable				Portion of wage gap accounted for statistically by			
	Males (Xm)	Females (Xf)	Difference between genders (Xm-Xf)	CONSAD STUDY (Difference in mean between genders)	Males (Bm)	Females (Bf)	Difference between genders (Bm-Bf)	CONSAD STUDY (Difference in coefficient between genders)	Difference in mean value of variable, based on value of coefficient for males (Bm*(Xm - Mf)) [Should be (Bm*(Xm-Xf)]	Difference in coefficient value between genders, based on mean value of variable among females (Xf*(Bm-Bf))	Difference in mean value of variable, based on value of coefficient for females (Bf*(Xm-Mf)) [Should be (Bf*(Xm-Xf)]	Difference in coefficient value between genders, based on mean value of variable among males (Xm*(Bm-Bf))
Log (hourly wage rate)	2.932	2.739	0.193	0.204								
Intercept					2.363	2.36	0.003	-0.048		0.003		0.003
Married	0.651	0.579	0.072	0.066	0.0828	0.0754	0.0074	0.017	0.006	0.004	0.005	0.005
Union representation	0.142	0.122	0.02	0.022	0.129	0.13	-0.001	0.012	0.003	0.000	0.003	0.000
Race (1 = White; 0 = Non-White)	0.826	0.795	0.031	0.031	0.106	0.0346	0.0714	0.067	0.003	0.057	0.001	0.059
High school degree or GED	0.302	0.281	0.021	0.024	0.28	0.259	0.021	0.017	0.006	0.006	0.005	0.006
Some college but no degree	0.169	0.187	-0.018	-0.017	0.413	0.398	0.015	0.014	-0.008	0.003	-0.008	0.003
Occupational/vocational associate	0.046	0.054	-0.008	-0.006	0.447	0.492	-0.045	-0.048	0.000	-0.002	0.000	-0.002
Associate from academic program	0.044	0.062	-0.018	-0.019	0.498	0.522	-0.024	-0.016	-0.010	-0.001	-0.010	-0.001
Bachelor's degree	0.216	0.234	-0.018	-0.018	0.784	0.749	0.035	0.031	-0.008	0.008	-0.007	0.008
Master's degree	0.075	0.091	-0.016	-0.014	0.942	0.913	0.029	0.022	-0.009	0.003	-0.009	0.002
Professional degree	0.018	0.013	0.005	0.005	1.061	1.057	0.004	-0.002	0.011	0.000	0.011	0.000
Doctoral degree	0.017	0.010	0.007	0.008	1.111	1.089	0.022	0.008	0.011	0.000	0.011	0.000
% of female workers in persons industry	0.404	0.576	-0.172	-0.171	-0.169	-0.116	-0.053	-0.075	0.030	-0.031	0.021	-0.021
% of female workers in persons occupation	0.362	0.611	-0.249	-0.247	-0.149	-0.139	-0.01	-0.022	0.037	-0.006	0.035	-0.004
% of similar people who are not in the labor force	0.054	0.174	-0.12	-0.126	-0.174	-0.328	0.154	-0.569	0.021	0.026	0.039	0.008
% of similar people who are working part time	0.061	0.150	-0.089	-0.133	-1.805	-0.72	-1.085	-0.076	0.162	-0.163	0.065	-0.065
Full time	0.919	0.784	0.135	0.131	0.167	0.134	0.033	0.103	0.023	0.026	0.019	0.030
Overtime	0.169	0.108	0.061	0.151	0.134	0.132	0.002	-0.025	0.008	0.000	0.008	0.000
Weighted N (in '000s)	**676,000**	**624,000**										
Unweighted N	**74919**	**73536**										
Portion of wage gap accounted for statistically by variables included in analysis									**0.261**	**-0.067**	**0.164**	**0.030**
Percentage of wage gap accounted for statistically by variables included in analysis									**134.38%**	**-34.38%**	**84.35%**	**15.65%**

APPENDIX B GENDER-BASED PAY GAP FOR 2017

Table B.1 | Descriptive Statistics for 2017 CPS Data

	Mean	
	Male	Female
Age	43.97	44.23
Age Squared	2099.634	2123.807
# Children	0.654	0.639
Hourly wage rate	27.321	22.929
Log (hourly wage rate)	3.134	2.958
% of workers female in persons industry	40.50%	57.84%
% of workers female in persons occupation	37.23%	60.29%
Overtime	16.47%	10.77%
Part-time	7.19%	18.46%
Full time	90.54%	78.40%
Part-time work for economic reasons	1.72%	2.62%
Part-time work for family	0.51%	6.14%
Married	62.72%	56.30%
Union representation	11.85%	10.56%
Race	82.19%	79.21%
Education completed		
Without high school degree	7.42%	4.83%
High school degree or GED	28.53%	22.90%
Some college but without degree	16.13%	16.56%
Occupational/vocational associate	4.86%	4.93%
Associate from academic program	5.45%	7.84%
Bachelor's degree	24.11%	26.82%
Master's degree	9.48%	12.46%
Professional degree	1.61%	1.61%
Doctoral degree	2.40%	2.05%
Percentage of similar people not in the labor force		
In last year*	5.14%	15.35%
In last 2 years (average)	5.39%	15.73%
In last 3 years (average)	5.68%	16.13%
In last 4 years (average)	6.02%	16.59%
In last 5 years (average)	6.44%	17.11%
Percentage of similar people working part time		
Last year*	6.14%	13.72%
Last 2 years (average)	6.30%	13.91%
Last 3 years (average)	6.47%	14.11%
Last 4 years (average)	6.64%	14.28%
Last 5 years (average)	6.82%	14.42%
Unweighted N	**71,561**	**69,796**

Table B.2 | Distribution of Workers Among Occupations, 2017

	NBER (Weighted)		NBER (Unweighted)	
	Male	Female	Male	Female
Management occupations	11.90%	9.95%	12.06%	10.07%
Business and financial operations occupations	4.56%	6.21%	4.52%	6.19%
Computer and mathematical science occupations	5.20%	1.93%	4.95%	1.83%
Architecture and engineering occupations	3.96%	0.78%	3.95%	0.76%
Life, physical and social science occupations	1.09%	1.07%	1.22%	1.10%
Community and social service occupations	1.27%	2.75%	1.32%	2.82%
Legal	0.93%	1.46%	1.05%	1.55%
Education, training and library	3.54%	10.34%	3.62%	10.74%
Arts, design, entertainment, sports and media	1.66%	1.60%	1.65%	1.58%
Healthcare practitioner and technical	2.90%	10.74%	2.93%	10.89%
Healthcare support	0.53%	4.42%	0.50%	4.19%
Protective support	3.46%	1.01%	3.43%	0.98%
Food preparation and serving related occupations	3.90%	5.06%	3.66%	5.06%
Building and grounds cleaning and maintenance	3.98%	2.92%	3.92%	2.92%
Personal care and service	1.31%	4.66%	1.24%	4.48%
Sales and related occupations	8.92%	8.79%	8.79%	8.73%
Office and administrative support	6.41%	19.49%	6.21%	19.46%
Farming, fishing and forestry occupations	1.02%	0.38%	1.09%	0.39%
Construction and extraction occupations	8.88%	0.29%	9.05%	0.31%
Installation, maintenance and repair occupations	6.43%	0.27%	6.58%	0.25%
Production occupations	8.39%	3.64%	8.46%	3.55%
Transportation and material moving occupations	9.77%	2.25%	9.79%	2.15%
Armed forces	0.00%	0.00%	0.00%	0.00%
Weighted N (in'000s)	**735,283**	**682,450**	**N/A**	**N/A**
Unweighted N	**71,561**	**69,796**	**71,561**	**69,796**

Table B.3 | Distribution of Workers Among Industries, 2017

	NBER (Weighted)		NBER (Unweighted)	
	Male	Female	Male	Female
Agriculture	1.20%	0.43%	1.34%	0.47%
Forestry, logging, fishing, hunting and trapping	0.18%	0.03%	0.25%	0.05%
Mining	0.93%	0.16%	1.43%	0.20%
Construction	10.38%	1.25%	10.28%	1.28%
Nonmetallic mineral product manufacturing	0.47%	0.14%	0.53%	0.13%
Primary metals and fabricated metal products	1.83%	0.42%	1.85%	0.44%
Machinery manufacturing	1.37%	0.43%	1.38%	0.44%
Computer and electronic product manufacturing	1.21%	0.55%	1.17%	0.52%
Electrical equipment, appliance manufacturing	0.46%	0.20%	0.44%	0.19%
Transportation equipment manufacturing	2.75%	0.93%	2.61%	0.82%
Wood products	0.23%	0.04%	0.27%	0.05%
Furniture and fixtures manufacturing	0.20%	0.06%	0.21%	0.07%
Miscellaneous and not specified manufacturing	1.35%	0.85%	1.28%	0.80%
Food manufacturing	1.44%	1.09%	1.56%	1.18%
Beverage and tobacco products	0.34%	0.10%	0.32%	0.09%
Textile, apparel and leather manufacturing	0.37%	0.50%	0.34%	0.43%
Paper and printing	0.92%	0.41%	0.91%	0.38%
Petroleum and coal products manufacturing	0.21%	0.05%	0.24%	0.05%
Chemical manufacturing	1.28%	0.77%	1.24%	0.69%
Plastics and rubber products	0.59%	0.22%	0.55%	0.21%
Wholesale trade	3.41%	1.61%	3.45%	1.52%
Retail trade	10.33%	9.84%	10.25%	9.85%
Transportation and warehousing	6.50%	2.48%	6.34%	2.35%
Utilities	1.66%	0.45%	1.79%	0.48%
Publishing industries	0.36%	0.40%	0.35%	0.36%
Motion picture and sound recording industries	0.30%	0.16%	0.26%	0.15%
Broadcasting (except internet)	0.52%	0.33%	0.49%	0.31%
Internet publishing and broadcasting	0.10%	0.07%	0.08%	0.06%
Telecommunications	0.89%	0.38%	0.86%	0.37%
Internet service provider and data processing services	0.08%	0.06%	0.08%	0.05%
Other information services	0.11%	0.26%	0.11%	0.29%
Finance	2.98%	3.69%	2.85%	3.64%
Insurance	2.79%	1.36%	2.68%	1.36%
Real estate	1.47%	1.58%	1.36%	1.52%
Rental and leasing services	0.36%	0.18%	0.37%	0.16%
Professional and technical services	8.15%	6.72%	7.88%	6.55%
Management of companies and enterprises	0.14%	0.15%	0.14%	0.14%
Administrative and support services	3.78%	3.29%	3.49%	3.02%
Waste management and remediation services	0.60%	0.14%	0.59%	0.14%
Educational services	6.11%	14.64%	6.26%	15.14%
Hospitals	2.44%	8.72%	2.51%	8.82%
Health care services, except hospitals	12.11%	2.63%	11.96%	2.63%
Social assistance	0.71%	3.59%	0.74%	3.61%
Arts, entertainment and recreation	1.78%	1.60%	1.77%	1.61%
Accommodation	0.81%	1.23%	0.86%	1.36%
Food services and drinking places	4.28%	4.98%	3.94%	4.81%
Repair and maintenance	1.88%	0.26%	1.80%	0.25%

	NBER (Weighted)		NBER (Unweighted)	
	Male	Female	Male	Female
Personal and laundry services	0.70%	1.76%	0.65%	1.59%
Membership associations and organizations	1.25%	1.81%	1.40%	2.03%
Private household	0.05%	0.72%	0.04%	0.66%
Public administration	5.96%	5.25%	6.58%	5.88%
Armed forces	0.00%	0.00%	0.00%	0.00%
Weighted N (in '000s)	**735,283**	**682,450**	**N/A**	**N/A**
Unweighted N	**71,561**	**69,796**	**71,561**	**69,796**

Table B.4 | Decomposition of Gender Wage Gap Based on Conventional Version of Wage Equation for Male Workers and Female Workers (Weighted, 2017)

Variable	Mean			Regression coefficient for variable			Portion of wage gap accounted for statistically by			
	Males (Xm)	Females(Xf)	Difference between genders (Xm-Xf)	Males (Bm)	Females (Bf)	Difference between genders (Bm-Bf)	Difference in mean value of variable, based on value of coefficient for males (Bm*(Xm-Xf)]	Difference in coefficient value between genders, based on mean value of variable among females (Xf*(Bm-Bf))	Difference in mean value of variable, based on value of coefficient for females (Bf*(Xm-Xf)]	Difference in coefficient value between genders, based on mean value of variable among males (Xm*(Bm-Bf))
Log (hourly wage rate)	3.125	2.956	**0.169**							
Intercept				1.398	1.505	-0.107		-0.107		-0.107
Age	43.111	43.519	-0.407	0.041	0.033	0.008	-0.017	0.366	-0.013	0.362
Age Squared	2023.31	2061.32	-38.01	0.000	0.000	0.000	0.015	-0.186	0.011	-0.182
Number of children	0.654	0.640	0.014	0.010	0.008	0.002	0.000	0.001	0.000	0.001
Married	0.615	0.547	0.069	0.094	0.048	0.046	0.006	0.025	0.003	0.028
Union representation	0.122	0.109	0.013	0.117	0.097	0.020	0.002	0.002	0.001	0.002
Race (1 = White; 0 = Non-White)	0.792	0.760	0.032	0.082	0.058	0.024	0.003	0.018	0.002	0.019
High school degree or GED	0.282	0.226	0.056	0.263	0.262	0.001	0.015	0.000	0.015	0.000
Some college but no degree	0.161	0.165	-0.005	0.364	0.366	-0.002	-0.002	0.000	-0.002	0.000
Occupational/vocational associate	0.045	0.048	-0.003	0.404	0.433	-0.029	-0.001	-0.001	-0.001	-0.001
Associate from academic program	0.055	0.078	-0.023	0.433	0.464	-0.031	-0.010	-0.002	-0.011	-0.002
Bachelor's degree	0.243	0.271	-0.028	0.763	0.749	0.014	-0.021	0.004	-0.021	0.003
Master's degree	0.095	0.124	-0.029	0.920	0.909	0.011	-0.027	0.001	-0.026	0.001
Professional degree	0.015	0.016	-0.001	1.006	1.061	-0.055	-0.001	-0.001	-0.001	-0.001
Doctoral degree	0.023	0.020	0.003	1.038	1.087	-0.049	0.003	-0.001	0.003	-0.001
% of female workers in persons industry	0.406	0.577	-0.171	-0.220	-0.102	-0.118	0.038	-0.068	0.017	-0.048
% of female workers in persons occupation	0.374	0.602	-0.228	-0.108	-0.136	0.028	0.025	0.017	0.031	0.010
Full-time	0.906	0.785	0.121	0.233	0.184	0.049	0.028	0.038	0.022	0.044
Overtime	0.162	0.108	0.054	0.133	0.113	0.020	0.007	0.002	0.006	0.003
Weighted N (in 000's)	**735,280**	**682,450**								
Unweighted N	**71,561**	**69,796**								
Portion of wage gap accounted for statistically by variables included in analysis							**0.062**	**0.109**	**0.037**	**0.134**
Percentage of wage gap accounted for statistically by variables included in analysis							**36.43%**	**63.57%**	**21.74%**	**78.26%**

Table B.5 | Decomposition of Gender Wage Gap Based on Alternative Version of Wage Equation for Male Workers and Female Workers (Weighted, 2017)

Variable	Mean			Regression coefficient for variable			Portion of wage gap accounted for statistically by			
	Males (Xm)	Females(Xf)	Difference between genders (Xm-Xf)	Males (Bm)	Females(Bf)	Difference between genders (Bm-Bf)	Difference in mean value of variable, based on value of coefficient for males (Bm*(Xm-Xf)	Difference in coefficient value between genders, based on mean value of variable among females (Xf*(Bm-Bf))	Difference in mean value of variable, based on value of coefficient for females (Bf*(Xm-Mf)) [Should be (Bf*(Xm-Xf)]	Difference in coefficient value between genders, based on mean value of variable among males (Xm*(Bm-Bf))
Log (hourly wage rate)	3.125	2.956	**0.169**							
Intercept			0.000	2.494	2.510	-0.016		-0.016		-0.016
Married	0.615	0.547	0.068	0.098	0.086	0.012	0.007	0.007	0.006	0.008
Union representation	0.122	0.109	0.013	0.123	0.106	0.017	0.002	0.002	0.001	0.002
Race (1 = White; 0 = Non-White)	0.792	0.760	0.032	0.086	0.058	0.027	0.003	0.021	0.002	0.021
High school degree or GED	0.282	0.226	0.056	0.268	0.253	0.015	0.015	0.003	0.014	0.004
Some college but no degree	0.161	0.165	-0.004	0.367	0.356	0.011	-0.002	0.002	-0.002	0.002
Occupational/vocational associate	0.045	0.048	-0.003	0.408	0.422	-0.014	-0.001	-0.001	-0.001	-0.001
Associate from academic program	0.055	0.078	-0.023	0.435	0.455	-0.020	-0.010	-0.002	-0.011	-0.001
Bachelor's degree	0.243	0.271	-0.028	0.765	0.731	0.034	-0.021	0.009	-0.021	0.008
Master's degree	0.095	0.124	-0.029	0.923	0.893	0.030	-0.027	0.004	-0.026	0.003
Professional degree	0.015	0.016	-0.001	1.008	1.044	-0.036	-0.001	-0.001	-0.001	-0.001
Doctoral degree	0.023	0.020	0.003	1.041	1.068	-0.027	0.003	-0.001	0.003	-0.001
% of female workers in persons industry	0.406	0.577	-0.171	-0.221	-0.098	-0.123	0.038	-0.071	0.017	-0.050
% of female workers in persons occupation	0.374	0.602	-0.228	-0.106	-0.139	0.033	0.024	0.020	0.032	0.012
Full-time	0.906	0.785	0.121	0.232	0.181	0.051	0.028	0.040	0.022	0.046
Overtime	0.162	0.108	0.054	0.130	0.109	0.021	0.007	0.002	0.006	0.003
% similar people not in labor force in last five years	0.068	0.175	-0.107	-0.822	-0.272	-0.550	0.088	-0.096	0.029	-0.037
% similar people working part time in last five years	0.070	0.146	-0.076	-0.673	-0.971	0.298	0.051	0.044	0.074	0.021
Weighted N (in 000's)	**735,280**	**682,450**								
Unweighted N	**71,561**	**69,796**								
Portion of wage gap accounted for statistically by variables included in analysis							**0.203**	**-0.034**	**0.145**	**0.025**
Percentage of wage gap accounted for statistically by variables included in analysis							**119.84%**	**-19.84%**	**85.44%**	**14.56%**

Table B.6 | Decomposition of Gender Wage Gap Based on Conventional Version of Wage Equation for Male Workers and Female Workers (Unweighted NBER, 2017)

Variable	Mean			Regression coefficient for variable			Portion of wage gap accounted for statistically by			
	Males (Xm)	Females(Xf)	Difference between genders (Xm-Xf)	Males (Bm)	Females(Bf)	Difference between genders (Bm-Bf)	Difference in mean value of variable, based on value of coefficient for males (Bm*(Xm-Xf)	Difference in coefficient value between genders, based on mean value of variable among females (Xf*(Bm-Bf))	Difference in mean value of variable, based on value of coefficient for females (Bf*(Xm-Xf)	Difference in coefficient value between genders, based on mean value of variable among males (Xm*(Bm-Bf))
Log (hourly wage rate)	3.134	2.958	**0.176**							
Intercept				1.428	1.546	-0.118		-0.118		-0.118
Age	43.967	44.230	-0.262	0.041	0.032	0.009	-0.011	0.416	-0.008	0.413
Age Squared	2099.634	2123.807	-24.173	-0.00039	-0.00028	0.000	0.009	-0.215	0.007	-0.212
Number of children	0.654	0.639	0.015	0.010	0.009	0.001	0.000	0.001	0.000	0.001
Married	0.627	0.563	0.064	0.095	0.045	0.050	0.006	0.028	0.003	0.031
Union representation	0.119	0.106	0.013	0.108	0.098	0.011	0.001	0.001	0.001	0.001
Race (1 = White; 0 = Non-White)	0.822	0.792	0.030	0.079	0.056	0.023	0.002	0.018	0.002	0.019
High school degree or GED	0.285	0.229	0.056	0.252	0.257	-0.005	0.014	-0.001	0.014	-0.001
Some college but no degree	0.161	0.166	-0.004	0.352	0.360	-0.008	-0.002	-0.001	-0.002	-0.001
Occupational/vocational associate	0.049	0.049	-0.001	0.398	0.430	-0.032	0.000	-0.002	0.000	-0.002
Associate from academic program	0.054	0.078	-0.024	0.421	0.463	-0.042	-0.010	-0.003	-0.011	-0.002
Bachelor's degree	0.241	0.268	-0.027	0.741	0.742	-0.001	-0.020	0.000	-0.020	0.000
Master's degree	0.095	0.125	-0.030	0.899	0.900	-0.001	-0.027	0.000	-0.027	0.000
Professional degree	0.016	0.016	0.000	1.027	1.088	-0.061	0.000	-0.001	0.000	-0.001
Doctoral degree	0.024	0.021	0.003	1.030	1.102	-0.072	0.004	-0.001	0.004	-0.002
% of female workers in persons industry	0.405	0.578	-0.173	-0.235	-0.104	-0.131	0.041	-0.076	0.018	-0.053
% of female workers in persons occupation	0.372	0.603	-0.231	-0.108	-0.139	0.031	0.025	0.019	0.032	0.012
Full-time	0.905	0.784	0.121	0.234	0.183	0.051	0.028	0.040	0.022	0.046
Overtime	0.165	0.108	0.057	0.130	0.112	0.018	0.007	0.002	0.006	0.003
Unweighted N	**71,561**	**69,796**								
Portion of wage gap accounted for statistically by variables included in analysis							**0.069**	**0.106**	**0.042**	**0.134**
Percentage of wage gap accounted for statistically by variables included in analysis							**39.41%**	**60.59%**	**23.79%**	**76.21%**

Table B.7 | Decomposition of Gender Wage Gap Based on Alternative Version of Wage Equation for Male Workers and Female Workers (Unweighted NBER, 2017)

Variable	Mean			Regression coefficient for variable			Portion of wage gap accounted for statistically by			
	Males (Xm)	Females(Xf)	Difference between genders (Xm-Xf)	Males (Bm)	Females(Bf)	Difference between genders (Bm-Bf)	Difference in mean value of variable, based on value of coefficient for males (Bm*(Xm-Xf)	Difference in coefficient value between genders, based on mean value of variable among females (Xf*(Bm-Bf))	Difference in mean value of variable, based on value of coefficient for females (Bf*(Xm-Xf)	Difference in coefficient value between genders, based on mean value of variable among males (Xm*(Bm-Bf))
Log (hourly wage rate)	3.134	2.958	**0.176**							
Intercept				2.505	2.481	0.024		0.024		0.024
Married	0.627	0.563	0.064	0.097	0.075	0.0219	0.006	0.012	0.005	0.014
Union representation	0.119	0.106	0.013	0.112	0.104	0.008	0.001	0.001	0.001	0.001
Race (1 = White; 0 = Non-White)	0.822	0.792	0.030	0.081	0.055	0.0256	0.002	0.020	0.002	0.021
High school degree or GED	0.285	0.229	0.056	0.255	0.250	0.005	0.014	0.001	0.014	0.001
Some college but no degree	0.161	0.166	-0.004	0.354	0.354	0	-0.002	0.000	-0.002	0.000
Occupational/vocational associate	0.049	0.049	-0.001	0.400	0.423	-0.023	0.000	-0.001	0.000	-0.001
Associate from academic program	0.054	0.078	-0.024	0.423	0.458	-0.035	-0.010	-0.003	-0.011	-0.002
Bachelor's degree	0.241	0.268	-0.027	0.742	0.729	0.013	-0.020	0.003	-0.020	0.003
Master's degree	0.095	0.125	-0.030	0.902	0.888	0.014	-0.027	0.002	-0.026	0.001
Professional degree	0.016	0.016	0.000	1.026	1.073	-0.047	0.000	-0.001	0.000	-0.001
Doctoral degree	0.024	0.021	0.003	1.031	1.085	-0.054	0.004	-0.001	0.004	-0.001
% of female workers in persons industry	0.405	0.578	-0.173	-0.236	-0.100	-0.1365	0.041	-0.079	0.017	-0.055
% of female workers in persons occupation	0.372	0.603	-0.231	-0.106	-0.141	0.035	0.024	0.021	0.033	0.013
Full-time	0.905	0.784	0.121	0.236	0.181	0.055	0.029	0.043	0.022	0.050
Overtime	0.165	0.108	0.057	0.127	0.110	0.017	0.007	0.002	0.006	0.003
% similar people not in labor force in last five years	0.064	0.171	-0.107	-0.445	-0.345	-0.1	0.047	-0.017	0.037	-0.006
% similar people working part time in last five years	0.068	0.144	-0.076	-0.686	-0.559	-0.127	0.052	-0.018	0.042	-0.009
Unweighted N	**71,561**	**69,796**								
Portion of wage gap accounted for statistically by variables included in analysis							**0.170**	**0.010**	**0.124**	**0.056**
Percentage of wage gap accounted for statistically by variables included in analysis							**94.57%**	**5.43%**	**68.97%**	**31.03%**

Table B.8 | Portion of Raw Gender Wage Gap for Which Different Versions of Wage Equation Statistically Account

2007									
		Accounted for by differences in attributes		(Xf*(Bm-Bf)		(Bf*(Xm-Xf)		(Xm*(Bm-Bf)	
		Amount	Percentage	Amount	Percentage	Amount	Percentage	Amount	Percentage
C(0)	Basic attributes: marital status, union representation, race, and educational attainment	-0.010	-5.0%	0.202	105.0%	-0.022	-11.3%	0.214	111.3%
C(1)	C(0) and % of workers who are female in worker's industry and % of workers who are female in worker's occupation	0.066	34.4%	0.126	65.6%	0.046	23.8%	0.146	76.2%
C(2)	C(1) and working overtime and working part-time	0.099	51.4%	0.094	48.6%	0.065	33.6%	0.128	66.4%
C(3)	C(2) and age, age-squared, and number of children	0.080	40.9%	0.115	59.1%	0.053	27.2%	0.142	72.8%
C(1) and working overtime and working part-time[3] for specific reasons:									
A(1a)	[a] economic reasons	0.075	38.7%	0.118	61.3%	0.054	27.8%	0.139	72.2%
A(1b)	[b] family-related reasons	0.090	46.7%	0.102	53.3%	0.058	30.2%	0.134	69.8%
C(2) and % of similar people[4] who are not in the labor force during specific time period and % of similar people who working part-time during same specific time period:									
A(2a)	[a] previous year	0.381	198.4%	-0.189	-98.4%	0.129	66.9%	0.064	33.1%
A(2b)	[b] average for previous 2 years	0.344	178.3%	-0.151	-78.3%	0.144	74.7%	0.049	25.3%
A(2c)	[c] average for previous 3 years	0.311	162.1%	-0.119	-62.1%	0.155	80.7%	0.037	19.3%
A(2d)	[d] average for previous 4 years	0.283	147.7%	-0.092	-47.7%	0.160	83.3%	0.032	16.7%
A(2e)	[e] average for previous 5 years	0.262	136.0%	-0.069	-36.0%	0.163	84.3%	0.030	15.7%
2017									
		(Bm*(Xm-Xf)		(Xf*(Bm-Bf)		(Bf*(Xm-Xf)		(Xm*(Bm-Bf)	
		Amount	Percentage	Amount	Percentage	Amount	Percentage	Amount	Percentage
C(0)	Basic attributes: marital status, union representation, race, and educational attainment	-0.021	-12.5%	0.191	112.5%	-0.033	-19.4%	0.203	119.4%
C(1)	C(0) and % of workers who are female in worker's industry and % of workers who are female in worker's occupation	0.052	30.8%	0.118	69.2%	0.029	17.0%	0.141	83.0%
C(2)	C(1) and working overtime and working part-time	0.081	47.5%	0.089	52.5%	0.049	29.0%	0.121	71.0%
C(3)	C(2) and age, age-squared, and number of children	0.066	38.7%	0.105	61.3%	0.039	22.9%	0.132	77.1%
C(1) and working overtime and working part-time[3] for specific reasons:									
A(1a)	[a] economic reasons	0.057	33.8%	0.112	66.2%	0.036	21.2%	0.133	78.8%
A(1b)	[b] family-related reasons	0.070	41.4%	0.099	58.6%	0.041	24.6%	0.127	75.4%
C(2) and % of similar people[4] who are not in the labor force during specific time period and % of similar people who working part-time during same specific time period:									
A(2a)	[a] previous year	0.282	167.0%	-0.113	-67.0%	0.136	80.3%	0.033	19.7%
A(2b)	[b] average for previous 2 years	0.265	155.4%	-0.095	-55.4%	0.143	84.0%	0.027	16.0%
A(2c)	[c] average for previous 3 years	0.244	144.9%	-0.076	-44.9%	0.146	86.5%	0.023	13.5%
A(2d)	[d] average for previous 4 years	0.224	131.3%	-0.053	-31.3%	0.147	86.1%	0.024	13.9%
A(2e)	[e] average for previous 5 years	0.205	121.0%	-0.036	-21.0%	0.145	85.9%	0.024	14.1%

Gender-Based Pay Disparity Study

WHITE PAPER

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INTRODUCTION

The supply- and demand-side factors of the U.S. labor market generate a range of hourly wage rates. Describing the variation in hourly wages is important for understanding how social and economic trends impact the labor market and, by extension, for understanding ways policy can address imperfections in the market. For example, if the relative value of a skillset or occupation is increasing over time, students preparing to enter the labor market may not see this value increase unless such information is available to educational service providers that communicate with these new entrants to the labor market. In short, people make more informed choices when accurate information is available and provided to them. Most differences in hourly wages seem reasonable and are determined by the supply- and demand-side factors; for example, Internal Medicine Physicians (MDs) receive higher hourly wages than U.S. History instructors at community colleges because the supply of MDs is tighter relative to the demand when compared to the supply and demand for community college instructors. However, some wage differences between groups are complex and their causes more difficult to parse and understand.

Specifically, this paper is concerned with the observed differences in wages between men and women. Since 1970, the differences in wages between full-time, year round salaried men and women have decreased substantially, but that trend appears to have plateaued over the past 15 years. As of 2017, the median earnings for full-time, year-round women workers were slightly greater than 80 percent of the median earnings for full-time, year-round men workers, compared to the 1970s, when the ratio of female-to-male median earnings was around 62 percent.[1] An independent, U.S. Department of Labor-funded report produced by the CONSAD Research Corporation (CONSAD Research Corporation [CONSAD], 2009) found, using 2007 data, approximately the same gender wage gap (20 percent). This white paper offers updated insights on gender wage differences as of 2018. The paper builds on the CONSAD study and includes a review of relevant literature related to the gender wage gap since 2007, as well as estimations of the gender wage gap and correlated factors that illuminate unknown variables influencing the wage differences between men and women.

One way to understand this gender wage gap problem is as follows. First, observed hourly wages are assumed to result from an approximate equilibrium in the labor market. This assumption means that what is observed reflects the forces of supply and demand. Second, the wage that a person earns depends on numerous attributes/characteristics of the person. For example, an individual's education and work experience impacts wage rates; in fact, the "starting wage rate" (no experience) or "annual increase" (value of an extra year of experience) is usually discussed during negotiations between employers (demand side) and potential hires (supply side). Third, the equilibrium value of such characteristics can be estimated by formulating statistical models that describe wages as a function of worker and job characteristics, such as education and experience (often just referred to as human capital) and occupation/industry). Last, using data on wages and characteristics of workers and jobs, estimations of these models reveal the equilibrium valuations of the worker and job characteristics. This revelation facilitates statements such as, "An additional year of work experience is associated with *X*

[1] U.S. Census Bureau, Current Population Survey, 1961 to 2018 Annual Social and Economic Supplements, Table A-4 - Female-to-Male Earnings Ratio. Accessed from: https://www2.census.gov/programs-surveys/demo/tables/p60/263/tableA4.xls This is distinct from the annual earnings estimate for full-time, year-round workers collected separately in the Annual Social and Economic Supplement.

percent higher wages in employee with characteristics *Y* in occupation *Z*." For example, the same level of human capital may be worth twice as much in one occupation/industry when compared to another.

The equilibrium assumption suggests that the values revealed by the estimations provide information about just one point on the supply and demand of any specific characteristic: These represent the *marginal* values. This poses a challenge to the formulation of policy recommendations solely through the examination of the valuations. If some occupation has a relatively high value, a policy that effectively increased labor in that occupation (an increase in supply) might result in lower valuations, depending on what happens on the demand side—making it difficult to judge the overall worth of such a policy. In other words, the estimations only describe the relationship between wages and characteristics and do not predict changes in wages from discrete changes in characteristics.

Literature has attempted to analyze the wage differences between men and women by estimating a wage model separately for each gender. Any observed differences are then "decomposed" into two parts. The first part is easy to interpret and stems from differences in the human capital and industry/occupation combinations between men and women. For example, if women have less human capital and/or if women are working in industries and occupations that are valued less by the labor market than industries and occupations in which men are working, then observed wage differences should be expected. The second part stems from differences in the market value of the human capital and industry/occupation of men and women; the implications from this part are more difficult to understand. For instance, the second part indicates that the human capital of women is valued differently than the human capital of men. Therefore, second part of the observed differences can be interpreted to mean that even if men and women have the same human capital and worked in the same industry/occupation, with all other factors being equal, the wage rates could still vary. Possible explanations include the presence of unobserved differences between men and women, as well as gender discrimination in the labor market. Furthermore, if women respond to societal expectation or implicit discrimination through the choices they make throughout their life, such as reducing their human capital accumulation, selecting a different major of study, or occupation and industry of employment, discrimination could further lead to differences in characteristics and affect the first observed differences as well. Women may also respond to discrimination by working part-time or by not entering the labor force. Much of the recent literature on the gender wage gap concerns ways to observe additional characteristics that differentiate men and women and are related to wages.

The narrowing of the gender wage gap since the 1970s can be analyzed both in terms of changes in worker characteristics (such as human capital accumulation, occupations/industries of employment) *and* changes in the relative values of these characteristics between men and women. Similarly, the flattening of the declining trend in the wage gap can be examined in light of these two changes as well. The empirical part of this paper relies on various methods of decomposing the gender differences and explaining why the differences between men's and women's wages still persist in the labor market.

One major weakness of this type of decomposition approach is that it only explains a small part of the wage differential and much is still unknown about why this differential persists. Generally, in these wage models, the first part of the decomposition explains much less of the gender wage gap than the second part. The presence of unexplained wage differences is consistent with discrimination theory; however, the presence of unexplained wage differences does not prove the existence of labor market discrimination. There may be important unmeasured differences between men's and women's

characteristics that are related to wages, and these unmeasured differences may contribute to the unexplained difference in wages but are not due to discrimination. However, discrimination may affect the educational and labor market decisions of the discriminated group. In that case, discrimination can affect both the explained and unexplained portion of the wage gap, as the explanatory variables are affected by the presence of discrimination. In addition, the decomposition methods posit that wages are a linear function of the explanatory variables, and the presence of unmeasured discrimination is a case of omitted variables bias. Since the coefficients are part of both the explained and unexplained portions of the wage gap, the results of the decomposition, in this case, may be misleading. Blau and Kahn (2017) note that modern efforts to measure discrimination employ research designs that are less vulnerable to this issue. Therefore, until data with more relevant information about workers and their jobs are available, large portions of the reasons for wage differentials will remain unexplained.

LITERATURE REVIEW

Significant progress has been made in establishing equality across all sectors of American society. Ensuring men and women have equal opportunities for education and employment has been central to these efforts, in part because guaranteeing equality facilitates earnings that enable workers to achieve economic self-sufficiency and upward mobility. Despite these efforts, on average, women still earn less than men. This persistent difference in earnings between men and women has been a topic of fundamental interest to policymakers and social scientists because the disparity reflects a lack of equity and efficiency in the labor market. While gender-based wage disparities have experienced significant reductions in the past 50 years, the differences that remain are substantial and uneven over the distribution of wages (Blau & Kahn, 2017).

Research has sought to measure the magnitude of the difference in wages between men and women and attempted to identify the factors (for example, gender differences in education and occupation) that contribute to the disparity in compensation. Factors that contribute to the gender wage gap have changed over time. In this white paper, we review research conducted since the CONSAD study (2007) to illuminate the factors that currently affect the gender wage gap.

The literature review is broadly divided into six themes:

(1) Education and Human Capital Development;
(2) Personality Traits, Non-Cognitive Skills, and Cognitive Skills;
(3) Total Compensation and Benefits;
(4) Firm and Industry-Specific Employment Characteristics;
(5) Work Experience, Career Interruptions, and Labor Force Attachment; and
(6) Labor Market Discrimination.

The factors related to the gender wage gap may not be subsumed by each of the themes independently. For example, personality traits may influence the educational and occupational choices and may codetermine the magnitude of the gender wage gap.

Education and Human Capital Development

Numerous studies have established education as an important determinant of wages; on average, higher levels of education are associated with higher wages. In early research, education was one of the primary factors that explained much of the gender wage gap. However, from 1981 to 2011, women surpassed men in educational attainment, which has contributed to the narrowing of the gender wage gap (Blau & Kahn, 2017). Over the same time span, the magnitude of the gender wage gap explained by education also declined. As a result, differences in education currently explain a small portion of the gender wage gap. In addition, women have closed the labor market experience gap, from nearly 7 years in the 1980s to 1.4 years in 2011 (Blau & Kahn, 2017). Likely this is another reason for the reduction in the gender wage gap in the 1980s (DiNatale & Boraas, 2002). The results presented below indicate that differences in work experience remains a relatively important factor in explaining the gender wage gap.

GENDER DIFFERENCES IN EDUCATION

In 1980, 24 percent of men and 21 percent of women between the ages of 25 and 29 in the United States had a bachelor's degree or higher (Table 104.20 in the 2018 Digest of Education Statistics).[2] By 2018, however, 33 percent of men and 41 percent of women in the United States had a bachelor's degree or higher. Similar trends of women having surpassed men in educational attainment have been observed in other research (Blau & Kahn, 2017; Charles & Luoh, 2003; Goldin, Katz, & Kuziemko, 2006; Pekkarinen, 2012),[3] but significant gender differences remain in some fields of study. In particular, women are underrepresented in the highly rewarded fields of science, technology, engineering, and mathematics (STEM) (Ceci, Ginther, Kahn, & Williams, 2014; Carnevale, Cheah, & Hanson, 2015).[4] The authors explain that women's preference for non-math-intensive careers and their scores on gatekeeper tests such as SATs constitute possible explanatory factors for the underrepresentation of women in some of the STEM fields and are most likely related to sociocultural norms. However, they do not distinguish between sociocultural norms and discrimination.

EDUCATION AND GENDER WAGE GAP

Women's gains in educational attainment are associated with closing of the gender wage gap. Bar, Kim, and Leukhina (2015) assert that women's gains in education account for 11 percent of the closing of the gender wage gap from 1975 to 1995.[5] Blau and Kahn (2017) show that in 1980, education differences accounted for 2.6 percent of the gender wage gap in favor of men, whereas in 2010, differences in education attainment accounted for 5.9 percent of the wage gap in favor of women. Moreover, recent

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[2] National Center for Education Statistics. (n.d.). *Digest of education statistics: List of 2018 digest tables*. Retrieved from https://nces.ed.gov/programs/digest/2018menu_tables.asp

[3] Pekkarinen (2012) shows that gains in educational attainment women have made relative to men holds true for most industrialized nations.

[4] A higher percentage of men than women receive bachelor's degrees in business, computer science, information science and support services, engineering and engineering technologies, engineering technologies/construction trades/mechanics and repairers, mathematics and statistics, philosophy and religious studies, and the physical sciences; women are overrepresented in agriculture and natural resources; area, ethnic, cultural, gender, and group studies; biological and biomedical sciences; communications and communication technologies; education; health professions and related programs; psychology; and public service and social service professions (Table 318.30 in the 2017 Digest of Education Statistics).

[5] The authors used the Current Population Survey (CPS) from 1975 to 1979 and from 1995 to 1999 to investigate the gender wage gap and find the convergence of the returns to observable characteristics, such as education, between men and women.

research shows that education differentially affects the gender wage gap across the distribution of wages. Karpio, Landmesser, Ukasiewicz, and Orowski (2016) find that the gender wage gap increases along the distribution of wages. Similarly, Kassenboehmer and Sinning (2014) provide evidence that the gender wage gap narrowed less at the top of the wage distribution than at the bottom of the distribution; the gap narrowed by 16 percent at the 10th percentile and by 5 percent at the 90th percentile. Below, we update these findings using the 2018 data.

Bobbitt-Zeher (2007) finds that the percentage of students that is female in a given college major accounts for 14 percent of the gender disparity in earnings. Similarly, Lewis and Oh (2009) estimate that women concentrating on fields that pay less and women's underrepresentation in STEM fields account for 3–4 percent of the difference in gender wage gap. Olitsky (2014) and Ma and Savas (2014) illustrate that both men and women benefit from entering STEM fields, but Olitsky (2014) shows that men who select a STEM field and score in the top quartile on the ACT receive an initial earnings premium of 27.5 percent, while women who select a STEM field and score in the top quartile on the ACT receive an earnings premium of 18 percent. Jacobson and Davis (2017) demonstrate that although women may select higher return fields of study than men, when the men and women select the same field, men usually have higher returns. Ceci et al. (2014) find that women are underrepresented in STEM fields and that differences in men's and women's attitudes toward and expectations about math careers and ability are evident early in life, which leads to differences in the propensity to major in math-intensive fields. Using data from the American Community Survey, Carnevale et al. (2015) show that STEM majors receive, on average, substantially higher wages than other majors. Taken together, the lower likelihood of women majoring in STEM fields coupled with the earnings advantage of STEM majors provides a stark example of how the gender difference in the field of study contributes to the wage gap. Therefore, recent research suggests that a person's choice in field of study contributes to the gender wage gap more due to disparity in compensation between fields than a person's educational attainment.

Personality Traits, Non-Cognitive Skills, and Cognitive Skills

PERSONALITY TRAITS AND NON-COGNITIVE SKILLS

Behavioral and experimental economists have provided evidence that men and women differ regarding preferences, potentially representing both free and constrained choices due to societal pressure, in addition to discrimination. Women are more averse to risk than men are; women's social preferences for altruism are higher than men's; and women's preferences for competitive situations are lower than men's (Eckel ^ Grossman, 2008; Croson & Gneezy, 2009). Bertrand (2011) documents similar differences in non-cognitive skills and personality traits between men and women.[6] Bonin, Dohmen, Falk, Huffman, and Sunde (2007) find that individuals who are more risk-averse are more likely to select occupations with more stable earnings that tend to pay less due to compensating differentials. The contribution of gender differences in these traits, whether chosen by preference or societal norm, to the gender gap is context-specific and does not uniformly disadvantage women. For example, if higher risk jobs and occupations are also more lucrative, then the difference in men's and women's risk aversion could lead to occupational choice differences that exacerbate the gender wage gap. On the other hand, Borghans,

[6] However, the research that determines the extent to which the gender differences in non-cognitive skills and preferences that have been documented in laboratory experiments contribute to differences in labor market outcomes is not nearly as advanced.

ter Weel, and Weinberg (2014) find that between the late 1970s and early 1990s in the United States, acceleration in the rate of increase in the importance of people skills, a trait for which women have an advantage over men, contributed to the closing of the gender wage gap.

In a laboratory setting, Niederle and Vesterlund (2007) find that, among men and women of similar ability, men are more than twice as likely to select a competitive environment. Moreover, Buser, Niederle, and Oosterbeek (2014) find that men are both more competitive and more likely to choose a prestigious track (tracks that are science- and math-intensive) even though men and women in the study have similar levels of academic ability. In a similar vein, Reuben, Sapienza, and Zingales (2015) find evidence that both men and women graduating from a prestigious MBA program earned 9 percent more if they were measured as competitive in a laboratory setting.[7] Furthermore, the authors provide evidence that women chose lower paying industries and conclude that differences in preference for competition accounts for approximately 10 percent of the gender pay disparity. Niederle and Vesterlund (2007) find that both men and women have higher expectations of their performance than is actually realized; however, men are relatively more overconfident about their performance than women. Correspondingly, Chen, Grove, and Hussey (2017) find that quantitative confidence explained 13 percent of the gender wage gap in their data.

Women are less likely to negotiate salaries than men, and this could reduce their pay relative to men (Croson & Gneezy, 2009; Bertrand, 2011; Leibbrandt & List, 2015). Leibbrandt and List (2015) find in a field experiment that men are more willing than women to negotiate salary when the ability to negotiate was not stated explicitly by employers. When it was stated explicitly that wages were negotiable, the gender difference in the willingness to negotiate salary disappeared and even reversed. Exley, Niederle, and Vesterlund (forthcoming) show in a laboratory experiment that increased willingness to negotiate is not more helpful and may hurt women's wages in environments where negotiations can be financially damaging. When negotiations are profitable, women do negotiate; hence, the possible negative effects of women's willingness to negotiate are mitigated by the environment in which negotiations are profitable for them. In other words, the gender difference in the willingness to negotiate salary is moderated by context, and blanket policies that encourage women to negotiate salary more may not be effective in certain environments.

Women tend to be more socially minded and tend to exhibit higher levels of altruism and preferences for redistribution of wealth than men (Croson & Gneezy, 2009; Bertrand, 2011). Hussey (2011) finds that ethical characteristics are negatively associated with wages of male graduate management admissions test (GMAT) registrants but are not associated with wages of female GMAT registrants. In addition, Hussey (2011) finds that the higher the degree to which men report that their business school's education enhances their ethical character, the lower those men's wages. For women, the relationship between wages and enhanced ethics through education at business school is a positive one. Fortin (2008) finds that men, on average, are more ambitious and value money, whereas women place more importance on people/family. Additionally, the author finds that the percentage of women who report valuing opportunities to work with people and be useful to society as important factors when selecting a career exceeds the percentage of men reporting the same by 10 percent. However, Fortin (2008)

[7] Using data collected on University of Chicago Master of Business Administration graduates that was merged with experimental data on competition, the authors find that the mean earnings for men, at $175,000, were significantly higher than mean earnings for women at $149, 000 even after accounting for industry.

concludes that non-cognitive factors such as self-esteem, external locus of control, the importance of money/work, and the importance of people/family account for a modest portion (1.9 log points of a 22.9 log point gender wage gap) with the importance of people/family being the most prominent factor at 1.7 log points of the gender wage gap.

Borghans, Duckworth, Heckman, and Weel (2008) provide a summary of the literature that finds that five personality traits—openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism—are related to economic outcomes. Some evidence suggests that these traits are related to the gender wage gap. Judge, Livingston, and Hurst (2012) analyze three sets of experiments and show across the studies, on average, that men who score one standard deviation below the mean on agreeableness earn $9,772 more than men who score one standard deviation above the mean for agreeableness. For women, however, the authors find inconsistent evidence of the effect of agreeableness on income; for two of the experiments, the effect of agreeableness on women's income was not significant. On average, women who score one deviation below the mean on agreeableness earn $1,828 more than women who score one mean above the standard deviation on agreeableness, which is far lower in magnitude relative to men.

Blau and Kahn (2017) summarize several studies that estimate the extent to which gender differences in psychological attributes contribute to the gender wage gap, and they find that only a modest proportion of the total wage gap is accounted for by gender differences in these factors—it ranges from 2.5 percent to 28 percent. However, of the studies they summarize, only one study finds that differences in psychological attributes accounts for more than 16 percent of the gap. Nevertheless, these results should be considered cautiously in a policy context; there is still significant debate on the extent to which "nature," "nurture," or some combination of both—as well as the context in which they can be rewarded or penalized—is the source of these gender wage differences. Questions related to gauging the personality traits of an individual are also not captured in national datasets, making it difficult to relate this literature to findings at the national level.

COGNITIVE SKILLS

Blau and Kahn (2017) suggest that gender differences in mathematical skills may be one factor that explains the gender wage disparity. In the United States, men, on average, have had higher mathematics test scores than women (Goldin et al., 2006; Hedges & Nowell, 1995). If more lucrative employment requires higher performance in mathematics, then the gender differences in mathematical acumen, as measured by test scores, could lead to gender differences in both occupational choice and compensation. However, women have made considerable gains in terms of performance on mathematics tests and closing the gender gap in math performance. Goldin et al. (2006) show that from 1972 to 1992, women closed the gap in math performance by 0.17 standard deviations. Keaveny, Inderrieden, and Toumanoff (2007) find that the gender difference in salary for young management professionals disappears when cognitive skills are taken into consideration. Moreover, they find that women are rewarded more for quantitative skills while men are rewarded more for verbal skills. Blau and Kahn (2017) use the results from Fortin (2008) to estimate the narrowing gap in math scores between two cohorts (one from 6,184 college seniors in 1972 and the other from 6,476 college seniors in 1994) and show that this decreased difference in scores accounted for 10 to 14 percent of the narrowing of the gender wage gap across the two cohorts.

Social factors are related to cognitive skills; studies have found that girls in countries (such as Norway, Sweden, and Iceland) and states (New England census division) that are more gender-equal tend to perform relatively better than boys on math tests (Guiso, Monte, Sapienza, & Zingales, 2008; Pope & Sydnor, 2010). Fryer and Levitt (2010) find no mean difference between boys and girls upon entry to school, but girls lose more than 0.2 standard deviations relative to boys over the first 6 years of schooling. After ruling out several possible explanations for this finding—for example, less investment by girls in math, low parental expectations, and biased tests—the authors state that they fail to identify a clear explanation for the decline in girl's performance in mathematics; additionally, they are unable to account for society-level socialization factors that operate at a macro level. Hedges and Nowell (1995) provide evidence that men are more likely to be higher performing in math than women; however, Hyde, Lindberg, Linn, Ellis, and Williams (2008) and Ceci et al. (2014) argue that the increased likelihood of men being high performers in math is insufficient to explain the relative lack of women in STEM fields.

Taken together, this evidence suggests that cognitive skills matter, but social factors, perhaps related to factors in schools and in the workplace, play a role both in the development of differences in men's and women's cognitive abilities and the extent to which women can benefit from gains made in their cognitive abilities.

Total Compensation and Benefits

The gender pay gap also depends on several demand-side factors, such as the rules under which pay is determined, the structure of the organization, the employee's position in the organization, and the characteristics of individuals who make pay decisions. The total compensation workers receive from their efforts in the labor market is a combination of wages and other benefits such as bonuses and health insurance. First, this section discusses the research on the relationship between factors related to pay determination and the gender wage gap. Second, given that total compensation typically consists of more than wages, we discuss whether differences in other aspects of compensation contribute to the gender wage gap.

Evidence suggests that the rules that guide the mode of pay negotiation affect the gender wage gap. Abraham (2017) finds that the effect of pay system formality varies with the gender of the manager and the gender of the non-managerial employee. The study finds an overall gender gap for the base salary. Additionally, the study finds that, on average, male employees who reported to male managers earned approximately 5 percent higher base salaries than male employees who reported to female managers; however, there was no difference in the base salaries of female employees based on their managers' gender. Abraham (2017) finds that female non-managerial employees earn lower base salaries across all occupational positions when compared to male employees in similar positions. However, male and female employees earned comparable formalized pay, which are compensation schemes with unambiguous rules, in each organizational position. Finally, the study shows that female managers compensate employees differently than male managers for base pay, but this effect was only present for employees ranked lowest in the organization. Bowles and Babcock (2013) study the social and financial outcomes of the strategies used by women when they are negotiating compensation. They find that negotiation strategies that make a female negotiator appear more gender-stereotype-conforming make a compensation request seem more legitimate and, therefore, lead to better financial and nonfinancial outcomes.

Studies that examine gender differences in compensation for executives reveal a great deal of heterogeneity. Using cross-sectional data collected from the Investor Responsibility Research Center, Compustat Fundamentals Annual, and Execucomp databases for firms from the United States for the years 1998–2010, Bugeja, Matolcsy, and Spiropoulos (2012) find that total compensation (which includes salaries and bonuses) for female Chief Executive Officers (CEOs) is lower than the total compensation for male CEOs, but the difference is not statistically significant. Examining the components of compensation, Bugeja et al. (2012) show that female CEOs earn higher salaries than male CEOs, and male CEOs receive larger bonuses than female CEOs; however, neither of the differences are statistically significant at conventional levels. Gayle, Golan, and Miller (2012) supplement Standard & Poors ExecuComp Database 2006 with data from Standard and Poors COMPUSTAT North America database from 1991–2006 and monthly stock price data to determine gender differences in lengths of careers, executive level, executive compensation over time, and lifetime compensation. When comparing men and women of similar experience, Gayle et al. (2012) find that women receive more than men in total pay and pay for performance for most ranks. Moreover, the study shows that, although female executives receive more internal promotions than their male counterparts, women are less than half as likely as male executives to become a CEO at any age. Simply put, when compared to men, women are less likely to reach the highest employment ranks. Hill, Upadhyay, and Beekun (2015) find that male CEOs receive greater compensation than female CEOs. Gupta, Mortal, and Guo (2018) replicate and extend the work of Hill et al. (2015)—using more comprehensive measures of compensation that include salary, bonus, the total value of restricted stocks granted, the total value of stock options granted, and long-term incentive payouts, Gupta et al. (2018) find little evidence of differences in compensation between female and male CEOs. The evidence suggests that for highly ranked positions, there is not consistent evidence of differences in compensation; however, this finding does not speak to gender differences in compensation for most positions.

It is possible that differences in preferences for the composition of the compensation package affect the gender wage gap. Using data from the 2002, 2004, 2006, and 2008 waves of the National Longitudinal Survey of Youth (NLSY), 1979, and data from the Medical Expenditure Panel Survey for the years 2002–2008, Cowan and Schwab (2016) use a difference-in-differences research design to compare workers who receive health insurance from their own employer to workers who receive their insurance elsewhere; they find that female workers face a larger wage gap when they have employer-sponsored health insurance. The study finds that employer-sponsored health insurance accounts for 10 percent of the gender wage gap. The authors compare women's wages with employer-sponsored health insurance and actual healthcare cost differences by gender to produce estimates that suggest an hourly loss in wages of $0.50 to $1.50 and a yearly loss in wages of $1,000 to $3,000. Cowan and Schwab (2016) attribute their findings to different uses of healthcare resources that vary by gender. Daneshvary and Clauretie (2007) use data from the Medical Expenditure Survey to examine a group of married men and women; the study finds that married female workers accepted wages that were about 20 percent lower in return for employer-sponsored health insurance, compared to 16.5 percent lower wages for married male workers with employer-sponsored health insurance, accounting for approximately 5 percent of the gender wage gap. In contrast to these studies, Lennon (2019) uses a difference-in-differences framework to exploit exogenous variation from the Affordable Care Act's employer mandate and finds estimates of the gender wage gap accounted for by employer-sponsored health insurance, which are smaller than estimates found in the previous literature. The proportion of the gap explained by

employer-sponsored health insurance is not statistically significant once individual medical expenses are accounted for.

Overall, the role of compensation and benefits as factors that decisively contribute to the gender wage gap is uncertain. Some evidence suggests that gender differences in compensation packages, particularly for health insurance, contribute to the gender wage gap, but this evidence is not conclusive. At least for highly ranked employees, there do not appear to be large differences in compensation. However, the fact that women are less likely than men to reach these career heights and that executive positions are a relatively small proportion of the workforce means that this finding has limited value in explanations for the gender wage gap.

Firm and Industry-Specific Employment Characteristics

As the gender wage gap has declined from 1980 to 2010, the portion of the gender gap explained by occupation and industry-specific characteristics has increased. Blau and Kahn (2017) claim that locational factors—industry and occupation—accounted for 27 percent of the gender wage gap in 1980. However, by 2010, these same factors accounted for 49 percent, nearly one half, of the significantly smaller gap in wages between men and women. This section discusses the current role of gender differences in industry, firm, and occupation of employment as more important factors that explain the gender wage gap than gender differences in human capital.

GENDER SORTING

Gender sorting across firms, industries, and occupations contributes to explaining the gender pay gap for two reasons. First, there is a sizable degree of gender segregation in the workforce (Goldin, 2014a; Kaplan and Schulhofer-Wohl, 2018). Second, firms, industries, and occupations with larger shares of female employees tend to pay less overall (Levanon, England, & Allison, 2009; Addison, Ozturk, & Wang, 2018).

On average, men and women work in different occupations and industries. However, over time, the distribution of men and women across occupations and industries has changed. Kaplan and Schulhofer-Wohl (2018) use data from the decennial censuses from 1950–2000 and the American Community Survey from 2011–2015 to estimate the distribution of occupations by sex, race, and education. They show that since 1950, both men and women have moved into managerial and professional specialty occupations and out of farming and machine operating. Further, the authors show that women have moved out of administrative support, but the share of men in that occupation remained constant, indicating a shrinking of the overall number of workers in administrative support. In contrast, men have shifted to service occupations. Using data from Table 10 of the 2016 Employment and Earnings Online and the 1970 microdata file of the U.S. Census, Blau and Winkler (2018) note that in 1970, women were more concentrated than men in administrative support occupations and service occupations; women were slightly more represented in professional and related occupations; and women were considerably more represented in female-dominant professions like teaching and nursing. Blau and Winkler (2018) show that by 2015, women were more concentrated in health and education services and that men were more concentrated in professions such as law, medicine, and engineering. Blau, Brummund, and Liu (2013a) and Blau, Brummund, and Liu (2013b) produce an index of occupational segregation based on Duncan and Duncan (1955). This index tells us the percentage of women that would have to change jobs for the occupational distributions to be identical. A value of 0 indicates no segregation, while a

value of 100 indicates complete segregation. Blau et al. (2013b) estimate that the index was 64.5 in 1970 but fell to 51 by 2009. While this decrease represents a large decline in occupational segregation, substantial differences in occupational concentration still remain.

Over time, women have moved into occupations and industries that previously were traditionally dominated by men. This change causes two opposing effects. On the one hand, as women move into occupations and industries that are male-dominated, one might expect women's wages to improve because these male-dominant occupations and industries tend to pay more. On the other hand, as the proportion of women in an occupation or industry increases, there is a possibility that the feminization of that particular occupation or industry acts to reduce the wage. Levanon et al. (2009) find empirical evidence consistent with a devaluation effect as more women enter an occupation or industry; that is, the proportion of women in an occupation affects pay, owing to devaluation of work done by women. Goldin (2014b) provides a "pollution" theory of discrimination, in which new female hires may reduce the prestige of highly male occupations and male employers may discriminate against potential female employees to protect male positions' prestige, to explain findings from Levanon et al. (2009).

In the same vein, research also suggests that some of the gender pay gap comes from women's concentration in lower paying occupations, despite these occupations requiring the same level of educational skills. Recent literature using new methodology has found evidence for the "devaluation" of occupations with a greater share of women compared to those occupations with lower percentage of women, after controlling for stable characteristics of occupations (Levanon et al., 2009; England, Allison, & Wu, 2007). Mandel (2013) and Mandel (2018) shows that the recent decline in the devaluation of occupations with higher share of women masks the educational attainment gains made by women, especially into occupations requiring high education, and the growing returns to education in general. These two opposite trends have concealed the greater decrease in pay following feminization of the occupation.

Gender sorting across occupations and industries and the changes in the distribution of genders across occupations and industries over time play an increasing role in explaining the gender wage gap. As women have moved into industries and occupations previously dominated by men, the returns to those same occupations have changed. This dynamic makes determining the impact of gender sorting on wages difficult, as the relative magnitudes of these forces depends on the idiosyncratic features of a given occupation or industry. For example, Miller (2009) finds that the gender pay gap differs in magnitude by the sector of employment; in the private sector, the gap is larger than in the public sector.

Thus far, this paper has discussed the role of gender sorting across different occupations and industries. However, these categories might be too broad to accurately explain the gender wage gap. Important gradations within a broader category could interact with gender in ways that contribute to differences in wages. For example, if men and women occupy different roles within a given occupation and there are differential returns to those roles, then researchers may improperly characterize that variation as unexplained when, in fact, they are unable to properly assess the importance of within-category variation because they lack data that are sufficiently granular.

Binder, Krause, Chermak, Thacher, and Gilroy (2010) use data on professors at the University of New Mexico to show that there are wage penalties for women at the university level rather than at the department level. Cech (2013) uses a sample of college graduates who are employed in the engineering field and finds a gender wage gap of approximately 16 percent, which is equivalent to $13,000, between

men and women. Furthermore, she finds that female engineers are more likely than their male counterparts to be employed in nontechnical subfields or to engage in social work activities that require communicative, emotional, and/or people skills. Joo Lee and Won (2014) find that universities where 10 percent of the full professors are women pay $28,252 more than institutions where 20 percent of the full professors are women. But, female representation at the assistant and associate professor levels are not systematically related to disparities in pay.

Rabovsky and Lee (2018) find that the gender pay gap was smaller in colleges where women comprise a majority of managerial staff and senior faculty. Hoisl and Mariani (2017) find, on average, that women earn approximately 14 percent less than male inventors. The authors find no difference in the quality of inventions between men and women; however, they do find that working in the research and development area was a strong predictor of differences in income. Choi (2018) shows that, for federal employees, redistributive agencies—for example, education and health care—that employ more women in traditionally male-dominated occupational categories tend to pay less than distributive and regulatory agencies, while women that work in distributive agencies are in low-paying jobs. These facts mean that the effects of the agency and the effects of the occupation offset each other. Babcock, Recalde, Vesterlund, and Weingart (2017) provide experimental evidence that women are more likely than men to be asked and to agree to take on tasks with low chances of promotion. The fact that women are more likely than men to take on tasks that are not strongly associated with possibility of promotion leads to slower progression in an organization for women relative to men, which may lead to furthering of the gender wage gap.

Overall, this evidence shows that to fully understand the contribution of gender sorting across firms, industries, and occupations to the magnitude of the gender wage gap, we must also carefully consider the differences between men and women in the roles that they occupy in these broader categories.

CHARACTERISTICS AND FEATURES

Firms, occupations, and industries are heterogeneous with respect to the flexibility of work hours and skill requirements. If men and women place different values on the attributes presented by different employment opportunities, then they could rationally select different occupations. If differences in the reward structure for the different aspects of employment opportunities are present, then the combination of differential selection of employment opportunities and differences in returns to the attributes of different employment opportunities may lead to differences in earnings between men and women.

Goldin (2014a) argues that there are firms that disproportionately reward workers who labor long hours and work particular hours. She shows that the costs of providing flexible work hours vary across occupations. In particular, the wage penalty for temporal flexibility is high in what the author terms “Nonlinear Occupations”—for example, law. These occupations typically involve tight deadlines, strict schedules, and tasks for which there are not close substitutes. For these occupations, the rate of compensation is an increasing function of hours worked. Cha and Weeden (2014) produce estimates consistent with this hypothesis and show rising returns to overwork (defined as working more than 50 hours per week) and the fact that a greater proportion of men engage in overwork, which raises men’s wages relative to women’s wages, exacerbating the gender wage gap by an estimated 10 percent of the total wage gap. Moreover, Cha and Weeden (2014) show that trends in the gender wage gap were most pronounced in professional and managerial occupations. Chen and Chevalier (2012) produce similar

evidence for physicians and show that male physicians earn higher wages over many more hours than their female counterparts. The wage penalty is not as high in what Goldin (2014a) calls "Linear Occupations"—for example, pharmacy. For these occupations, the rate of compensation is constant; therefore, compensation increases linearly as a function of hours worked. Goldin and Katz (2016) show that the gender wage gap is low relative to similar occupations at 4–7 log points, a large decrease from 34 log points in 1970. They argue that the decrease is due to the high degree of substitutability between pharmacists, as a result of their specialized training and the standardization of drugs.

Temporal flexibility is an amenity in a theory of compensating differentials. Workers who value flexibility essentially pay for it by accepting lower wages. Wiswall and Zafar (2016) find that women, on average, trade higher wages for jobs with greater work flexibility and job stability and that men prefer jobs with higher earnings growth. Prokos, Padavic, and Schmidt (2009) show that, among a sample of scientists and engineers in the United States, women are overrepresented in nonstandard work arrangements, those that lack at least one of three markers of standard work: a direct relationship between employer and worker, full-time work, and an assumption that the employment relationship continues over time. In particular, women are engaged in opportunities characterized by lower wages and benefits. Differential sorting by genders across jobs, given differences in preferences for flexible work hours, contributes to the gender wage gap. However, as Goldin (2014a) notes, efforts to change the structure of work such that workers are more easily substitutable and efforts to reduce the need for long hours have the potential to reduce the gender wage gap.

Acemoglu and Autor (2011) provide a detailed discussion of how the changing returns to skill levels, the supply of skills, and the structure of demand for those skills interact to affect the distribution of wages. The interplay of differences in skill requirements across occupations, gender differences in skill endowments, and the change in the returns to skill are potentially important determinants of gender differences in wages. Deming (2017) finds that the rewards for social skills are increasing and that the fastest growing high-skill occupations—for example, managers, teachers, nurses, and therapists—require significant interpersonal interaction. Bacolod and Blum (2010) argue that a substantial increase in the value of cognitive skills and people skills (for which women, on average, have comparative advantage) and a decline in the value of motor skills (where men, on average, have a comparative advantage) account for 20 percent of the narrowing gender wage gap. Yamaguchi (2018) shows that, on average, men have better motor skills than women, but the returns to motor skills have dropped significantly, which accounts for a part of the narrowed gender wage gap from 1980 to 2000 and hence, the technological changes during those two decades are responsible for the narrowing the gender wage gap. From 2000 to 2010, the gender wage sap continued to decline slowly but the author attributes this to the growth of women's cognitive skills relative to men. The evidence supports the idea that differences in skill requirements across different occupations are an important determinant of gender differences in pay, given differences in the skills that men and women bring to the labor market.

Fundamental economic features such as market power and vulnerability to globalization are features of particular firms, industries, and occupations that potentially affect the gender wage gap. Ransom and Oaxaca (2010) use data from a chain of grocery stores to estimate the labor supply elasticities of both men and women and find that the labor supply of women is relatively more inelastic than men. They conclude that a Robinson-style model of monopsony—where a firm has influence on wages given its influence on the quantity of labor that is demanded in a given market—explains the difference in compensation between men and women in the grocery industry. The firm having market power allows it

to price-discriminate; the relatively lower labor supply elasticity of women means that the firm can offer relatively lower wages to women because women, at least in the grocery industry, are not as responsive to changes in wages. Kongar and Price (2010) show that women's low-wage employment declined in occupations at risk of being offshored, which led to a decrease in the gender wage gap for those women who remain employed, as those at the bottom of the wage distribution are more likely to lose their jobs.

The features and characteristics of firms, industries, and occupations matter while understanding why the gender wage gap exists. Though these characteristics and features are discussed separately, it is important to recognize that they are inextricably linked to other factors. For example, a lawyer attempting to make partner at a prestigious firm must put in long hours, meet tight deadlines, and adhere to strict schedules. In addition, this environment is highly competitive because there are many lawyers competing for few slots. A competitive work environment, long work hours, and lack of flexibility are not separable in this context. Therefore, the characteristics and features of firms certainly affect gender sorting across firms, industries, and occupations. Any analysis that seeks to understand the contribution of firm-, industry-, and occupation-specific characteristics of the gender wage gap must acknowledge the contribution of these interactions.

Work Experience, Career Interruptions, and Labor Force Attachment

The degree to which work experience, career interruptions, and labor force attachment influence the gender wage gap is directly related to differential responses to familial, marital, and child-rearing responsibilities. Lachance-Grzela and Bouchard (2010) summarize the research on the allocation of household labor among couples and show that, despite making substantial gains in the labor market, women are responsible for approximately two-thirds of routine household tasks. The unequal allocation of domestic labor, conditional on marriage, means that it is more difficult for women to occupy positions that require long hours, strict schedules, and tight deadlines. Hotchkiss and Pitts (2007) find that men earn a marriage premium while women receive a marriage penalty. Erosa, Fuster, Kambourov, and Rogerson (2017) also analyze gender differences in labor market outcomes that arise due to gender asymmetries in home production responsibilities. They find that an exogenous difference in time devoted to home production of 10 hours per week increases the observed gender wage gap by roughly 11 percentage points and decreases the share of women in occupations requiring long hours by 14 percentage points. Barth, Kerr, and Olivetti (2017) find that for college-educated men and women, the gender earnings gap widens by 44 log-points between the ages of 24 and 45 years old and is primarily due to differential earnings growth within establishments; however, between establishments, movement is also important for this group and accounts for 27 percent of the widening earnings gap. For people with no college, Barth et al. (2017) find that the earnings gap increases by 27 log points between the ages of 24 and 45 years old and that the gap is fully explained by differential moves by men and women across establishments. They conclude that, for both education groups, the between-establishment component of the increasing wage gap is due almost entirely to those who are married. Marriage, on average, increases the cost of devoting more time to the formal labor market for women, which makes it more difficult to move across establishments and take on positions that require more of a time investment. This difficulty exacerbates the gender wage gap. Moreover, Liu (2016) finds that the preference for part-time work increases among women who are married and that the preference for part-time work does not increase among men who are married. This difference in preferences for part-time work between married men and married women accounts for 6 percent of the gender wage gap.

On average, women are primarily responsible for childcare duties, and these duties are time intensive. For example, Jolly et al. (2014) examine a sample of physician recipients of highly selective National Institutes of Health grants made to early-career researchers who hold clinical doctorate degrees to support their career development and who had an active academic affiliation at the time of the survey. The study finds that, among couples with children, female physicians spend 8.5 more hours per week on domestic duties than their male counterparts spend. Women, on average, also perform a greater share of household labor than their male partners perform (Oslawski-Lopez, 2016). The unequal division of childcare responsibilities increases the chance that women's labor market experiences will be more sporadic and that women will face more difficulty obtaining positions that have inflexible schedules and heavy time commitments—the jobs that Goldin (2014a) finds offer large returns to earnings. Furthermore, research supports the idea that having a child, on average, exacerbates the gender wage gap. Sigle-Rushton and Waldfogel (2007) estimate that non-mothers earn 64 percent of men's earnings while mothers earn between 52 and 57 percent of men's earnings. Bertrand, Goldin, and Katz (2010) use data on MBAs from the University of Chicago to show that male and female MBAs have similar earnings at the beginnings of their careers; however, their earnings quickly diverge. A decade after completion of an MBA, men have nearly 60 log points of advantage over women. Chung, Downs, Sandler, and Sienkiewicz (2017) find that the spousal earnings gap doubled in the 2 years before and the first year following the birth of the first child. They show that the increase in the spousal earnings gap is driven by a decrease in the earnings of the female spouse. These studies show that parenthood is an important contributor to the gender wage gap.

Bailey and Lindo (2017) describe the relationship between access to contraceptives and a number of demographic changes—for example, declines in family size, declines in fertility, increases in the ages at which women first give birth, increases in the ages at which women get married, and increases in non-marital childbearing. Namely, the study finds that the availability of contraceptives to some degree decoupled marriage and childbearing and offered women more control over reproductive decisions. Bailey (2006) finds that the availability of oral contraceptives increased the number of women in the paid labor force and increased the number of annual hours worked by women. This conclusion is consistent with the increasing labor force participation rate of women in the latter part of the 20th century (Juhn & Potter, 2006). The changes outlined above also contributed to the decline in the difference in full-time experience presented in Blau and Kahn (2017).

Gender differences in work experience, career interruptions, and labor force attachment are important contributors to the gender wage gap. Munasinghe, Reif, and Henriques (2008) find that the labor market returns to experience are lower for women than for men. The study uses a decomposition analysis to show that the wage return to job tenure is lower for women than for men and that the wage return to experience is higher for women than for men. The authors argue that the differences in wage returns are driven by the fact that women are not as attached to their jobs as men are to theirs, and the authors provide the following supportive evidence for their hypothesis: (1) Women are more likely to quit their jobs; (2) women take substantially fewer hours of company-provided training; and (3) women are more likely than men to report that they expect not to work after age 35. Indeed, the bulk of the difference in hourly wages between married men and married women reported in Hotchkiss and Pitts (2007) is due to intermittency. Furthermore, a primary source of the gender pay gap in work experience, career interruptions, and labor force attachment is differential responses to marriage and parenthood. Changes in marriage and fertility patterns over time have contributed to a decrease in relative differences

between men and women in work patterns over time. Still, the evidence clearly shows that remaining differences in work experience, career interruptions, and labor force attachment explain a portion of the mean wage differences. Goldin (2014a) points out, however, that high levels of experience and the capacity to avoid career interruptions matter for highly paid occupations. Differences in these factors are particularly relevant to gender differences in wages at the top of the wage distribution, which has seen less convergence in wages between the genders than seen in the lower portions of the wage distribution.

Labor Market Discrimination

The Oaxaca-Blinder decomposition (Kitagawa, 1955; Oaxaca, 1973; Blinder, 1973) is often used to provide evidence of discrimination in the labor market. Unexplained differences in earnings are consistent with the labor market discrimination theory; however, the presence of unexplained differences in earnings does not prove the existence of labor market discrimination. If there are important *unmeasured* differences between men and women that are related to earnings but missing, then these differences also contribute to the unexplained gap in earnings but are not due to labor market discrimination. In addition, discrimination can affect the educational and labor market decisions of the discriminated group. If this is the case, then discrimination affects both the explained and unexplained portion of the wage gap from the decomposition, as the explanatory variables are affected by the presence of discrimination. The traditional Oaxaca-Blinder decomposition posits that wages are a linear function of the explanatory variables, and the presence of unmeasured discrimination is a case of omitted variables bias. Since the coefficients are part of both the explained and unexplained portions of the wage gap, the results of the decomposition, in this case, are wrong. Blau and Kahn (2017) make a similar point, noting that modern efforts to measure discrimination employ research designs that are not as vulnerable to this issue.

On average, motherhood penalizes the earnings of women (Jolly et al., 2014; Oslawski-Lopez, 2016; Sigle-Rushton & Waldfogel, 2007). The mechanism by which this penalty occurs is not well understood. Correll, Benard, and Paik (2007) propose status-based discrimination as a mechanism. If motherhood is perceived as a devalued status by employers, then employers may judge mothers more harshly. Status-based discrimination is similar to statistical discrimination; however, status-based discrimination is different in that it claims that the standard used to evaluate workers is systematically biased in favor of high-status groups. The authors use a laboratory experiment to evaluate the hypothesis that status-based discrimination may explain the gender wage gap. They perform an audit study of employers advertising for both entry- and mid-level marketing and business job openings at a large, northeastern American city newspaper over a period of 18 months. They find that mothers were penalized on numerous measures; for example, a woman's status as a mother affected perceptions of her competence and influenced her recommended starting salary. Men did not suffer a penalty for fatherhood. Therefore, the audit study shows that employers discriminate against women who are mothers.

If employers believe that mothers, on average, are less likely to be attached to the labor market, then the employment opportunities for mothers could suffer, even though mothers vary in their degree of labor force attachment. Thomas (2015) produces a theoretical model in which firms underinvest in women, due to a belief that women are likely to work fewer hours than men in the future. The author further argues that given asymmetric information (firms are unable to discern an individual's

attachment to the labor market), mandated/government-provided family leave benefits exacerbate the issue because their presence makes employment more attractive to women who, absent the availability of mandated benefits, might not participate in the labor force. The author provides empirical evidence in support of this model.

Reuben, Sapienza, and Zingales (2014) study the effect of gender-based stereotypes in an experimental market where subjects were hired to complete an arithmetic task for which both genders perform equally well on average. They find that, lacking information other than the candidate's appearance (including gender), both male and female employers were more than twice as likely to hire a man than they were to hire a woman. The study illustrates that the discrimination persisted when performance was self-reported: Men tend to overreport their performance, and women tend to underreport. Discrimination was reduced but not completely eliminated when information about performance on the task was available.

In contrast to the studies discussed above, Williams and Ceci (2015) find evidence to support the hiring of women instead of men. They examine five audit hiring experiments in which faculty evaluated hypothetical female and male applicants for assistant professorships in biology, engineering, economics, and psychology. Both male and female faculty members preferred female applicants at a ratio of 2 to 1 for all fields except economics. In addition, the study finds that women faculty members preferred divorced mothers to divorced fathers. Male evaluators preferred mothers who took parental leave more than mothers who opted not to take parental leave.

Discrimination results in suboptimal labor market outcomes, adversely affects the outcomes of individuals, and likely reduces overall productivity. Second, discrimination affects the reliability of metrics used to possibly detect discrimination. Clearly, discrimination has real effects, and its existence is resistant to measurement using standard methods. Moreover, different types of discrimination require different types of policies. Neumark (2018) points out that the most natural policy to ameliorate the effects of taste-based discrimination is to raise the cost of engaging in discriminatory behavior while implementing statistical discrimination policies that increase both the availability and reliability of information are likely to be effective. Policymakers must exercise caution in contending with these issues.

CAVEATS FROM THE LITERATURE REVIEW

Our literature review provides a snapshot of the state of the field in explaining gender wage gap as of 2019. As we expected, the picture is complex, given the way social sciences (including economics) approach multidimensional problems—incrementally, focusing on one dimension at a time. As such, no one should expect to find "the" answer to understanding the causes of the gender wage gap. Nevertheless, general themes that have emerged help to inform interpretations of the empirical analysis conducted in this study.

First, the closing and even reversal of human capital gaps in both education and work experience, coupled with seemingly persistent wage gap between the genders, have led to research focusing on potential unobserved factors, such as differences in preferences for risk and, to some extent, evolving societal gender roles. For example, in the labor market, differences in preference for risk may intersect with how firms offer compensation and benefits, the relative security of different occupations, and

workers' desires for work-life balance and family, including marriage and children—all resulting in a logical, efficient, and persistent gender wage gap. However, the existence of such an equilibrium means social/behavioral structures exist to keep this equilibrium in place (such as men protecting their participation share in traditionally male-dominated occupations). This causes inefficiency in the form of labor market gender discrimination, although this inefficiency is somewhat veiled by the differences in preferences that may be driven by society or discrimination and the constraint of preferences based on traditional gender roles and occupation reinforcement.

Second, persistent wage gaps have encouraged more literature to focus on how education affects occupational choice. For example, recent research has challenged the rationale that there are innate differences in mathematics ability between men and women. Instead, research has been focused on social structures in schools that may nurture such differences in ability, indicating that policy aimed at reducing gender discrimination may need to start before individuals even enter the labor market.

A final takeaway is that the *quantitative* analyses, like those presented in this study, require corresponding *qualitative* analyses to better understand the findings. For example, an estimate associated with an occupation likely absorbs the effects of some of the unobserved factors, thereby causing us to attribute the entire effect (or lack of effect) to the occupation. We then miss the opportunity to acquire a more nuanced understanding of the findings. For example, some industry/occupation combinations may differ regarding how an individual's unobserved factors may influence his or her choices; by comparing findings between industry/occupations, we may be able to better understand the relative importance of individual preferences. This missingness of important factors that explain the gender wage gap leads to admission of some omitted variables in the models and these variables also have statistical consequences on the other correlated variables, which can only be addressed quantitatively with additional data.

ANALYSIS

Data

This study uses the Current Population Survey Outgoing Rotation Group (CPS ORG) to examine the factors related to gender wage gap. The CPS is a monthly survey, administered by the U.S. Census Bureau, of 50,000–60,000 households that provides data on persons aged 16 and older. The interviews are conducted once a month for 4 months; then after 8 months, the interviews are again conducted once a month for another 4-month period. The CPS ORG data are assembled from the last month in each 4-month series. The study obtained public-use extracts of the CPS ORG files from the Integrated Public Use Microdata Series (IPUMS).[8] The sample for 2018 (approximately 125,000 people) represents salaried, non-farm workers between the ages of 25 and 64 years.[9] The study team removed workers

[8] IPUMS provides harmonized variables that simplify the construction of longitudinal datasets. Based on existing literature, CPS data extracted from IPUMS also provide flexibility to explore variables and recode them to more meaningful explanatory factors for the analysis, compared to the CPS ORG extract from the Center for Economic and Policy Research or the National Bureau of Economic Research (NBER).

[9] Data extraction from IPUMS uses the following restrictions: age > 15 years, month in sample is 4 or 8, only salaried workers (given by class of worker).

with no reported weekly earnings or no usual weekly hours, as well as workers earning less than 50 percent of the federal minimum wage.[10] The CPS ORG data include earnings weights,[11] also known as the outgoing rotation weights, which we use to represent the labor force.

To maintain the confidentiality of respondents and to prevent the identification of individuals with very high or very low incomes, the U.S. Census Bureau has a system of topcoding reported income. The system of recoding varies by year, but for the 2018 data, all values greater than the income topcode were ranked from lowest to highest and systematically swapped with other values within a bounded interval. However, including topcoded data comes with its own set of challenges. Topcoding makes it difficult to produce accurate measures of gender wage differences, especially in the higher percentiles of the wage distribution. The study team has attempted to address this issue by presenting results, excluding topcoded wages, in Appendix A. To understand the gender wage gap, we explore multiple methods that examine the CPS data in the following sections.

Methodology

A simple definition of the gender wage gap is the difference in average pay between men and women. This measure is often referred to as the "unadjusted" gender pay gap because it fails to account for differences in factors that may logically impact women's and men's wages. The gender wage gap obtained after controlling for differences in individual characteristics is called the adjusted gender pay gap. Decomposition of the gap involves estimating the proportion of the overall gender pay gap stemming from differences in individual and other characteristics and, therefore, the remaining portion of the gap that is unexplained by such characteristics.

The decomposition methods used here can be classified as (a) mean decomposition method employed by Oaxaca (1973) and Blinder (1973); (b) beyond the mean decomposition, including quantile regression method employed by Chernozhukov, Fernandez-Val, and Melly (2013); and (c) recentered influence function (RIF) regression employed by Firpo, Fortin, & Lemieux (2009).

MEAN GENDER WAGE GAP

Analysis of the mean gender wage gap is based on wage regressions, such as the following:[12]

$$(1)\quad \ln(W_m) = \alpha_m + \beta_m X_m + \varepsilon_m$$

$$(2)\quad \ln(W_f) = \alpha_f + \beta_f X_f + \varepsilon_f$$

$$(3)\quad \ln(W_p) = \alpha_p + \beta_p X_p + \varepsilon_p$$

[10] We compared the final IPUMS CPS ORG sample with the NBER CPS ORG sample to verify the data extraction and found the sample size to be larger by 8,000 observations. Further investigation revealed that the indicator variable to identify those eligible for the earner study were overstated in the IPUMS data. This event was corrected by comparing the descriptive statistics and sample size from the two datasets.

[11] The earnings weight is provided only to adult civilians in the two outgoing rotations (4 and 8) (see page 11 of the report found at https://www.nber.org/morg/docs/cpsx.pdf). The earnings weight is roughly four times the original person weight. The earnings weight makes the data comparable for monthly files.

[12] Regression is a statistical technique for estimating the relationship between the mean value of some variable (wages) and other variables (worker and job characteristics.

In equations (1)–(3), $\ln(W)$ is the natural logarithm of the wage (e.g., hourly wage or annual earnings), X is a vector of characteristics that determine wage differences, β is a vector of coefficients that represent the incremental return of the X; α is an intercept; and ε is an error term. The subscripts denote m–males, f–females, and p–pooled (including both men and women). The main parameters that define each relationship (α and β) can be estimated using ordinary least squares (OLS), will be referred to as "estimated coefficients," and are denoted by as and bs.

The adjusted wage gap can be estimated from the pooled regression (3) and by including an indicator for gender as part of the observable characteristics (Fryer & Levitt, 2004; Neal & Johnson, 1996).

Following Oaxaca (1973) and Blinder (1973), hereafter the OB method, more detail about the adjusted wage gap can be illuminated by estimating equations (1) and (2). To "decompose" the explained and unexplained differences at the mean can be calculated using equation (4):[13]

$$(4)\quad \overline{\ln(W)}_m - \overline{\ln(W)}_f = b_m\left(\overline{X}_m - \overline{X}_f\right) + \overline{X}_f(b_m - b_f).$$

In equation (4), $b_m\left(\overline{X}_m - \overline{X}_f\right)$ is the part of the observed difference in the means of log wages explained by observed differences in the characteristics, and $\overline{X}_f(b_m - b_f)$ is the part that is unexplained by the characteristics. Note that the first term of equation (4) is the difference between the mean values of men and women on each characteristic multiplied by the men's value of each respective characteristic, while the second term is the difference in the characteristic values multiplied by the characteristics of women. This process estimates the explained difference in earnings, given the observed differences between men and women and assuming each characteristic has the men's value (using b_m instead of b_f). This process causes some dissymmetry in the effects depending on which gender is considered to be the reference group. Cotton (1988) argues that undervaluation by one group might cause overvaluation in the other. Reimers (1983) proposes a method to address this limitation using the average coefficients over both groups as an estimate for the nondiscriminatory parameter. Neumark (1988) and Jann (2008) suggest the use of the coefficients from a pooled regression over both groups as an estimate for the explained portion of the gender pay gap. This approach was further supported by Oaxaca and Ransom (1994) and is reported in the study team's analyses that use the coefficients from a pooled model over both groups as the reference coefficients.

GENDER WAGE GAP ACROSS THE DISTRIBUTION

Decomposition methods can go beyond the mean and examine the difference in each percentile of men's and women's wages (i.e., across the distribution of wages for both groups). For example, if researchers are interested in examining the factors that contribute to differences in wages between men and women at the bottom of the distribution of wages (for instance, the 10th percentile) or at the top of the distribution (for instance, the 90th percentile), then decomposition methods that focus on the mean are inadequate. More recent innovations in decomposition methods, motivated by quantile regression as introduced by Koenker and Bassett (1978), have increasingly focused on features of the

[13] We use bars to denote means of variables (e.g., the mean of X is denoted as $\overline{X}$).

distribution of a given outcome. These methods assume that there is a mapping from explanatory factors to outcomes and that this mapping is constant.

In a seminal paper, Juhn, Murphy, and Pierce (1993) explain a method (the JMP method) that examines the profile of the wage gap across the wage distribution. The JMP method decomposes the differences between the quantile function of the natural logarithm of wages by gender. We estimate two counterfactual distributions using this method. First, if the distribution is based on the characteristics distribution of, for instance, women, then we estimate the mean coefficients for women and the residual distribution for men. Second, we estimate the distribution based on the characteristics of women and the conditional distribution of wages for men. We use these counterfactuals to decompose differences in distribution into three components—namely, residuals, mean coefficients, and characteristics.

Total gender wage gap = difference in residuals + difference in coefficients + difference in characteristics

The coefficients are estimated by a linear mean regression. The distribution of residuals is estimated independent of the explanatory variables by the unconditional distribution of the estimated residuals. Therefore, the distribution of wages is a function of the explanatory variables, the OLS coefficients, and the distribution of the residuals (which are assumed to be independent from the explanatory variables).

Melly (2005) and Autor, Katz, and Kearney (2005) build on the JMP method by estimating the distribution of the residuals using a family of quantile regressions. This method avoids assuming that the residuals are independent from the covariates, as in the JMP method. In this approach, we estimate the distribution of wages conditional on explanatory variables by using linear quantile regression. Here, the distribution of wages is a function of the distribution of the covariates, the median regression coefficients, and the other quantile regression coefficients that estimate the conditional distribution of the residuals. We can then estimate the counterfactual distribution of wages that would hold among women if their distribution of characteristics was the same as that of men.

Following this method, Chernozhukov et al. (2013) developed an approach (the CFM method) that decomposes unconditional intergroup gaps between men and women at a given percentile into two portions: a portion due to the distribution of characteristics and a portion due to different wage functions conditional on characteristics. Basically, this method allows researchers to assess the contributions of both changes in the distribution of covariates that determine the outcome and changes in the mapping from covariates to outcomes on the distribution of a given outcome, like wages. This method involves creating a hypothetical wage distribution for women in which they are compensated according to the male wage function. The difference between the unconditional distribution of log wages with the male wage function and the hypothetical wage distribution is the effect of the distribution of characteristics (which corresponds to the explained portion of the OB method). The difference between the hypothetical wage distribution and the unconditional distribution of log wages with female wage function is the effect of coefficients (which corresponds to the unexplained portion of the OB method). We follow this procedure to estimate 100 quantile regressions and the conditional wage distribution and compute standard errors using bootstrapping with 50 repetitions.

By using a form of quantile regression to estimate the distribution of the residuals, the CFM method does not assume that the residuals are independent of the individual characteristics. The method is also path-independent. The results of the decomposition are not influenced by the order in which the

various components of the detailed decomposition are calculated. However, the method is unable to provide detailed decomposition as contributed by each covariate.

RECENTERED INFLUENCE FUNCTION APPROACH

Firpo et al. (2009) present an alternative method (the RIF method) to examine the gender wage gap across the distribution of wages and to provide detailed decomposition with the effect of each covariate on the gap between the two groups. Influence functions are tools that have been used to analyze the robustness of distributional statistics to small disturbances in data. Provided the necessary assumptions hold true in this method, one could create a counterfactual scenario to produce the distribution of earnings that women would experience if they were awarded the same return to characteristics as men. However, the issue with creating the counterfactual is that we do not directly observe the distribution of the characteristics and wages for the counterfactual. Hence, the counterfactual component is approximated using a reweighting factor generated by reweighting the distribution of wages for men such that the distribution of covariates is identical to that of women.

In this method, the regression coefficients explain how much the average influence of observations vary with a variable, holding other covariates constant. In other words, the RIF method helps estimate unconditional quantile regression that allows to obtain partial effects of explanatory factors on any unconditional quantile of wages.[14] It is a two-stage procedure that decomposes changes or differences in the distribution of wages. The first stage involves dividing the distributional changes into a wage structure effect (corresponds to the unexplained portion of the OB method) and a composition effect (corresponds to the explained portion of the OB method) using the reweighting method. The wage structure effect is given by the sum of a pure wage structure effect and the reweighting error that assesses the overall fit of the model. The composition effect is defined by the sum of a pure composition effect and a specification error that is used to assess the importance of departures from linearity. The second stage involves dividing these two components further into the contribution of each explanatory variable using RIF regressions in combination with the OB method.[15] To summarize, the RIF method estimates the impact of the explanatory variables on the distributional statistic of interest and also provides a detailed decomposition of each explanatory factor. This presents an advantage over the other distributional methods and the OB method.

Descriptive Summary

In this section, we employ the alternative methodologies discussed above to provide estimates of decompositions of the U.S. gender wage gap from the 2018 CPS ORG data. Table 1 presents a summary of characteristics for men and women in the age group 25 to 64 years for 2018. To add perspective, we have included the characteristics for men and women in the same age group for 2010. Hourly wage rate is defined as the ratio of total weekly earnings and number of hours worked in a usual week. The statistics indicate that, in 2018, the average unadjusted wage rate among men was 19 percent higher than the average wage rate among women, approximately the same as in 2010. Marital status is a binary variable to indicate whether an individual is married or not, while number of children is classified

[14] The simplest method to estimate the unconditional quantile regression is the RIF-OLS implemented using the Stata command "rifreg."

[15] The oaxaca_rif command is used for this type of decomposition in Stata.

into three categories: those with no children, those with one child, and those with more than two children. Individuals with no children are used as the reference group in the analysis. There were relatively fewer married individuals and as a result a higher percentage of individuals reporting having no children in 2018 compared to 2010. We have also made an attempt to capture the contribution of citizenship to the gender wage gap by defining the categories as individuals who are non-U.S. citizens, U.S. citizens, or naturalized citizens. Non-U.S. citizens are used as the reference group in the analysis. Race has been categorized as white non-Hispanic, black non-Hispanic, Asian non-Hispanic, Hispanic, and other non-Hispanic, with white non-Hispanic as the reference group. The male-to-female ratio fell noticeably for Hispanic people, indicating relatively more Hispanic women in the labor force in 2018 compared to 2010.

Geographical location is defined by two types of variables. One of these variables is a dichotomous variable to indicate whether an individual is a resident of a metro area, or not the second is a categorical variable using the four Census regions (the northeast region is the reference category). Differences between men and women in geographic locations were small.

As observed in the literature review, a larger percentage of women are earning advanced degrees in 2018 compared to women in 2010. The share of women with bachelor's degrees increased from 24 percent to 28 percent between 2010 and 2018, with a similar increase in the share of women obtaining master's degrees (11 percent to 13 percent). The male-to-female ratio for professional degrees fell by almost 0.4 (decrease of 28 percent from 1.35 to 0.97), similar to the decline in the ratio for doctoral degrees (decrease of 26 percent from 1.48 to 1.09).

The actual work experience is not captured in CPS. To overcome this limitation, an approximate value of work experience is constructed using education and age. The study team has derived potential work experience by subtracting the number of years of schooling and six years (start of the schooling) from the individual's current age (Mincer, 1974). Number of years of schooling is not directly reported by the respondents and has been derived from an individual's education. Since potential work experience and years of schooling are both derived from reported data and are not directly observed, one can expect some amount of measurement error in the estimates as a result of this approximation. However, it is essential to account for work experience as it is an important factor in explaining the gender wage gap. Another measure used to identify the skill of a worker is professional certification, which indicates whether the respondent has a professional certification or state and industry license. In 2018, women had more potential work experience and a higher percentage of women reported having professional certifications than was reported by men. Occupations have been classified into 22 categories, and industries have been classified into 13 major categories, excluding those individuals in the armed forces. It is also necessary to acknowledge the role of men and women sorting into occupations prior to joining the labor market by choosing certain majors in college. This fact is especially relevant when examining the role of women in STEM fields. Comparing the percentage of men and women employed in each occupation in 2018, fewer women work in STEM occupations, but women have made relative gains in STEM since 2010.[16] Reviewing the percentage of women in occupations and industries may help explain some of the gender wage gap, as some of the gap may be due to such gender differences in occupation

[16] STEM occupations are defined using https://www2.census.gov/programs-surveys/demo/guidance/industry-occupation/stem-census-2010-occ-code-list.xls.

and industry. The detailed classification of the percentage of men and women in these occupations and industries is presented in Tables A.2 and A.3.

Compared to women, a larger percentage of men were receiving overtime pay in 2018, and this ratio has changed little since 2010. While women more frequently choose to work part-time,[17] the male-to-female ratio of part-time workers fell from 0.36 in 2010 to 0.34 in 2018.

The characteristics listed in Table 1 indicate that, in 2018, women are equal to men with respect to basic demographics, education, and experience. We observe larger variations in occupation, industry, and part-time work. Following the difference in the baseline characteristics of men and women, the tables presented below examine the contribution of these variables in explaining the gender wage gap.

Table 1 | Descriptive Statistics Comparing 2010 and 2018

	2010			2018		
	Male	**Female**	**Male-to-Female Ratio**	**Male**	**Female**	**Male-to-Female Ratio**
Unweighted *N*	**65,130**	**65,817**		**63,082**	**61,028**	
Raw wage gap		**0.175**			**0.174**	
Wage						
Hourly wage rate ($)	24.040	20.130	1.194	28.490	24.030	1.186
Natural logarithm of wage	3.013	2.838	1.062	3.185	3.011	1.058
Demographics						
Age	42.550	43.260	0.984	42.680	43.130	0.990
Married (%)	68.3	62.7	1.089	64.2	59.3	1.083
Number of Children						
0 children (%)	49.5	45.9	1.078	52.0	47.4	1.097
1 child (%)	18.8	23.0	0.817	17.8	22.0	0.809
> = 2 children (%)	31.6	31.1	1.016	30.3	30.6	0.990
Citizenship						
Non U.S. Citizen (%)	11.2	6.9	1.628	11.4	7.8	1.456
U.S. Citizen (%)	81.2	85.6	0.949	79.6	83.0	0.959
Naturalized citizen (%)	7.7	7.6	1.013	9.0	9.1	0.987
Race						
White non-Hispanic (%)	66.9	68.1	0.982	61.4	61.4	1.000
Black non-Hispanic (%)	9.6	12.9	0.747	10.8	13.7	0.788
Asian non-Hispanic (%)	5.1	4.9	1.053	6.7	6.7	1.008
Hispanic (%)	16.6	12.4	1.339	18.8	15.7	1.197
Other non-Hispanic (%)	1.7	1.8	0.934	2.2	2.5	0.890
Location						
Metro area (%)	85.8	85.0	1.009	88.4	88.1	1.003
Northeast (%)	18.7	19.3	0.969	17.6	18.5	0.951
Midwest (%)	21.9	22.8	0.961	21.1	21.7	0.972
South (%)	36.0	36.2	0.994	36.7	37.2	0.987
West (%)	23.4	21.7	1.078	24.6	22.6	1.088
Education and Human Capital Development						
Years of schooling (expected)	14.250	14.600	0.976	14.470	14.960	0.967
Without high school degree (%)	9.6	6.1	1.584	8.1	5.1	1.574
High school degree or equivalent (GED) (%)	29.5	26.0	1.135	27.9	22.0	1.268
Some college but without degree (%)	16.7	17.4	0.960	15.4	15.3	1.007

[17] Part-time work is defined as working fewer than 35 hours a week.

	2010			2018		
	Male	Female	Male-to-Female Ratio	Male	Female	Male-to-Female Ratio
Associate's degree from academic/occupational program (%)	9.5	12.8	0.741	10.1	12.7	0.795
Bachelor's degree (%)	22.7	24.4	0.930	24.8	27.8	0.892
Master's degree (%)	8.4	10.7	0.785	9.9	13.3	0.741
Professional degree (%)	1.8	1.3	1.353	1.5	1.6	0.968
Doctorate degree (%)	1.9	1.3	1.481	2.3	2.1	1.089
Professional certification (%)	n/a	n/a	n/a	22.1	29.2	0.757
Employment Characteristics						
STEM occupations (%)	7.9	2.5	3.155	11.7	4.1	2.826
Healthcare industry (%)	5.7	24.6	0.233	5.9	24.7	0.240
Private sector (%)	84.4	78.2	1.079	86.6	80.4	1.077
Union coverage (%)	15.4	14.2	1.085	13.3	12.5	1.064
Percentage of female workers in person's industry	42.6	57.7	0.738	41.7	56.6	0.737
Percentage of female workers in person's occupation	37.6	62.3	0.604	37.4	60.6	0.617
Work Experience						
Part-time work (< 35 hours per week) (%)	7.1	19.7	0.358	5.9	17.1	0.342
Part-time work for economic reasons (%)	4.4	5.4	0.814	2.0	2.7	0.733
Part-time work for school/training (%)	0.6	0.9	0.665	0.7	1.0	0.657
Part-time work for family reasons (%)	0.1	1.0	0.083	0.1	1.4	0.077
Receive overtime pay (%)	15.5	9.8	1.580	17.2	10.9	1.578
Potential work experience	22.30	22.66	0.984	22.21	22.17	1.002
Job tenure	8.46	7.92	1.068	8.27	7.89	1.048

Note: The sample includes individuals in the age group 25 to 64 years old. Self-employed and farm workers are excluded from the analysis. Wages are bottom-coded to 50 percent of the federal minimum wage of $7.25 per hour. Occupation and industry codes are based on the 2012 SOC and NAICS codes, respectively. All estimates are weighted by the earning weight. The sample sizes for job tenure are 4,587 and 4,876, respectively, for men and women in 2010, and 4,355 and 4,244, respectively, for men and women in 2018.

Results

OAXACA BLINDER RESULTS

As seen in Table 2, the raw gender wage gap (the difference in the natural logarithms of male and female wages) in 2018 for individuals ages 25–64 years was 0.174. The OB decomposition method can be examined by calculating the explained portion of the gender wage gap and comparing that to the unexplained portion of the gap. Table 2 shows decompositions using the male estimated coefficients as the reference and vary by model specification. More specifically, the explained portion of the wage gap using the coefficients from Model 1 of the male wage equation (11.8 percent) is determined by multiplying the difference between mean values of the male and female characteristics by their respective male regression coefficients (see first term on the right-hand-side of equation [4], above) and then summing over all products.[18]

[18] In a similar fashion, the explained portions listed under the female and pooled columns in Table A.4 in Appendix A use female and pooled regression coefficients, respectively. Given the context of the study, valuing female characteristics using the male coefficients corresponds to a real-life scenario; hence, the remaining discussion focuses on the decomposition using male coefficients.

Model 2 generates an overall decomposition that indicates approximately 21 percent of the raw gender pay gap (0.036 log points) is explained by characteristic differences—the highest among the three models. The lower panels of Table 2 give more detailed explanations of the decomposition that have been aggregated into broad categories. For example, the decomposition due to educational attainment is the sum of the decompositions due to each educational category, with individuals without high school degrees functioning as the reference group. Examining Model 2 in detail, potential experience, which is a combination of full-time and part-time work experience and experience squared (addressing the non-linear relationship of experience with wages) accounts for almost 13 percent of the raw gender wage gap (0.022 log points). The percentage of female workers in an individual's occupation and industry together account for almost 30 percent of the raw wage gap (0.05 log points), with 20 percent of it as the effect of an individual's occupation and the remaining 10 percent from the individual's industry. Interestingly, the role of human capital factors (education and experience combined) account for a very small portion of the raw wage gap. The negative coefficients for education indicate that women attain higher education than men, and if this component were removed from the analysis, the gender wage gap would increase. This information supports existing literature that identifies the role of reversal of education, with women being more educated than men (Blau & Kahn, 2017; DiNatale & Boraas, 2002). However, the portion of the wage gap explained by factors listed in Table 2 is limited, in the range of 12–21 percent, with 79–88 percent of the gender wage gap remaining unexplained.

This limited explanation for the wage gap indicates the need for further research to determine the factors influencing the gender wage gap, after accounting for observed characteristics like demographics, occupation, industry, training, and hours worked. Recent studies have suggested factors like cognitive traits, non-cognitive skills, preferences, and attitude toward risk and choices, as well as differences in how men and women are rewarded for these characteristics, job roles, and firm-specific policies, may play an important role in explaining the remainder of the gender pay gap today. A significant limitation of the CPS data is the lack of factors that could measure these attributes. Hence, to examine the persistence of the gender wage gap despite the convergence of human capital between men and women, the study explores subgroups of the population by age, selected occupation types, and industrial sectors.[19]

[19] While the results presented in Table 2 provide weighted estimates, Tables 3 and 4 refer to estimates of a sample without the use of earning weights.

Table 2 | Decomposition of Gender Pay Gap Using the OB Method for Different Model Specifications

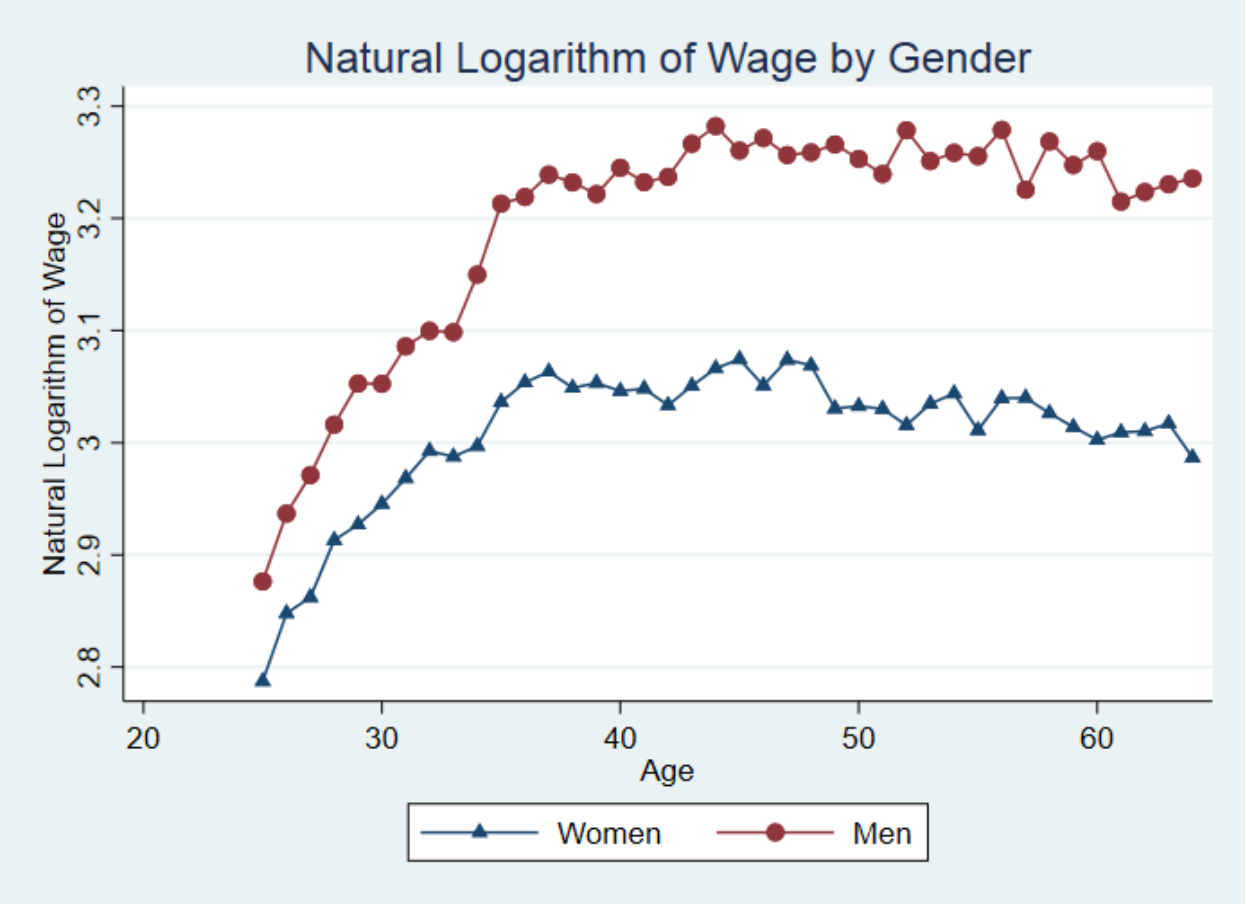
	Model 1	Model 2	Model 3
Raw wage gap	0.174	0.174	0.174
Explained	0.021	0.036	0.025
Unexplained	0.153	0.138	0.149
Portion of wage gap explained	**11.8%**	**20.7%**	**14.4%**
Portion of wage gap not explained	**87.9%**	**79.3%**	**85.6%**
Total	**100%**	**100%**	**100%**
Explained			
Age	-0.004	-0.007	-0.005
Marital status	0.001	0.002	0.002
Number of children	0.000	0.000	0.000
Race	0.000	0.000	0.000
Educational attainment	-0.028	-0.039	-0.037
Location	0.001	0.002	0.002
Potential work experience	0.015	0.022	0.000
Professional certification	-0.005	-0.007	-0.007
Receive overtime pay	0.009	0.007	0.008
Part-time work (< 35 hours per week)			0.019
STEM occupations			0.015
Percentage of female workers in person's occupation		0.036	
Percentage of female workers in person's industry		0.021	
Union coverage	0.001	0.000	0.000
Industry	0.024		0.028
Occupation	0.005		
Unexplained			
Intercept	-0.002	0.171	0.039
Age	0.186	-0.085	0.078
Marital status	0.021	0.023	0.020
Number of children	0.012	0.014	0.014
Race	0.003	0.002	0.006
Educational attainment	-0.022	-0.022	-0.033
Location	-0.004	0.007	-0.001
Potential work experience	-0.078	0.043	-0.001
Professional certification	-0.004	-0.010	-0.009
Receive overtime pay	0.003	0.005	0.004
Part-time work (< 35 hours per week)			-0.006
STEM occupations			0.004
Percentage of female workers in person's occupation		0.017	
Percentage of female workers in person's industry		-0.031	
Union coverage	0.005	0.005	0.007
Industry	0.027		0.027
Occupation	0.006		
Unweighted *N*		**124,110**	
Weighted *N*		**108,438,168**	

Note: This table presents wage decomposition using the OB method. All estimates are weighted by the earning weight. Standard errors are clustered at the household level. Model 1: Demographics like age, marital status, number of children (0, 1, > =2), and race; location like region and metro area; education; full-time and part-time work experience and their squares; professional certification and an indicator for receiving overtime pay + 12 dummies for industry and 21 dummies for occupation; and union coverage. Model 2: Demographics, location, education, full-time and part-time work experience and experience squares, professional certification, percentage female in individual's occupation and industry, and union coverage. Model 3: Demographics, education, experience, professional certification, indicator for receiving overtime pay, part-time work dummy, indicator variable for STEM occupation, industry dummies, union coverage, and dummy for private sector. Results with women and pooled estimates as reference coefficients are reported in Table A.4.

OB DECOMPOSITION BY AGE

While the results presented above explain some of the variation of the gender wage gap, examining factors by subgroups may provide deeper insight into changes across the distribution of wages. Figure 1 depicts the gender wage gap across ages from 25 to 64. There is divergence of the gender wage gap starting at age 35.

Figure 1 | Trend in Raw Log Wages by Gender Across Ages



Note: The figure above denotes the trend in raw wages across ages for men and women.

Table 3 shows OB decompositions for the 25–34, 35–44, 45–54 and 55–64 age groups using male coefficients as the reference. Again, the human capital variables of education and experience explain very little of the gender pay gap. The measured percentage of female workers in an individual's industry and occupation contributes to the gap more than remaining factors.

Table 3 | Gender Wage Gap Using the OB Method for Various Age Groups

Age Groups	25–34 Years	35–44 Years	45–54 Years	55–64 Years
Raw wage gap	0.113	0.190	0.214	0.234
Explained	-0.005	0.040	0.061	0.084
Unexplained	0.118	0.150	0.153	0.150
Portion of wage gap explained	**-4.4%**	**21.2%**	**28.3%**	**35.7%**
Portion of wage gap not explained	**104.4%**	**78.9%**	**71.5%**	**64.1%**
Total	100%	100%	100%	100%
Explained				
Demographics	0.002	0.004	0.002	0.003
Human capital	-0.060	-0.055	-0.033	-0.014
Location	0.000	0.002	0.000	0.002
Part time work (< 35 hours per week)	0.013	0.025	0.025	0.029
Receive overtime pay	0.008	0.007	0.006	0.006
Percentage of female workers in person's industry	0.013	0.022	0.023	0.025
Percentage of female workers in person's occupation	0.026	0.043	0.041	0.036
Union coverage	0.000	0.000	0.000	0.000
Professional certification	-0.008	-0.007	-0.005	-0.004
Unexplained				
Intercept	0.180	-0.031	-0.326	0.144
Demographics	0.000	0.038	0.054	0.045
Human capital	0.015	0.154	0.414	-0.040
Location	0.011	0.000	0.008	0.019
Part-time work (< 35 hours per week)	-0.009	-0.004	-0.004	-0.010
Receive overtime pay	0.004	0.006	0.007	0.005
Percentage of female workers in person's industry	-0.054	-0.045	-0.044	-0.042
Percentage of female workers in person's occupation	-0.030	0.040	0.048	0.044
Union coverage	0.007	0.001	0.007	0.003
Professional certification	-0.006	-0.009	-0.011	-0.019
Unweighted *N*	33,554	32,586	31,677	26,293

Note: This table presents the OB decomposition by age groups using Model 2 of Table 2. Demographic variables include race, marital status, and number of children (0, 1, >= 2). Human capital variables include education and potential work experience. Location variables include dummies for three of the four Census regions and a dummy for metro area. Union coverage and professional certification are both indicator variables. Results with women and pooled estimates as reference coefficients are reported in Table A.5.

The raw gender wage gap increases between ages 25 and 64, as seen in Table 3 (0.113 to 0.234). The negative coefficient refers to women earning more than men due to that characteristics. Between 25-34, not much of the raw wage gap is explained by the characteristics. At older ages, the raw wage gap widens and so does the contribution of factors like part-time work and female-dominated occupations and industries. Almost 36 percent of the raw wage gap is explained for individuals ages 55–64, with the proxy variables indicating that female-dominated occupations and industries account for about 26 percent of the raw wage gap. This pattern is also observed among ages 35–54.

Examining Table 4, the wage gap is much higher among those employed in sales-related occupations (0.34) when compared to those employed in management occupations (0.183). A larger portion of the gender wage gap, almost 41 percent, is explained for those employed in sales-related jobs. Out of the 40 percent explained, part-time work and receiving overtime pay account for almost 23 percent of the raw wage gap, closely followed by human capital factors at almost 10 percent. Similarly, we examine the wage gap for those employed in the private or public sectors, where we see a higher wage gap in the private sector compared to the public sector (Table A.7 in Appendix A).

Table 4 | Gender Pay Gap Using OB Method, by Selected Occupations

	Management	Sales
Raw wage gap	0.183	0.340
Explained	0.049	0.140
Unexplained	0.134	0.200
Portion of wage gap explained	**26.8%**	**41.2%**
Portion of wage gap not explained	**73.2%**	**58.8%**
Total	**100%**	**100%**
Explained		
Demographics	0.009	0.025
Human capital	-0.008	0.033
Location	0.002	0.004
Part-time work (< 35 hours per week)	0.011	0.052
Receive overtime pay	0.001	0.024
Percentage of female workers in person's industry	0.035	0.001
Union coverage	0.000	0.000
Professional certification	-0.001	0.001
Unexplained		
Intercept	-0.231	-0.194
Demographics	0.823	1.662
Human capital	-0.480	-1.103
Location	-0.002	0.003
Part-time work (< 35 hours per week)	0.000	-0.006
Receive overtime pay	0.006	-0.013
Percentage of female workers in person's industry	0.022	-0.143
Union coverage	0.001	0.001
Professional certification	-0.004	-0.007

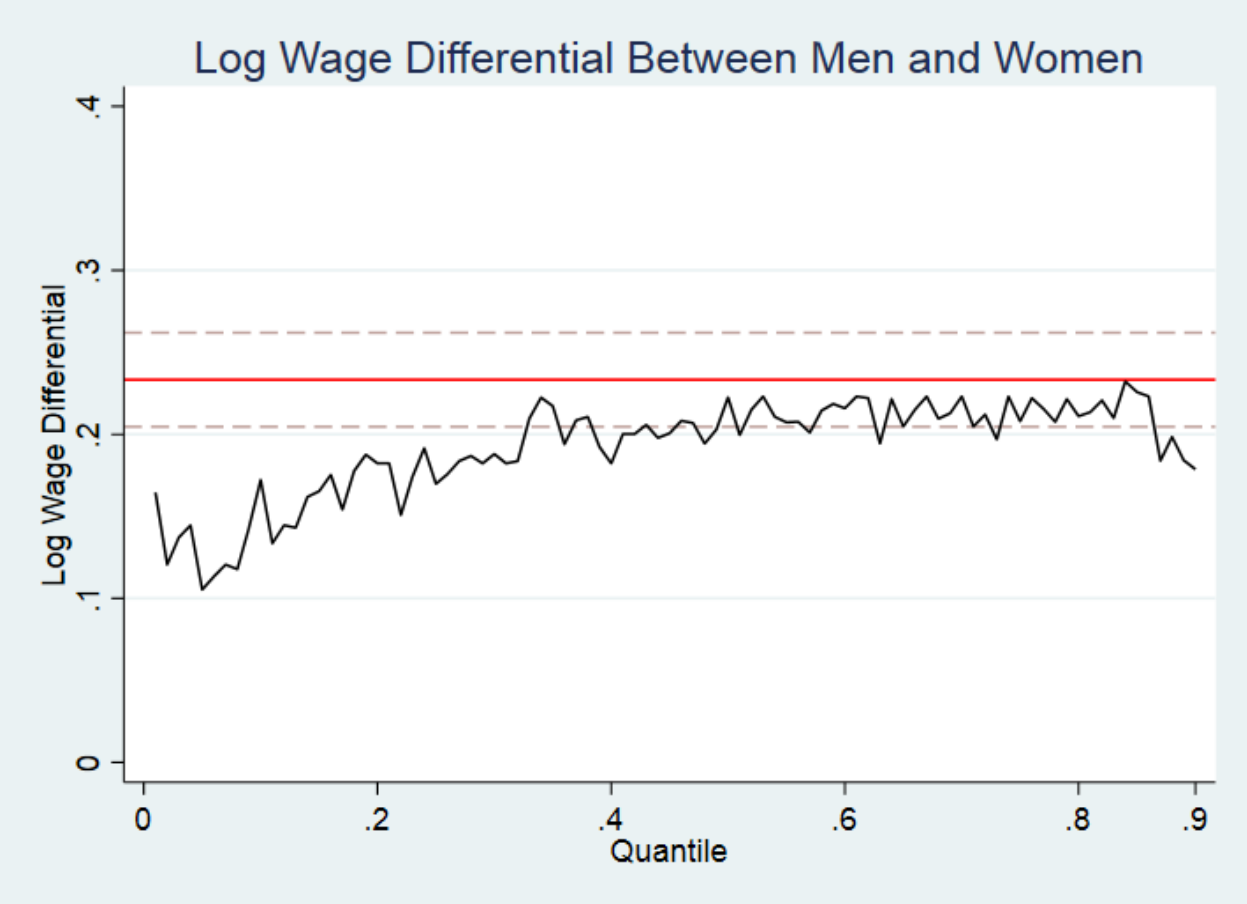
Note: This table presents the OB decomposition by the two occupations of management and sales using Model 2 of Table 2. Demographic variables include race, marital status, and number of children (0, 1, >= 2). Human capital variables include education and potential work experience. Location variables include dummies for three of the four Census regions and a dummy for metro area. Union coverage, receipt of overtime pay, and professional certification are all indicator variables. Results with women and pooled estimates as reference coefficients are reported in Table A.6.

When examining these subgroups, it is important to note that the OB method provides the decomposition of raw gender wage gap at the respective mean. Since the decompositions vary by subgroup, the initial OB estimates mask the contributions due to other locations of the distribution of wages. This motivates the use of distributional methods to identify the contribution of covariates at the distribution of wages and not just at the mean.

QUANTILE RESULTS

As presented in Figure 2, there is a relatively large gender pay gap at the top of the wage distribution. This fact suggests that women face barriers in entering the top levels of the labor market. To understand this phenomenon better, we decompose the gender pay gap into portions at specific percentiles of the distribution due to their characteristics and portions due to wage coefficients.

Figure 2. Wage Differential Between Men and Women



The JMP method decomposes the differences between the quantile function of wages by gender, generating a decomposition into three effects—characteristics, coefficients, and residuals. Results for specific characteristics are not estimable. The total wage differential is calculated as a sum of the three components at each percentile across specifications. The highest wage gap is between the 50th and 75th percentiles for all specifications (Table A.9). The wage differential reduces slightly at the 90th percentile as observed in Figure 2. The characteristics (human capital, occupation, and industry) explain a larger portion of the wage gap in the 10th percentile, but the wage gap at the higher percentiles may be driven by differentials within each covariate, motivating use of the RIF method (Firpo et. al.,2009).

Like the JMP method, the CFM method also provides overall decompositions—not decompositions of specific characteristics at quantiles (Table 5). This overall decomposition allows us to recover the unconditional distribution of wages (wage differential) by adding the effects of the characteristics to the effects of the wage coefficients. The explained gap, given by the effect of characteristics, is highest at the 10th percentile and lowest at the 90th percentile across specifications. Correspondingly, the unexplained gap is largest at the highest percentile and lowest at the 10th percentile. This suggests a larger role at the bottom percentiles of the wage distribution for differences in factors like occupation and industry than at the higher percentiles, while the gap at the higher percentiles of the wage

distribution could be driven by gender differences within the explanatory factors. These results are consistent with Kassenboehmer and Sinning (2014), who found a slightly larger unexplained gap at the 90th percentile than at the 50th percentile using Panel Study of Income Dynamics (PSID) data. However, the nonresponse among the higher quantiles can lead to biased results (Bollinger, Hirsch, Hokayem, & Ziliak, 2018). We limit the highest quantile at the 90th percentile for our analysis.

Table 5 | Decomposition of the Gender Pay Gap Using the CFM Method

Percentile	Model 1	Model 2	Model 3
Wage Gap			
10th percentile	0.145	0.149	0.146
25th percentile	0.184	0.181	0.183
50th percentile	0.209	0.209	0.211
75th percentile	0.211	0.211	0.209
90th percentile	0.186	0.181	0.172
Effect of Characteristics			
10th percentile	55.9%	72.0%	53.1%
25th percentile	39.7%	48.6%	38.6%
50th percentile	29.2%	31.1%	28.9%
75th percentile	24.6%	21.7%	25.0%
90th percentile	22.6%	19.2%	25.6%
Effect of Coefficients			
10th percentile	44.1%	28.0%	46.9%
25th percentile	60.3%	51.4%	61.4%
50th percentile	70.8%	68.9%	71.1%
75th percentile	75.4%	78.3%	75.0%
90th percentile	77.4%	80.8%	74.4%

Note: This table reports the decomposition of the distribution of wages using the CFM method. Model 1 includes human capital variables such as age; marital status; number of children (0, 1, >= 2); race; education; location; work experience; part-time work; indicator variable for receiving overtime pay; 12 industry dummies; and 22 occupation dummies. Model 2 includes human capital variables such as age; marital status; number of children (0, 1, > 2); race; education; location; work experience; part-time work; indicator variable for receiving overtime pay; and percentage of female workers in occupation and industry. Model 3 includes human capital variables such as age; marital status; number of children (0, 1, > 2); race; education; location; work experience; and part-time work along with an indicator variable for receiving overtime pay and indicator variables for STEM occupations and healthcare industries.

RIF RESULTS

For each percentile, it is also possible to decompose the gender wage gap into its structural (based on the coefficients) and composition (based on the characteristics) effects, using the RIF regression decomposition method in combination with the OB method. More specifically, while the OB method provides the decomposition of wages at the mean and the CFM method shows differences in the contribution of the covariates across the wage distribution, the RIF method combines the two approaches to estimate the decomposition of wages along the distribution and to capture the contribution of each variable to the total explained and unexplained portion.

Table 6 | Decomposition of the Gender Pay Gap Using the RIF Regression with the OB Method

Percentile	10th Percentile			50th Percentile			90th Percentile		
Raw Wage Gap									
Male	2.486			3.16			3.976		
Counterfactual	2.361			3.013			3.878		
Female	2.31			2.96			3.802		
Raw Wage Gap	0.176			0.200			0.174		
Explained	0.051			0.053			0.076		
Unexplained	0.125			0.147			0.099		
Pure explained	0.014			0.040			0.101		
Specification error	0.037			0.013			-0.025		
Pure unexplained	0.135			0.181			0.130		
Reweighted error	-0.009			-0.034			-0.032		
		Pure explained	**Specification error**	**Total Explained**	**Pure explained**	**Specification error**	**Total Explained**	**Pure explained**	**Specification error**
Age	0.136	-0.014	0.150	-0.169	-0.017	-0.152	0.218	-0.002	0.220
Marital status	-0.004	0.001	-0.004	0.004	0.001	0.003	0.003	0.001	0.002
Children	-0.003	0.000	-0.003	-0.010	0.000	-0.011	0.004	-0.001	0.006
Race	-0.001	-0.002	0.001	-0.009	-0.002	-0.006	-0.005	-0.001	-0.004
Location	0.019	0.004	0.015	0.063	0.004	0.059	0.018	0.005	0.013
Education	-0.187	-0.014	-0.173	0.106	-0.017	0.124	-0.050	0.000	-0.051
Potential work experience	-0.145	0.009	-0.154	0.136	0.009	0.127	-0.026	-0.002	-0.023
Part-time work (< 35 hours per week)	0.030	0.033	-0.003	0.026	0.028	-0.003	0.000	0.000	-0.001
Receive overtime pay	0.006	0.004	0.002	0.008	0.007	0.001	0.002	0.005	-0.004
Percentage of female workers in person's occupation	-0.048	-0.026	-0.022	0.053	0.025	0.028	0.212	0.074	0.138
Percentage of female workers in person's industry	-0.010	0.018	-0.028	-0.059	0.002	-0.061	0.012	0.022	-0.009
Intercept	0.257		0.257	-0.098		-0.098	-0.313		-0.313
	Total Unexplained	**Unexplained component**	**Reweighting error**	**Total Unexplained**	**Unexplained component**	**Reweighting error**	**Total Unexplained**	**Unexplained component**	**Reweighting error**
Age	0.809	0.800	0.009	0.206	0.200	0.007	-0.920	-0.920	0.000
Marital status	0.028	0.027	0.000	0.030	0.029	0.001	0.003	0.002	0.001
Children	0.009	0.010	-0.001	0.025	0.025	-0.001	0.002	0.001	0.001
Race	-0.005	-0.006	0.002	-0.006	-0.008	0.002	-0.002	-0.001	-0.001
Location	-0.011	-0.009	-0.002	-0.063	-0.060	-0.004	-0.002	0.001	-0.003
Education	0.057	0.062	-0.006	-0.148	-0.109	-0.039	0.007	0.048	-0.040
Potential work experience	-0.254	-0.238	-0.016	-0.057	-0.051	-0.006	0.245	0.238	0.007
Part-time work (< 35 hours per week)	-0.011	-0.013	0.002	0.000	-0.001	0.002	-0.001	-0.001	0.000
Receive overtime pay	0.004	0.004	0.001	0.006	0.005	0.001	-0.002	-0.003	0.001
Percentage of female workers in person's occupation	-0.088	-0.086	-0.002	-0.024	-0.025	0.001	0.003	0.002	0.000
Percentage of female workers in person's industry	0.017	0.014	0.003	-0.019	-0.021	0.002	-0.008	-0.011	0.002
Intercept	-0.429	-0.429		0.196	0.196		0.774	0.774	

In Table 6, all explained and unexplained portions are statistically significant. Different specifications with additional characteristics could be explored for each percentile of the wage distribution. About 30 percent of the gender wage gap is explained at the 10th and 50th percentiles, while almost 40 percent is explained at the 90th percentile. The explained portion is a sum of two components. The pure explained portion captures almost 55 percent of the wage gap in the 90th percentile, but 25–30 percent of the raw wage gap is captured in the lower percentiles. The gender wage gap is highest at the 50th percentile, consistent with the findings in Table 5. This fact indicates that factors that could explain the existing wage gap could vary along the wage distribution. Kassenboehmer and Sinning (2014) discuss how educational attainment was related to this reduction of the gap, but we find that part-time work and female-oriented industries also play an important role in this reduction. The importance of part-time work is highest at the median wage and reduces at the 90th percentile, where female-oriented occupations and industries have a significant contribution to explaining the wage gap. Interestingly, potential work experience explains large portions of the wage gap in the 10th and 50th percentiles, with a larger portion explained in the specification error. This fact could be a result of a nonlinear relationship between work experience and wages.

We also evaluate changes in the occupational structure by employing occupational information from the O*NET Program.[20] The O*NET data contains hundreds of standardized and occupation-specific descriptors on approximately 1,000 occupations covering the entire U.S economy. We defined occupational characteristics by six categories: competitive roles, interactional skills, social contribution, cognitive skills, physical skills, and inflexibility of work. However, a limitation of using these occupational data in combination with CPS data is that the O*NET data exist at a much more micro level compared to the census occupation codes. This results in an average effect of the occupational characteristics and prevents us from observing changes for more descriptive occupations.[21] This may explain why our analysis did not provide significant findings.

[20] https://www.onetonline.org/

[21] The IPUMS CPS dataset has 482 occupational codes compared to 958 occupation codes available through O*NET.

SUMMARY REMARKS

The decomposition methods provide insight into the problem of discrimination by estimating the overall gender wage gap and decomposing the wage gap into two components: the part explained by observed differences in the characteristics between men and women and the part resulting from the different valuations of the characteristics between men and women (unexplained part). For a policymaker, the second part suggests there may be some gender discrimination in the labor market, in addition to the possibility that differences in the observed characteristics themselves reflect larger workplace and societal discrimination which in turn affects the explained part of the gap. Otherwise, how could the valuation of characteristics vary? Recent literature, summarized in this paper, provides numerous explanations for the persistent unexplained gender wage gap in the United States, but there are no nationally representative datasets to test most of these explanations.

This study provides decomposition estimates using data from the 2018 CPS and, therefore, updates the results from similar studies with older waves of the CPS. Additionally, we applied recent methodological advances to study the decompositions at different locations of the overall wage distribution. The gender wage gap increases between the 50th and 75th percentiles of the wage distribution and remains greatest at the higher percentiles. Human capital plays an important role in determining the gender wage gap when individuals enter the labor market (having little work experience), but its importance varies across the wage distribution. Explanations for these results are consistent with the assumed roles of observed explanatory factors but are not conclusive due to omitted variables bias that may be confounding the findings. Cumulative hours that an individual has worked is considered an important determinant of gender wage gap (Azmat & Ferrer, 2017). The CPS does not provide sufficient information on cumulative hours worked, which is a limitation of using the CPS data to understand the gender wage gap. Another variable omitted from the CPS is determinants of ability, usually measured through test scores (Mulligan & Rubinstein, 2008). Productivity of employers, preferences, and attitudes of individuals toward work are other factors that are not observed in the CPS and could result in biasing the results. These issues could be addressed using longitudinal datasets like the National Longitudinal Survey of Youth (NLSY) and the PSID. However, this study does build a current starting point for further research that finds a way to include data regarding additional characteristics that distinguish male and female workers.

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APPENDIX A: ADDITIONAL TABLES

Table A.1 | OLS Regression Results

Model Variable	M1	M2	M3	M4	M5	M6	M7
Intercept	2.199	1.841	1.659	1.750	2.265	1.843	1.784
Demographics							
Age	0.045	0.045	0.038	0.031	0.024	0.032	0.028
Age squared	-0.0005	-0.0005	-0.0003	-0.0002	-0.0002	-0.0002	-0.0002
Female	**-0.172**	**-0.176**	**-0.217**	**-0.177**	**-0.142**	**-0.132**	**-0.159**
Marital status	0.104	0.116	0.066	0.064	0.044	0.064	0.063
Number of children	-0.003	0.000	0.012	0.015	0.015	0.015	0.015
Race							
Black non-Hispanic	-0.233	-0.224	-0.156	-0.154	-0.118	-0.148	-0.150
Asian non-Hispanic	0.078	0.114	0.015	0.014	-0.002	0.016	-0.006
Hispanic	-0.292	-0.252	-0.094	-0.094	-0.066	-0.095	-0.085
Other non-Hispanic	-0.124	-0.122	-0.063	-0.061	-0.039	-0.060	-0.059
Location							
Midwest		-0.084	-0.057	-0.057	-0.057	-0.060	-0.058
South		-0.081	-0.058	-0.055	-0.063	-0.060	-0.057
West		0.002	0.022	0.025	0.016	0.021	0.021
Metro area		0.213	0.113	0.111	0.091	0.114	0.106
Citizenship							
U.S. Citizen		0.211	0.126	0.113	0.082	0.123	0.124
Naturalized citizen		0.151	0.083	0.071	0.056	0.080	0.079
Education							
High school degree or equivalent (GED)			0.200	0.186	0.151	0.191	0.182
Some college but without degree			0.276	0.262	0.186	0.273	0.253
Associate's degree from academic/ occupational program			0.342	0.328	0.215	0.345	0.313
Bachelor's degree			0.619	0.605	0.425	0.624	0.576
Master's degree			0.759	0.747	0.548	0.772	0.713
Professional degree			0.852	0.844	0.608	0.878	0.844
Doctorate degree			0.862	0.858	0.661	0.897	0.825
Potential work experience			-0.001	0.000	0.002	-0.001	0.003
Work experience squared			0.000	0.000	0.000	0.000	0.000
Employment Characteristics							
STEM occupations							0.248
Healthcare industry							0.012
Private sector				0.050	0.023	0.033	0.045
Union coverage				0.071	0.108	0.068	0.083
Percentage of female workers in person's industry						-0.145	
Percentage of female workers in person's occupation						-0.128	
Work Experience							
Part time work(< 35 hours per week)				-0.238	-0.156	-0.223	-0.228
Part-time work for economic reasons				-0.123	-0.102	-0.128	-0.121
Part-time work for school/training				-0.031	-0.019	-0.023	-0.027
Part-time work for family reasons				0.026	0.032	0.025	0.023
Receive overtime pay				0.131	0.160	0.126	0.140
Industry dummies					x		
Occupation dummies					x		
Observations				**124,110**			
R-squared	**11%**	**14%**	**30%**	**33%**	**41%**	**34%**	**35%**

Note: Reference groups for variables above – Not married, no children, White non-Hispanic, Northeast, Not US citizen, Without high school education, Non-STEM occupation, Non-Healthcare industry, Public sector, No union coverage, Full time work, part time work for non-economic reasons, part time for other reasons, No overtime pay

Table A.2 | Descriptive Statistics, by Occupation

	Male	Female	Male-to-Female Ratio
Management	12.4%	10.5%	1.18
Business and financial operations	4.5%	6.4%	0.70
Computer and mathematical science	5.8%	2.1%	2.75
Architecture and engineering	4.0%	0.8%	5.13
Life, physical, and social science	1.1%	1.0%	1.12
Community and social service	1.2%	2.9%	0.42
Legal	1.0%	1.5%	0.66
Education training and library	3.3%	10.6%	0.31
Arts, design, sports media	1.7%	1.5%	1.10
Healthcare practitioner and technical	2.9%	11.1%	0.26
Healthcare support	0.6%	4.4%	0.13
Protective service	3.5%	1.0%	3.38
Food preparation and serving	3.4%	4.5%	0.75
Building and grounds cleaning	3.8%	3.1%	1.21
Personal care and service	1.2%	4.5%	0.27
Sales related	8.6%	8.5%	1.01
Office and administrative support	6.1%	18.4%	0.33
Farming, fishing, and forestry	0.9%	0.3%	2.74
Construction and extraction	9.3%	0.3%	28.30
Installation maintenance and repair	6.4%	0.3%	25.24
Production	8.5%	3.7%	2.31
Transportation and material moving	9.7%	2.4%	3.97
Unweighted *N*	**63,082**	**61,028**	-
Weighted *N*	**56,484,941**	**51,953,227**	-

Table A.3 | Descriptive Statistics, by Major Industries

Industry	Male	Female	Male-to-Female Ratio
Agriculture	1.3%	0.4%	2.93
Mining	0.9%	0.2%	5.63
Construction	10.9%	1.4%	7.83
Manufacturing	15.8%	7.0%	2.27
Wholesale and retail trade	12.9%	11.0%	1.18
Transportation and utilities	8.3%	3.2%	2.61
Information	2.4%	1.6%	1.51
Financial activities	6.3%	8.2%	0.76
Professional and business services	13.0%	10.2%	1.28
Educational and health services	11.8%	39.5%	0.30
Leisure and hospitality	6.4%	7.1%	0.90
Other services	3.8%	4.7%	0.82
Public administration	6.1%	5.6%	1.09
Unweighted *N*	**63,082**	**61,028**	
Weighted *N*	**56,484,941**	**51,953,227**	

Table A.4 | Decomposition of Gender Pay Gap Using OB Method for Different Model Specifications

Reference Coefficient	Model 1			Model 2			Model 3		
	Male	Female	Pooled	Male	Female	Pooled	Male	Female	Pooled
Raw wage gap	0.174	0.174	0.174	0.174	0.174	0.174	0.174	0.174	0.174
Explained	0.021	0.056	0.034	0.036	0.058	0.045	0.025	0.051	0.039
Unexplained	0.153	0.118	0.140	0.138	0.116	0.128	0.149	0.123	0.135
Portion of wage gap explained	**11.8%**	**32.4%**	**19.5%**	**20.7%**	**33.3%**	**26.1%**	**14.4%**	**29.2%**	**22.1%**
Portion of wage gap not explained	**87.9%**	**67.8%**	**80.5%**	**79.3%**	**66.7%**	**73.6%**	**85.6%**	**70.7%**	**77.6%**
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Explained									
Age	-0.004	-0.006	-0.006	-0.007	-0.008	-0.007	-0.005	-0.007	-0.006
Marital status	0.001	0.003	0.002	0.002	0.004	0.003	0.002	0.003	0.003
Number of children	0.000	-0.001	-0.001	0.000	-0.001	-0.001	0.000	-0.001	-0.001
Race	0.000	0.002	0.001	0.000	0.002	0.001	0.000	0.002	0.001
Educational attainment	-0.028	-0.023	-0.025	-0.039	-0.038	-0.039	-0.037	-0.032	-0.034
Location	0.001	0.001	0.001	0.002	0.001	0.001	0.002	0.001	0.001
Potential work experience	0.015	0.027	0.019	0.022	0.036	0.026	0.000	0.000	0.000
Professional certification	-0.005	-0.004	-0.004	-0.007	-0.004	-0.006	-0.007	-0.004	-0.005
Receive overtime pay	0.009	0.010	0.010	0.007	0.008	0.008	0.008	0.009	0.009
Part time work (< 35 hours per week)							0.019	0.031	0.023
STEM occupations							0.015	0.018	0.017
Percentage of female workers in person's occupation				0.036	0.025	0.030			
Percentage of female workers in person's industry				0.021	0.032	0.028			
Union coverage	0.001	0.001	0.001	0.000	0.001	0.000	0.000	0.001	0.000
Industry	0.024	0.033	0.027				0.028	0.030	0.031
Occupation	0.005	0.014	0.009						
Unexplained									
Intercept	-0.002	-0.002	-0.002	0.171	0.171	0.171	0.039	0.039	0.039
Age	0.186	0.186	0.186	-0.085	-0.084	-0.085	0.078	0.079	0.079
Marital status	0.021	0.021	0.021	0.023	0.021	0.022	0.020	0.019	0.019
Number of children	0.012	0.012	0.012	0.014	0.015	0.014	0.014	0.015	0.015
Race	0.003	0.003	0.003	0.002	0.000	0.001	0.006	0.004	0.005
Educational attainment	-0.022	-0.022	-0.022	-0.022	-0.023	-0.023	-0.033	-0.037	-0.035
Location	-0.004	-0.004	-0.004	0.007	0.008	0.008	-0.001	-0.001	-0.001
Potential work experience	-0.078	-0.078	-0.078	0.043	0.029	0.038	-0.001	-0.002	-0.001
Professional certification	-0.004	-0.004	-0.004	-0.010	-0.014	-0.012	-0.009	-0.011	-0.010
Receive overtime pay	0.003	0.003	0.003	0.005	0.003	0.004	0.004	0.003	0.003
Part-time work (< 35 hours per week)							-0.006	-0.017	-0.010
STEM occupations							0.004	0.001	0.002

Reference Coefficient	Model 1			Model 2			Model 3		
	Male	Female	Pooled	Male	Female	Pooled	Male	Female	Pooled
Percentage of female workers in person's occupation				0.017	0.028	0.023			
Percentage of female workers in person's industry				-0.031	-0.042	-0.038			
Union coverage	0.005	0.004	0.005	0.005	0.005	0.005	0.007	0.007	0.007
Industry	0.027	0.018	0.024				0.027	0.025	0.024
Occupation	0.006	-0.003	0.003						
R squared									
Unweighted *N*				**124,110**					
Weighted *N* ('000)				**108,438**					

Note: Reference groups for variables above – Not married, no children, White non-Hispanic, Northeast, Not US citizen, Without high school education, Non-STEM occupation, Non-Healthcare industry, Public sector, No union coverage, Full time work, part time work for non-economic reasons, part time for other reasons, No overtime pay

Table A.5 | Gender Wage Gap Using OB Method for Various Age Groups

Reference Coefficient	Age Groups											
	25–34 years			35–44 years			45–54 years			55–64 years		
	Male	Female	Pooled	Male	Female	Pooled	Male	Female	Pooled	Male	Female	Pooled
Raw wage gap	0.113			0.19			0.214			0.234		
Explained	-0.005	0.048	0.027	0.040	0.053	0.045	0.061	0.072	0.062	0.084	0.104	0.088
Unexplained	0.118	0.065	0.086	0.150	0.138	0.145	0.153	0.142	0.152	0.150	0.130	0.146
Portion of wage gap explained	**-4.8%**	**42.2%**	**23.7%**	**21.2%**	**27.7%**	**23.5%**	**28.3%**	**33.4%**	**29.1%**	**35.7%**	**44.4%**	**37.5%**
Portion of wage gap not explained	**104.4%**	**57.5%**	**76.0%**	**78.9%**	**72.6%**	**76.3%**	**71.5%**	**66.4%**	**71.0%**	**64.1%**	**55.6%**	**62.4%**
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Explained												
Demographics	0.002	0.001	0.001	0.004	0.006	0.004	0.002	0.008	0.005	0.003	0.013	0.008
Human capital	-0.060	-0.058	-0.059	-0.055	-0.052	-0.054	-0.033	-0.033	-0.033	-0.014	-0.012	-0.013
Location	0.000	0.000	0.000	0.002	0.001	0.002	0.000	0.000	0.000	0.002	0.002	0.002
Part time work(< 35 hours per week)	0.013	0.024	0.017	0.025	0.036	0.028	0.025	0.038	0.028	0.029	0.046	0.034
Receive overtime pay	0.008	0.009	0.009	0.007	0.010	0.009	0.006	0.009	0.008	0.006	0.008	0.008
Percentage of female workers in person's industry	0.013	0.032	0.024	0.022	0.039	0.032	0.023	0.040	0.032	0.025	0.040	0.033
Percentage of female workers in person's occupation	0.026	0.045	0.042	0.043	0.018	0.030	0.041	0.011	0.025	0.036	0.008	0.019
Union coverage	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.001	0.000
Professional certification	-0.008	-0.005	-0.008	-0.007	-0.004	-0.006	-0.005	-0.003	-0.004	-0.004	-0.001	-0.002
Unexplained												
Intercept	0.180	0.180	0.180	-0.031	-0.031	-0.031	-0.326	-0.326	-0.326	0.144	0.144	0.144
Demographics	0.000	0.001	0.001	0.038	0.036	0.038	0.054	0.048	0.051	0.045	0.035	0.040
Human capital	0.015	0.013	0.014	0.154	0.152	0.153	0.414	0.414	0.414	-0.040	-0.042	-0.041
Location	0.011	0.012	0.012	0.000	0.000	0.000	0.008	0.008	0.008	0.019	0.019	0.019
Part time work(< 35 hours per week)	-0.009	-0.021	-0.013	-0.004	-0.015	-0.007	-0.004	-0.018	-0.008	-0.010	-0.027	-0.015

Reference Coefficient	Age Groups											
	25–34 years			35–44 years			45–54 years			55–64 years		
	Male	Female	Pooled	Male	Female	Pooled	Male	Female	Pooled	Male	Female	Pooled
Receive overtime pay	0.004	0.002	0.003	0.006	0.003	0.004	0.007	0.004	0.005	0.005	0.003	0.003
Percentage of female workers in person's industry	-0.054	-0.072	-0.065	-0.045	-0.062	-0.055	-0.044	-0.061	-0.053	-0.042	-0.057	-0.050
Percentage of female workers in person's occupation	-0.030	-0.049	-0.046	0.040	0.064	0.053	0.048	0.078	0.065	0.044	0.072	0.062
Union coverage	0.007	0.006	0.007	0.001	0.001	0.001	0.007	0.007	0.007	0.003	0.003	0.003
Professional certification	-0.006	-0.009	-0.007	-0.009	-0.011	-0.010	-0.011	-0.013	-0.012	-0.019	-0.021	-0.020
Unweighted *N*		33,554			32,586			31,677			26,293	

Note: This table presents the OB decomposition by age groups using Model 2 of Table 2. Demographic variables include race; marital status; and number of children (0, 1, > 2). Human capital variables record education and potential work experience. Location variables include dummies for three of the four Census regions and a dummy for metro area. Union coverage and professional certification are both indicator variable.

Table A.6 | Gender Pay Gap Using OB Method, by Selected Occupations

Reference Coefficient	Management			Sales		
	Male	Female	Pooled	Male	Female	Pooled
Raw wage gap	0.183	0.183	0.183	0.340	0.340	0.340
Explained	0.049	0.056	0.054	0.140	0.160	0.148
Unexplained	0.134	0.127	0.129	0.200	0.181	0.193
Portion of wage gap explained	**26.8%**	**30.5%**	**29.5%**	**41.2%**	**47.1%**	**43.5%**
Portion of wage gap not explained	**73.2%**	**69.4%**	**70.5%**	**58.8%**	**53.2%**	**56.8%**
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Explained						
Demographics	0.009	0.037	0.029	0.025	0.039	0.030
Human capital	-0.008	-0.025	-0.023	0.033	0.022	0.030
Location	0.002	0.002	0.002	0.004	0.003	0.004
Part-time work (< 35 hours per week)	0.011	0.010	0.011	0.052	0.068	0.057
Receive overtime pay	0.001	0.003	0.002	0.024	0.019	0.021
Percentage of female workers in person's industry	0.035	0.029	0.033	0.001	0.008	0.005
Union coverage	0.000	0.000	0.000	0.000	0.000	0.000
Professional certification	-0.001	0.000	0.000	0.001	0.001	0.001
Unexplained						
Intercept	-0.231	-0.231	-0.231	-0.194	-0.194	-0.194
Demographics	0.823	0.795	0.802	1.662	1.648	1.657
Human capital	-0.480	-0.463	-0.465	-1.103	-1.092	-1.100
Location	-0.002	-0.002	-0.002	0.003	0.003	0.003
Part time work (< 35 hours per week)	0.000	0.001	0.000	-0.006	-0.022	-0.011
Receive overtime pay	0.006	0.004	0.005	-0.013	-0.008	-0.010
Percentage of female workers in person's industry	0.022	0.027	0.024	-0.143	-0.149	-0.146
Union coverage	0.001	0.002	0.002	0.001	0.001	0.001
Professional certification	-0.004	-0.005	-0.005	-0.007	-0.007	-0.007
Percentage men/women in occupation	**12.4%**	**10.5%**		**8.6%**	**8.5%**	

Table A.7 | Gender Wage Gap Using OB Method, by Industrial Sector

Reference Coefficient	Public Sector			Private Sector		
	Male	Female	Pooled	Male	Female	Pooled
Raw wage gap	0.169	0.169	0.169	0.195	0.195	0.195
Explained	0.027	0.039	0.036	0.026	0.065	0.041
Unexplained	0.143	0.131	0.133	0.169	0.130	0.154
Portion of wage gap explained	**16.0%**	**22.8%**	**21.4%**	**13.5%**	**33.4%**	**21.2%**
Portion of wage gap not explained	**84.6%**	**77.5%**	**78.7%**	**86.7%**	**66.7%**	**79.0%**
Total	**101%**	**100%**	**100%**	**100%**	**100%**	**100%**
Explained						
Demographics	0.000	-0.003	-0.001	0.002	0.002	0.002
Human capital	-0.028	-0.012	-0.022	-0.021	-0.019	-0.020
Location	0.002	0.003	0.002	0.000	0.000	0.000
Part time work (< 35 hours per week)	0.011	0.018	0.014	0.016	0.030	0.021
Receive overtime pay	0.009	0.011	0.011	0.009	0.010	0.010
Occupation	0.033	0.021	0.034	0.022	0.040	0.028
Professional certification	-0.001	0.000	-0.001	-0.004	-0.004	-0.004
Union coverage	0.000	0.000	0.000	0.003	0.005	0.004
Unexplained						
Intercept	-0.415	-0.415	-0.415	0.125	0.125	0.125
Demographics	1.199	1.203	1.201	0.064	0.063	0.063
Human capital	-0.675	-0.691	-0.681	-0.012	-0.015	-0.014
Location	0.045	0.044	0.045	-0.008	-0.008	-0.008
Part-time work(< 35 hours per week)	-0.004	-0.011	-0.006	-0.006	-0.020	-0.011
Receive overtime pay	0.003	0.001	0.002	0.003	0.002	0.002
Occupation	0.008	0.019	0.007	-0.002	-0.020	-0.009
Professional certification	-0.014	-0.015	-0.014	0.000	0.000	0.000
Union coverage	-0.005	-0.005	-0.005	0.006	0.004	0.005

Table A.8 | Sensitivity Analysis Excluding Topcoded Data Using OB Method

Reference Coefficient	Model 1			Model 2			Model 3		
	Male	Female	Pooled	Male	Female	Pooled	Male	Female	Pooled
Raw wage gap	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139
Explained	0.003	0.039	0.017	0.014	0.046	0.032	0.009	0.036	0.023
Unexplained	0.137	0.1	0.122	0.125	0.0926	0.107	0.13	0.103	0.116
Portion of wage gap explained	**1.8%**	**27.9%**	**12.5%**	**10.2%**	**33.4%**	**22.7%**	**6.1%**	**25.6%**	**16.8%**
Portion of wage gap not explained	**98.6%**	**71.9%**	**87.8%**	**89.9%**	**66.6%**	**77.0%**	**93.5%**	**74.1%**	**83.5%**
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Explained									
Age	-0.006	-0.009	-0.008	-0.011	-0.011	-0.011	-0.008	-0.010	-0.010
Marital status	0.001	0.002	0.002	0.002	0.003	0.002	0.001	0.002	0.002
Number of children	0.000	-0.001	-0.001	0.000	-0.001	-0.001	0.000	-0.001	-0.001
Race	0.000	0.001	0.000	-0.001	0.000	-0.001	-0.001	0.001	0.000
Educational attainment	-0.032	-0.024	-0.028	-0.045	-0.041	-0.043	-0.042	-0.034	-0.038
Location	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Potential work experience	0.014	0.025	0.018	0.022	0.033	0.025	0.000	0.001	0.000
Professional certification	-0.005	-0.004	-0.005	-0.008	-0.004	-0.006	-0.007	-0.004	-0.006
Receive overtime pay	0.009	0.010	0.009	0.006	0.008	0.007	0.007	0.009	0.008
Part-time work (< 35 hours per week)							0.018	0.028	0.022
STEM occupations							0.014	0.017	0.016
Percentage of female workers in person's occupation				0.020	0.030	0.026			
Percentage of female workers in person's industry				0.028	0.029	0.031			
Union coverage	0.001	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001
Industry	0.022	0.029	0.024				0.025	0.025	0.028
Occupation	-0.002	0.009	0.003						
Unexplained									
Intercept	-0.049	-0.049	-0.049	0.164	0.164	0.164	0.009	0.009	0.009
Age	0.233	0.237	0.236	-0.030	-0.029	-0.029	0.117	0.119	0.118
Marital status	0.019	0.018	0.018	0.020	0.018	0.019	0.017	0.016	0.016
Number of children	0.010	0.011	0.010	0.011	0.012	0.012	0.012	0.013	0.012
Race	0.003	0.002	0.002	0.000	-0.002	-0.001	0.003	0.002	0.002
Educational attainment	-0.024	-0.032	-0.028	-0.033	-0.036	-0.035	-0.042	-0.051	-0.046
Location	-0.008	-0.008	-0.008	0.001	0.001	0.001	-0.009	-0.008	-0.008
Potential work experience	-0.093	-0.104	-0.097	0.019	0.008	0.016	-0.016	-0.016	-0.016
Professional certification	-0.003	-0.005	-0.004	-0.010	-0.013	-0.011	-0.008	-0.011	-0.010
Receive overtime pay	0.003	0.002	0.002	0.005	0.003	0.004	0.004	0.003	0.003

Reference Coefficient	Model 1			Model 2			Model 3		
	Male	Female	Pooled	Male	Female	Pooled	Male	Female	Pooled
Part-time work (< 35 hours per week)							-0.005	-0.016	-0.009
STEM occupations							0.006	0.002	0.004
Percentage of female workers in person's occupation				-0.001	-0.002	-0.004			
Percentage of female workers in person's industry				-0.027	-0.037	-0.033			
Union coverage	0.004	0.004	0.004	0.006	0.005	0.005	0.007	0.007	0.007
Industry	0.019	0.013	0.017				0.036	0.036	0.033
Occupation	0.023	0.012	0.017						

Table A.9 | Decomposition of Gender Pay Gap using JMP Method

Percentile	Model 1	Model 2	Model 3	Model 4	Model 5
Wage Differential					
10th percentile	0.167	0.168	0.170	0.172	0.168
25th percentile	0.186	0.187	0.186	0.187	0.186
50th percentile	0.197	0.197	0.194	0.192	0.196
75th percentile	0.197	0.196	0.194	0.193	0.196
90th percentile	0.181	0.181	0.182	0.186	0.182
Effect of characteristics					
10th percentile	0.026	0.080	0.058	0.064	0.080
25th percentile	0.017	0.073	0.056	0.061	0.072
50th percentile	0.013	0.066	0.057	0.059	0.065
75th percentile	0.012	0.062	0.063	0.060	0.060
90th percentile	0.013	0.059	0.068	0.062	0.056
Effect of coefficients					
10th percentile	0.156	0.099	0.118	0.119	0.099
25th percentile	0.167	0.111	0.125	0.125	0.111
50th percentile	0.171	0.118	0.126	0.126	0.120
75th percentile	0.172	0.124	0.124	0.124	0.126
90th percentile	0.171	0.127	0.123	0.121	0.13
Effect of residuals					
10th percentile	-0.015	-0.011	-0.007	-0.011	-0.011
25th percentile	0.002	0.004	0.005	0.001	0.003
50th percentile	0.014	0.012	0.011	0.008	0.012
75th percentile	0.013	0.010	0.007	0.010	0.010
90th percentile	-0.003	-0.005	-0.009	0.004	-0.005

Note: This table reports the decomposition of the distribution of wages using the JMP method. M1 includes human capital variables including age; dummies for number of children (0, 1, > 2); race; education; location; work experience; part-time work; and an indicator variable for receiving overtime pay. M2 is M1 in addition to percentage of female workers in occupation and industry. M3 is M1 in addition to indicator variables for STEM occupations and healthcare industries. M4 is M1 in addition to indicator variables for 13 industries and 22 occupations. M5 includes M2, along with the reason for part-time work.

APPENDIX B: CONSAD STUDY UPDATE

The study team presents updated results following the study conducted by CONSAD Research Corporation (the CONSAD study) (CONSAD, 2009). The CONSAD study used data from the 2007 CPS ORG to explain the gender wage gap using OB decomposition. We present the updated results using CPS ORG data from the current version of CPS (2017). We were able to replicate the results from the CONSAD study, except for a few descriptive variables that require understanding of the assumptions made in the CONSAD report and that are not available to us. The lack of detailed description has led to certain disparities in results, as well as different assumptions in constructing the variables. Using the 2017 CPS ORG data, we find that the gender-based wage gap has narrowed from 20.4 percent in 2007 to 17.6 percent in 2017 for individuals in the age group 23 to 79 years.

Various combinations of explanatory variables were used to estimate equation (3) in the CONSAD study. Certain combinations of variables had the potential to be highly correlated, leading to confounding results. Therefore, the CONSAD study used only variables that would be independent of such confounding factors. The final two versions chosen, conventional and alternative versions, include variables that can account for factors determining the gender wage gap indicated in earlier studies. The conventional version includes explanatory variables that have been found to explain the gender wage gap in the existing literature using cross-sectional databases up to 2007. The alternative version, on the other hand, is an attempt to accommodate explanatory factors proven to explain some of the gender wage gap using longitudinal studies.

The analysis in the CONSAD study was conducted using unweighted observations. Since the CPS ORG is drawn as a multistage sample—stratified by age, gender, and race/ethnicity—within geographically defined Primary Sampling Units, it is important to use weights to provide statistically representative estimates for the population and labor force. The CPS ORG data provide earnings weights,[22] also known as the outgoing rotation weights, which we use to update the results from the CONSAD study and account for the sampling design. Another limitation of the study is the measure of career interruption used by the authors in the alternative specification of the analysis. The authors have taken percentages of workers not participating in the labor force or working part-time as surrogates for potential career interruptions and used these to infer the role that career interruption plays in explaining gender wage gap. However, doing so could lead to potential ecological fallacy by interpreting the results that come from the analysis of aggregate data for all individuals who make up these groups. Additionally, factors like work experience, industry, and occupation are not appropriately controlled for, which could lead to confounding the findings.

This Appendix presents the updated results of the CONSAD study with the 2017 CPS ORG data from NBER. The analysis in this section accounts for weighted observations on male and female workers, which was not included in the CONSAD study. We use the earnings weight for further analysis. As defined in the CONSAD study, there are two model specifications used in the analysis—conventional and alternative versions.

[22] The earnings weight is provided only to adult civilians in the two outgoing rotations (4 and 8) (see page 11 of the report found at https://www.nber.org/morg/docs/cpsx.pdf). The earnings weight is roughly four times the original person weight. The earnings weight makes the data comparable for monthly files.

In Table B1, we note the ratio of average values among male and female workers for each characteristic. Table B1 reveals differences in male and female workers in key factors like higher education and part-time work between 2007 and 2017. The average wage rate among male workers is 19 percent higher than the average wage rate among female workers in 2017, compared to 22 percent higher in 2007. The share of women who have earned professional or doctoral degrees has increased since 2007. In addition, there are fewer women working part-time in 2017 compared to 2007.

Table B1 | Descriptive Statistics for 2017 CPS Data

Explanatory Variables	Mean		Male-to-Female Ratio	
	Male	Female	2017	2007
Age	43.11	43.52	0.99	0.98
Age Squared	2023.31	2061.32	0.98	0.96
Number of Children	0.654	0.640	1.02	1.02
Hourly wage rate	27.137	22.893	1.19	1.22
Log (hourly wage rate)	3.125	2.956	1.06	1.06
Percentage of female workers in person's industry	40.6%	57.7%	0.70	0.70
Percentage of female workers in person's occupation	37.4%	60.2%	0.62	0.59
Overtime	16.2%	10.8%	1.50	1.56
Part-time	7.1%	18.3%	0.39	0.31
Full-time	90.6%	78.5%	1.15	1.17
Part-time for economic reasons	1.9%	2.8%	0.68	0.63
Part-time for family reasons	0.5%	6.2%	0.08	0.06
Married	61.5%	54.7%	1.12	1.12
Union representation	12.2%	10.9%	1.12	1.15
Race (1 = White; 0 = Non-white)	79.2%	76.0%	1.04	1.04
Education completed				
Without high school degree	8.2%	5.2%	1.58	1.64
High school degree or GED	28.2%	22.6%	1.25	1.07
Some college but without degree	16.1%	16.5%	0.98	0.90
Occupational/vocational associate degree	4.5%	4.8%	0.94	0.85
Associate's degree from academic program	5.5%	7.8%	0.71	0.71
Bachelor's degree	24.3%	27.1%	0.90	0.92
Master's degree	9.5%	12.4%	0.77	0.82
Professional degree	1.5%	1.6%	0.94	1.38
Doctoral degree	2.3%	2.0%	1.15	1.70
Percentage of similar people not in the labor force				
In last year*	5.4%	15.6%	0.35	0.27
In last 2 years (average)	5.6%	16.0%	0.35	0.27
In last 3 years (average)	6.0%	16.4%	0.37	0.28
In last 4 years (average)	6.3%	16.9%	0.37	0.30
In last 5 years (average)	6.8%	17.5%	0.39	0.31
Percentage of similar people working part-time				
Last year	6.2%	13.8%	0.45	0.38
Last 2 years (average)	6.4%	14.1%	0.45	0.38
Last 3 years (average)	6.6%	14.3%	0.46	0.39
Last 4 years (average)	6.8%	14.5%	0.47	0.40
Last 5 years (average)	7.0%	14.6%	0.48	0.41
Weighted *N* (in 000s)	**735,283**	**682,450**		
Unweighted *N*	**71,561**	**69,796**		

In Table B2, we summarize and compare the explanatory variables' contribution to explaining the gender wage gap in 2007 and 2017, using the appropriate CPS data. The first issue we investigate is whether the higher wages paid to men are a result of the greater advantage of education, experience, and other observable factors or whether, instead, men are paid more even after we account for factors like education, experience, and demographics. If the latter holds true, then the wage gap between men and women may, at least in part, be due to labor market discrimination. We determine this gap in wages using the OB decomposition.

Table B2 | Gender-Based Wage Gap in 2007 and 2017 (Conventional Approach)

	Difference in mean value of variable, based on value of coefficient for male workers	Difference in coefficient value between genders, based on mean value of variable among female workers	Difference in mean value of variable, based on value of coefficient for female workers	Difference in coefficient value between genders, based on mean value of variable among male workers
NBER 2007				
Portion of wage gap accounted for statistically by variables included in analysis	0.076	0.117	0.052	0.140
Percentage of wage gap accounted for statistically by variables included in analysis	39.31%	60.69%	27.17%	72.83%
NBER 2017				
Portion of wage gap accounted for statistically by variables included in analysis	0.062	0.109	0.037	0.134
Percentage of wage gap accounted for statistically by variables included in analysis	36.43%	63.57%	21.74%	78.26%

Table B2 indicates that differences between the average attributes of male and female workers statistically account for 36.4 percent of the raw gender wage gap when the male coefficients are used in the decomposition but only account for 21.7 percent of the gap when the female coefficients are used instead. While the portion of the wage gap accounted for by variables included in the conventional version of the analysis is 0.076 in 2007, it decreases to 0.062 in 2017 when using the male coefficient. For the raw gender wage gap of 0.17 (i.e., average hourly wages of female workers that are 17 percent lower than those of male workers), the portion of the raw gap that remains unexplained is estimated to be 0.109 based on the male coefficients and about 0.134 based on the female coefficients in 2017. On the other hand, using the alternative version of equation (1) presented in Table B3, we find that differences between the average characteristics of male and female workers statistically account for 119.8 percent of the raw gender wage gap in 2017 when the male coefficients are used in the decomposition and account for 85.4 percent of the gap when female coefficients are used instead. The percentage accounted for using the male coefficients is larger than the percentage when using the female coefficients, primarily because the estimated value of the male coefficient for percentage of

similar people not in the labor force (-0.822) is much lower than the estimated value of the corresponding female coefficient (-0.272). The primary observation is that the unexplained portion of the raw wage gap increases when using coefficient estimates for males but decreases when using coefficient estimates for females between 2007 and 2017 in the alternative version of the analysis.

Table B3 | Gender-Based Wage Gap in 2007 and 2017 (Alternative Approach)

	Difference in mean value of variable, based on value of coefficient for male workers	Difference in coefficient value between genders, based on mean value of variable among female workers	Difference in mean value of variable, based on value of coefficient for female workers	Difference in coefficient value between genders, based on mean value of variable among male workers
NBER 2007				
Portion of wage gap accounted for statistically by variables included in analysis	0.261	-0.067	0.164	0.030
Percentage of wage gap accounted for statistically by variables included in analysis	134.38%	-34.38%	84.35%	15.65%
NBER 2017				
Portion of wage gap accounted for statistically by variables included in analysis	0.203	-0.034	0.145	0.025
Percentage of wage gap accounted for statistically by variables included in analysis	119.84%	-19.84%	85.44%	14.56%

Gender-Based Pay Disparity Study

ANNOTATED BIBLIOGRAPHY

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INTRODUCTION

As of 2017, the median earnings of women were about 80 percent of the median earnings of men, suggesting that women earn about 80 cents for every 1 dollar that men earn (U.S. Census Bureau, Current Population Survey, 1961 to 2018 Annual Social and Economic Supplements, Table A-4 - Female-to-Male Earnings Ratio). While these figures represent substantial progress since the 1970s when the ratio of female-to-male median earnings was around 62 percent, the ratio has hovered around 80 percent since 2005 (U.S. Department of Labor [DOL], Women's Bureau, 2018).

In 2009, an independent U.S. Department of Labor- (DOL) funded report produced by the CONSAD Research Corporation (CONSAD Research Corporation [CONSAD], 2009) systematically reviewed then-available research on gender differentials in earnings. However, since the publication of the CONSAD study in 2009, numerous studies that examine gender-based pay disparities have been published.[1] In addition, labor market trends (e.g., economy) and economic events like the Great Recession mean that updates to the CONSAD study could shed new light on gender-based pay disparities. As such, the purpose of this study is to first conduct a comprehensive review of the literature, with a focus on research published since 2009, and then to produce an updated *Annotated Bibliography* on this topic.

The comprehensive literature review will support three areas of this DOL Gender-Based Pay Disparity Study. As stated above, we will first use the literature review to identify the most relevant studies to include in the updated *Annotated Bibliography*. This bibliography will provide DOL with a single source for rapidly identifying the existing research trajectories on this topic and, correspondingly, a basis for assessing existing and proposed federal policy. Second, the literature review will guide our empirical work that estimates the gender-based pay gap using CONSAD's methodology employing the latest Current Population Survey data and that extends the methodology and estimations in ways that are motivated by recent research. Finally, we will use the literature review to provide evidence-based context for our analytical results, which will be presented as a white paper.

METHODS

In this section, we briefly describe our process for identifying and screening articles for inclusion in the *Annotated Bibliography*, which encompasses our search strategy, screening and reviewing of identified studies, identification of additional studies through our subject matter experts (SMEs), and reviewing DOL-recommended websites.

Search Strategy

2M Research (2M) developed initial search terms and submitted them to DOL for review and approval on November 5, 2018. We subsequently conducted a search in Web of Science using the search terms listed in Exhibit 1.

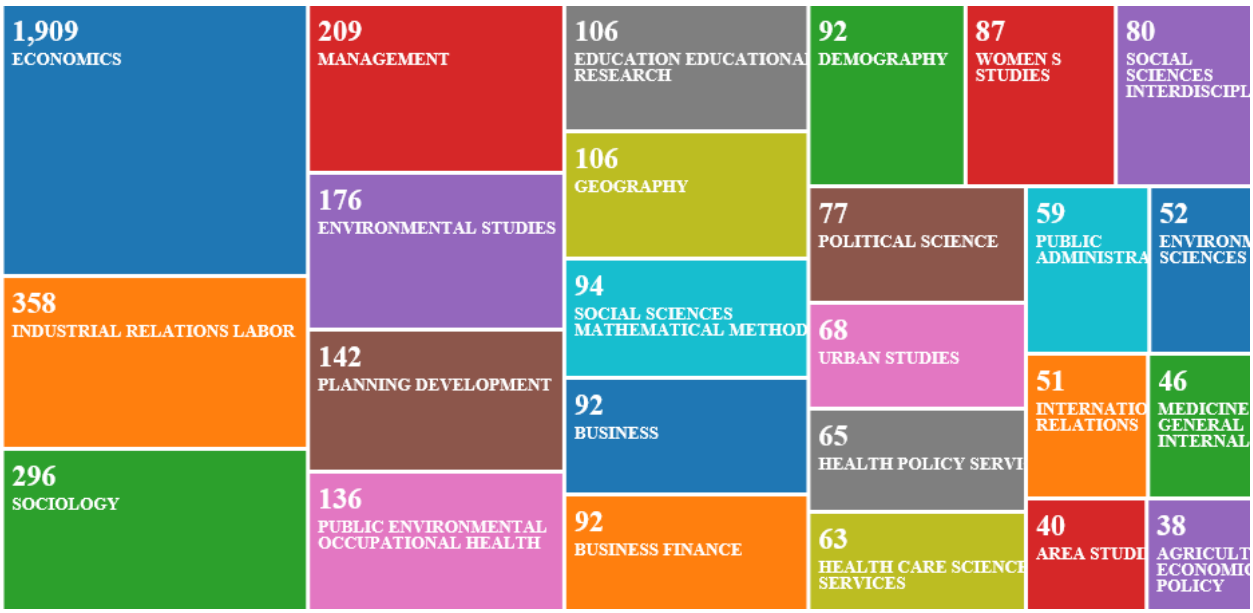
[1] Blau and Kahn (2017) present an overview of the current state of the literature; Card, Cardoso, Heining, and Kline (2018) examine the literature on firm-level wage inequality; and Grund (2015) examines gender-based gaps in various components of overall compensation.

Exhibit 1 | Search Terms

Search Terms									
("pay disparit*" OR "pay diff*" OR "pay gap" OR "pay discrimination")	**OR**	("income disparit*" OR "income diff*" OR "income gap" OR "income discrimination")	**OR**	("wage disparit*" OR "wage diff*" OR "wage gap" OR "wage discrimination")	**OR**	("earn* disparit*" OR "earn* diff*" OR "earn* gap" OR "earn* discrimination")	**AND**	(gender OR (wom* AND men) OR (fem* AND male*) OR sex)

In addition to the search terms listed in Exhibit 1, we also restricted the search to English-only and included the following document types: Article, Book, Book Chapter, Data Paper, or Proceedings Paper specified. This search returned 3,665 citations that fell into several categories. Exhibit 2 below illustrates the categories returned, as well as the number of references within each category. All references were imported into EndNote, screened for any duplicates, and then exported to MS Excel for abstract review.

Exhibit 2. Categories of Citations Returned



Internal Team Trainings

Two separate trainings were held for the researchers reviewing the abstracts (Abstract Review Team) and those reviewing the full texts (Full Text Review Team). Both trainings began with an overview of the project's overall purpose. Each training introduced the topic to the team and reviewed the inclusion/exclusion criteria (see Exhibit 3) for coding the abstracts. The trainings focused on coding representative cases as a group (of abstracts for the Abstract Review Team or full-text papers for the Full Text Review Team) so that all team members generally agreed on the appropriate application of the criteria.

We held weekly check-in meetings with both teams to troubleshoot any issues as they arose, ensure we were applying the inclusion/exclusion criteria uniformly, and ensure we were making adequate progress on this task.

Exhibit 3 | Inclusion/Exclusion Criteria for Annotated Bibliography

Component	Inclusion Criteria	Exclusion Criteria
Language	▪ English	▪ Any language other than English
Year	▪ 2007 or later	▪ Before 2007*
Data Type	▪ Cross-sectional ▪ Longitudinal ▪ Panel ▪ Time-series ▪ Survey ▪ Administrative	▪ Interviews ▪ Document review
Methodology	▪ Quasi-experimental design ▪ Multivariate regression ▪ Oaxaca-Blinder (or Blinder-Oaxaca) decomposition ▪ Randomized controlled trial ▪ Program evaluation	▪ Observational ▪ Qualitative ▪ Systematic review ▪ Meta-analysis ▪ Methodological papers/simulation
Population	▪ Women/Men aged 16 years or older (DOL is particularly interested in 25–64 years old, which is considered "prime working age") ▪ Employed	▪ Under 16 years old ▪ Unemployed ▪ Only men/male ▪ Only women/female
Occupation-Specific	▪ If single occupation/industry, must be based in United States ▪ If multiple occupations/ industries included, can be based both in United States or in any of the included countries	▪ If single occupation/industry is examined outside the United States
Outcome of Interest	▪ Wage ▪ Gender-/sex-based wage gap ▪ Income ▪ Earnings	▪ Not wage- or gender-/sex-based wage gap (e.g., social security, taxes, transportation, unions, hiring patterns); not actual wages ▪ Reservation wages
Type of Publication	▪ Peer-reviewed journal articles ▪ Government publications	▪ Letters to the editor/opinion ▪ Commentaries ▪ Blogs ▪ Websites/webpages ▪ Dissertation/thesis ▪ Thought paper
Region	▪ Any part of United States ▪ Entire country of the included Organisation for Economic Co-operation and Development (OECD) countries**	▪ Not OECD-selected studies ▪ If only a region/part of the OECD-selected studies
Age of Dataset	▪ 1960 or newer	▪ 1959 or older

Note: *Papers of interest (e.g., theory, context) were flagged separately for the 2M Team to review; also, five potential categories of interest were flagged separately for further review: education and human capital development; employment characteristics; work experience, career interruptions, and labor-force attachment; fringe benefits and total compensation; work arrangements; (also, bargaining).

**Included OECD countries are Australia, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States.

Screening and Reviewing Identified Studies

To ensure consistency and accuracy in completing the literature review, first, a member of the Abstract Review Team independently screened all titles and abstracts to determine initial inclusion/exclusion for full-text review. If the team member was unsure whether a paper should have been included based on the abstract, they consulted another Abstract Review Team member. If there was still uncertainty about the paper after initial review by two team members, we consulted a trained third reviewer from the 2M Team. In this first stage, the 2M Team may, for example, have screened out unpublished dissertations, letters to the editor, commentaries, blogs, and other systematic reviews.[2]

Then, a trained member of the Full Text Review Team reviewed the full text of included studies from the first stage and made the final inclusion/exclusion determinations for the literature review. We consulted a trained second reviewer from the 2M Team if the first reviewer could not determine final inclusion/exclusion.

It is also important to note that throughout the identification and screening process, we kept records of the number of articles identified, screened, and included (see Appendix A).

Identification of Additional Studies

During the first stage, the 2M Team also reviewed additional articles that were potentially relevant. More specifically, as detailed in Appendix A, a member of the 2M Team identified three additional articles that seemed relevant and that were included for further review. An SME meeting was also held to review our process and share preliminary included and excluded papers to ensure that relevant articles were included. The 2M Team also reviewed the Blau and Kahn (2017) study to identify other potentially relevant studies that met our inclusion criteria. More detailed information on these processes is provided below.

SUBJECT MATTER EXPERT MEETING

The 2M Team conducted a WebEx meeting with the SMEs on January 9, 2019, to solicit their formal input on the proposed scope for the *Annotated Bibliography*. We summarized the preliminary abstract inclusion/exclusion decisions and sought input from the SMEs for finalizing the list of relevant literature. During this meeting, we also asked for SME input regarding whether additional studies warranted screening for potential inclusion in the final set of studies. SMEs suggested a total of seven additional studies to review; five were included in the final *Annotated Bibliography*.

REVIEW OF BLAU AND KAHN (2017) REFERENCE LIST

We reviewed Blau and Kahn's (2017) reference list to identify other potentially relevant studies. The additional studies that met our date range parameter (2007–present) were reviewed using the same process as noted above and, ultimately, we included the final *Annotated Bibliography* (see Appendix A).

[2] Other systematic reviews will still be presented in the main body of the chapter as sources, but they were excluded from the *Annotated Bibliography*, which concentrated on original studies on gender-wage gap.

REVIEWING DOL WEBSITES

On February 5, 2019, DOL asked the 2M Team to review the following websites for potentially relevant papers:

- U.S. Bureau of Labor Statistics (BLS)
- U.S. Census Bureau (Census)
- National Bureau of Economic Research (NBER)

Because these websites are structured differently from the Web of Science, we used a slightly different search process. Each of the three sites required a different search strategy, briefly described below. For all papers returned from these websites, a trained team member first reviewed the title of each paper to determine whether the abstract should be reviewed, using our established inclusion/exclusion criteria. It is important to note that most of the returned papers' titles were clearly not related to gender; thus, no further review was required.

BLS

For the BLS site, we reviewed papers from Monthly Labor Review, Reports, and Research Papers, each of which required slightly different search strategies.

Monthly Labor Review. On February 7, 2019, we conducted separate searches using each of the following search terms to identify additional papers from Monthly Labor Review: "pay disparity," "pay difference," "pay gap," "pay discrimination," "income disparity," "income difference," "income gap," "income discrimination," "wage disparity," "wage difference," "wage gap," "wage discrimination," "earnings disparity," "earning difference," "earnings gap," and "earnings discrimination." We entered each of these terms into the search bar and recorded the number of papers returned from 2007–present. We used the inclusion/exclusion criteria (Exhibit 3) to determine whether each returned paper warranted full-text review. If the trained team member deemed the paper appropriate for full-text review, they downloaded the paper. A total of 106 papers were returned (including duplicates) that were published in 2007 or later; 5 papers were identified for full-text review.

Reports. On February 8, 2019, a trained team member examined all Highlights of Women's Earnings papers published from 2007–2018, yielding 11 papers total. These papers were reviewed by the Abstract Review Team, which determined that these papers will not be included in the *Annotated Bibliography* but rather will provide additional descriptive background information.

Research Papers. Between February 8, 2019, and February 11, 2019, we conducted this search using the same search terms used for the Monthly Labor Review but eliminated the quotation marks because they too narrowly restricted the papers returned. We again entered each of the search terms separately into the search bar and recorded the number of papers returned from 2007–present. We used the inclusion/exclusion criteria (Exhibit 3) to determine whether each returned paper warranted full-text review. If the trained team member deemed the paper appropriate for full-text review, they downloaded the paper. A total of 179 papers were returned (including duplicates) that were published in or after 2007; 3 papers were identified for full-text review.

CENSUS

Between February 11, 2019, and February 15, 2019, a trained team member reviewed all papers in the following subsections of the Census Active Working Paper Series:

- American Community Survey Papers and Presentations
- Center for Administrative Records Research and Applications Working Papers
- Center for Economic Studies Discussion Papers
- Population Working Papers
- Survey of Income and Program Participation Working Papers
- Other Census Bureau Working Papers

A total of 2,543 working papers were published from 2007–present across these 6 subsections of the Active Working Paper Series. Most were unrelated to this study; after applying the inclusion/exclusion criteria, the trained team member identified and downloaded a total of 9 papers for full-text review.

NBER

Between February 15, 2019, and February 20, 2019, we conducted separate searches using each of the following search terms in the "Full Text Search" section of the NBER webpage to identify additional papers: "pay disparity," "pay difference," "pay gap," "pay discrimination," "income disparity," "income difference," "income gap," "income discrimination," "wage disparity," "wage difference," "wage gap," "wage discrimination," "earnings disparity," "earning difference," "earnings gap," and "earnings discrimination." Each term was entered into the search bar separately and the number of papers returned from 2013–present was recorded.[3] We used the inclusion/exclusion criteria (Exhibit 3) to determine whether each returned paper warranted full-text review. If the trained team member deemed the paper appropriate for full-text review, they downloaded the paper. A total of 1,662 papers were returned (including duplicates) that were published in 2013 or later; 37 (including duplicates) were identified for full-text review. The search engine did not show accurate numbers of results in the auto-counts at the bottom of the pages, so the trained team member manually counted each returned paper from 2013 and later.

After duplicates were removed, these websites yielded an additional 35 studies for full-text review; 11 were included in the final *Annotated Bibliography* (see Appendix A).

Screening Out Studies Included in CONSAD

The 2M Team purposely reviewed studies that were published in 2007 or later, though the CONSAD study was published in 2009, to ensure that we did not miss any potentially relevant studies. We examined our identified studies and removed (n = 2) those included in CONSAD (2009).

[3] A different timeframe was used because these are working papers, and we assumed that papers prior to this date were likely to have been published in peer-reviewed journals.

SUMMARY OF INCLUDED STUDIES

We categorized the studies by the following themes or topics of interest:

Category	Description
Education and Human Capital Development	Studies that examine human capital development, including education and childhood experience.
Personality Traits, Cognitive, and Non-Cognitive Skills	Studies that examine specific innate traits and skills rather than education and experience.
Compensation and Benefits	Studies that examine compensation structure (i.e., fringe benefits, total compensation, structured compensation); collective bargaining/union presence; work arrangements (i.e., flexibility and remote working).
Firm- and Industry-Specific Employment Characteristics	Studies related to particular firm/industry/sector/occupation employment characteristics or institutional factors.
Work Experience, Career Interruptions, and Labor-Force Attachment	Studies with a focus on individual-specific decisions that impact work experience and labor force participation/attachment, including part-time work arrangements.
Others	Studies where the main focus lies outside one of the above categories.

We also identified other themes as they arose. In addition to categorizing articles by these themes, we also specifically utilized the explanatory factors denoted in the CONSAD study to standardize the summary presented below. In particular, we used gender, age, education, experience, married, children, race, and region for personal characteristics (but also allowed for additional coding when relevant) and used occupation, industry, percent female, union, full or part time, and firm size for employment characteristics (also allowing for additional coding when relevant). In the table below, we will summarize the countries from which the top 100 studies came, by category:

Exhibit 4. Themes of the Studies

Themes for Top 100 (All Included Studies)						
	Education and Human Capital Development	Personality Traits, Cognitive, and Non-Cognitive Skills	Compensation and Benefits	Firm- and Industry-Specific Employment Characteristics	Work Experience, Career Interruptions, and Labor-Force Attachment	Other
United States	14	8	10	42	17	12

In the section below, we detail each paper identified for inclusion in the final *Annotated Bibliography*. Please note, although some studies may include additional findings, the *Annotated Bibliography* findings are restricted to only the gender-specific wage gap.

Overall, the included studies generally indicate that, controlling for a variety of factors, an unexplained gender wage gap exists; in studies using longitudinal data, the gender wage gap appears to be narrowing slightly. Additionally, the gender wage gap appears to be more pronounced at the higher end of the salary distribution (i.e., there is a bigger wage gap between men and women for high earners).

ANNOTATED BIBLIOGRAPHY

Education and Human Capital Development

Citation: Bar, M., Kim, S., & Leukhina, O. (2015). Gender wage gap accounting: The role of selection bias. *Demography, 2*(5), 1729–1750. doi: 10.1007/s13524-015-0418-x.

Data source: Current Population Survey, 1975–1979 and 1995–1999.

Population studied: Married women with spouses reported to have positive incomes.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X		X		X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X		

Bar, Kim, and Leukhina (2015) provided consistent estimates of Mulligan and Rubinstein's (2008) wage equations. The authors argued that the previous models overstated the role of selection bias and understated the role of reduced discrimination in closing the gender wage gap. In addition to the theoretical model, the authors provide empirical estimates of mean log wage equations using ordinary least squares.

Key findings: Overall, the study's empirical estimates lend credence to their argument that declining gender-based discrimination is responsible for a great deal of convergence in the gender wage gap. Authors argued that the convergence of returns to observable characteristics, by gender, has accounted for 11 percent of the closing of the gender wage gap.

Citation: Bobbitt-Zeher, D. (2007). The gender income gap and the role of education. *Sociology of Education*, *80*(1), 1–25. doi: 10.1177/003804070708000101

Data source: Repeated cross section of the 1999 National Educational Longitudinal Survey.

Population studied: U.S. college graduates who were full-time, year-round workers and had annual income data available for 1999.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X		X	X	X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X	X				Standardized test scores, grades, coursework, college major.

Bobbit-Zeher (2007) used estimated generalized least squares regression to examine gender's impact on income when controlling for other characteristics. Bobbit-Zeher also used the Oaxaca-Blinder decomposition methods and regression analysis to capture the amount of the total gender income gap that can be attributed to each independent variable.

Key findings: The study indicated that education contributed to gender stratification despite women's general success in educational realms. The study found gender composition of college majors to be the largest educational influence on gender disparities in earnings. While the content of the major's field of study does relate to income inequality, the gender composition of the major had a much greater impact on determining wages. The percentage female of the college major explained 14 percent of the income gap, whereas scores on standardized tests explained only 5 percent. Finally, almost half of the gender disparities in earnings can be explained by work-related characteristics, particularly occupation, sector, industry, and average number of hours worked per week.

Citation: Campbell, C., & Pearlman, J. (2013). Period effects, cohort effects, and the narrowing gender wage gap. *Social Science Research*, *42*(6), 1693–1711. doi: 10.1016/j.ssresearch.2013.07.014

Data source: Current Population Survey, 1976—2010.

Population studied: 1,860,126 individuals ages 26–59 who made a wage or salary income, excluding those born before 1930 and those who are self-employed.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X		X	X	X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X			X		Period effects (variations produced by events that simultaneously affect all ages); cohort effects (variations produced by the timing of an event, such as a birth or entering the labor market).

Campbell and Pearlman (2013) conducted Age-Period-Cohort analysis using a series of ordinary least squares regression models in order to examine the impact of period and cohort effects on the gradual narrowing of the gender wage gap over time.

Key findings: The study found that cohort effects largely explain the narrowing of the gender wage gap between 1975 and 2009. However, period effects only account for about 30 percent of the decline and are completely absent after 1994. While gains in female wages contributed to the decline in the gender wage gap for cohorts born before 1950, declines in male wages mainly explain the narrowing of the gender wage gap for later cohorts. Age effects increase the gender wage gap.

The findings suggest that "cohort replacement" has been driving the narrowing of the gender wage gap in recent years. Since the gender wage gap decreases for each successive cohort, the gender wage gap declines due to the cohort composition of the labor force. As older cohorts with a larger gender wage gap age out of the workforce, they are replaced by younger cohorts with a smaller gender wage gap. The authors also note that age effects contribute to an increasing gender wage gap because more middle-aged women, for whom the gender wage gap is the largest, are remaining in the workforce.

Citation: Goodwin-White, J. (2018). "Go West, young woman?": The geography of the gender wage gap through the Great Recession. *Economic Geography, 94*(4), 331–354. doi: 10.1080/00130095.2018.1427505

Data source: American Community Survey, 2005–2007 and 2011–2013.

Population studied: Nearly full-time (at least 35 hours worked per week), full-year (at least 50 weeks worked), non-self-employed workers aged 25–55 who are not residents in group or institutional quarters.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X				X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other

Goodwin-White (2018) used bootstrapped quantile regressions to estimate conditional wage distributions for men and women. The author estimated 100 counterfactual quantile distributions for men's and women's wages in the top 100 metropolitan areas of the United States. The distributions were estimated at the 10th, 25th, 50th, 75th, and 90th percentile, with 50 bootstraps in each case.

Key findings: The study showed that gender inequality has resulted in increased polarization across the wage distribution and across the United States. The findings also revealed that the recession worsened this pattern. The Rust Belt saw the greatest decline in gender disparities, mostly among below-median earning workers. However, Western metropolitan areas faced relative increases in the gender pay gap, particularly at the 75th or 90th percentiles.

Citation: Guvenen, F., Kaplan, G., Song, J., & Weidner, J. (2017). *Lifetime incomes in the United States over six decades*. National Bureau of Economic Research Working Paper 23371.

Data source: Continuous Work History Subsample, from the U.S. Social Security Administration's Master Earnings File, 1957–2013.

Population studied: Individuals who were 25–55 years old during the panel period; had income larger than a year-specific threshold-level income in at least 15 years between ages 25 and 55; and had a total lifetime income of at least 31 times the average level of income corresponding to working at least 520 hours at one half of the legal minimum wage for that year.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X						

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other

Guvenen, Kaplan, Song, and Weidney (2017) used the consumer price index and personal consumption expenditure deflator for price indexes. They examined the trends in the average lifetime incomes across the cohorts for both men and women, respectively.

Key findings: This study found that gains in men's lifetime incomes were marginal or even negative; however, women experienced increases in income across the lifetime. While this difference should work to decrease the overall gender income gap, the lifetime income gains for women were relative to low lifetime incomes for the earlier cohorts of women; therefore, closing this lifetime income gap did not outweigh the stagnation of lifetime incomes for men. Additionally, the authors found that inequality within lifetime incomes has significantly increased within each gender group; however, the closing lifetime gender gap has kept this lifetime inequality virtually flat. The increase within gender groups is largely a result of the increase in inequality at young ages.

Citation: Jacobson, L., & Davis, J. (2017). The relative returns to Workforce Investment Act-Supported training in Florida by field, gender, and education and ways to improve trainees' choices. *Journal of Labor Economics, 35*(S1), 337–375. doi: 10.1086/692277

Data source: Researchers used a database that provides accurate information about almost 90,000 training spells funded by Individual Training Account Vouchers (ITAs) from 2004–2012. Additionally, the database includes individuals who trained in all types of postsecondary institutions. It describes the

occupational field of each trainee, the details of their training, and their employment and demographic information.

Population studied: 23,972 individuals from 24,192 completed ITA-funded training programs, who exited ITA-supported training between 2004–2008 who (1) reported some Unemployment Insurance earnings in pretraining and post-training or (2) fell below the 2nd percentile or above the 98th percentile among individuals.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X				X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X	X				Business cycle at exit, Unemployment Insurance, provider type, quarter of application.

Jacobson and Davis (2017) applied the Oaxaca-Blinder decomposition to examine the before- and after-program differences in earnings. Differences in earnings and relative returns were estimated across 17 employment fields and by education levels.

Key findings: The study found that female Workforce Investment Act trainees select higher return fields than men; despite this, men usually have higher returns than women in the same field. Within the male sample, they found that the higher the level of education, the greater the proportion who select high-return fields; the opposite was true for women. Lastly, men and women both largely select fields in which they are the gender-majority, even though it can be financially profitable to make an unconventional choice. The exception to this is women selecting healthcare practitioners and technicians training, which has the greatest fraction of women and the highest returns for women.

Citation: Jacobsen, J. P., Khamis, M., & Yuksel, M. (2014). *Convergences in men's and women's life patterns: Lifetime work, lifetime earnings, and human capital Investment*. Institute for the Study of Labor (IZA) Discussion Paper #8425

Data source: U.S. Census Annual Demographic Files (March Current Population Survey) 1964–2013; Integrated Public Use Microdata Series.

Population studied: Individuals aged 25 to 65 throughout the sample period 1964–2013.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X		X		X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Rural/urban area.

Jacobsen, Khamis, and Yuksel (2014) estimated separate hourly earnings regressions for each year and each gender. This amounts to 100 different equations throughout the 50-year sample period. They estimated ordinary least squares (OLS) regressions without correcting for sample selection and then estimated a two-step Heckman selection-correction model.

Key findings: The study indicated a significant convergence in men and women's work lives during the past five decades, both in average returns and selection into work. Women's selection into work has risen and changed from positive to negative, implying that those women who benefit most from participating in paid work are increasingly likely to be found in the labor force. Women and men with higher potential labor market experience have converged in terms of earnings, for both OLS and selection-corrected models. However, this trend is not observed for workers with lower levels of potential experience.

Citation: Karpio, K., Landmesser, J. M., Lukasiewicz, P., & Orlowski, A. J. (2016). The quantile decomposition of personal income distributions in the USA. *Acta Physica Polonica, Series a, 129*(5), 965–970. doi: 10.12693/APhysPolA.129.965

Data source: Census Bureau Survey of Income and Program Participation Project.

Population studied: 287,298 records.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X				**X**	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Origin (Spanish/Others).

The study compared differences in the income distribution for men with the same distribution for women and the differences in income distributions by race—whites versus all others—using quantile regression models.

Key findings: The study found that differences between income distributions for men and women are significantly larger than for whites and others. Among attributes that are correlated with the differences, those related to education are the most important, while age and race are less important.

Income distribution differences increase with income and tends to favor men, indicating the existence of glass ceiling effects for women.

Citation: Kassenboehmer, S. C., & Sinning, M. G. (2014). Distributional changes in the gender wage gap. *ILR Review, 67*(2), 335–361. doi: 10.1177/001979391406700203.

Data source: Two waves of the Panel Study of Income Dynamic, 1994 to 1996 and 2005, 2007, and 2009.

Population studied: White male and female full-time employed workers who are either the head or spouse of the head of their households.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X				X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
			X			Number of years worked since age 18, tenure with the current employer.

Kassenboehmer and Sinning (2014) estimated the changes in gender differentials across the wage distribution using Oaxaca- Blinder-type decomposition for unconditional quantile regression models. This was done in two stages. In the first stage, the authors decomposed the gender wage gap during the two time periods (1994 to 1996, and 2005, 2007, and 2009). In the second stage, they performed separate decompositions of the changes in wage levels over time for both genders.

Key findings: The study found a narrowing of the gender wage gap by 16 percent and by 5 percent at the lowest decile and highest decile, respectively, of the wage distribution between the periods 1993 to 1995 and 2004 to 2008. Furthermore, they found that the narrowing of the gender wage gap was due to changes in educational attainment in favor or female workers at the highest decile; and work history changes, especially at the lowest decile.

Citation: Lewis, G. B., & Oh, S. S. (2009). A major difference? Fields of study and male-female pay differences in federal employment. *American Review of Public Administration, 39*(2), 107–124. doi: 10.1177/0275074008317158

Data source: A 1 percent sample of the Central Personnel Data File from the U.S. Office of Personnel Management.

Population studied: College graduates working in full-time, white-collar positions in the General schedule.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X			X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X		Disability, veterans' preference, disabled veteran status, white collar positions.

Lewis and Oh (2009) used regression analysis with the natural logarithm of annual salary. Regression coefficients translate roughly into proportional differences in salary. For many analyses, the authors restricted the parameters to include only non-Hispanic whites to minimize the potential of confusing racial and gender effects. Following this, the authors repeated some of these analyses on a sample which included African Americans, Latinos, and Asian Americans.

Key findings: The study found that on average, the pay for a female college graduate rose from 72 percent to 89 percent of a man's pay from 1983 to 2003, mainly due to increases in women's seniority levels. Women's concentration in lower paying fields and underrepresentation in engineering, mathematics, and statistics accounts for another 3 to 4 percent of the pay gap; however, women's movement into traditionally male fields appears to have had little impact on reducing the gender pay gap. Between 1983 and 2003, the percentage of white college graduate women rose from 20 to 32 percent. Pay for female college graduates is still 7 to 11 percent less than white men, but this gap has decreased by nearly half between 1983 and 2003.

Citation: Ma, Y., & Savas, G. (2014). Which is more consequential: Fields of study or institutional selectivity? *The Review of Higher Education*, *37*(2): 221–247.

Data source: 1988–2000 National Education Longitudinal Study and its restricted postsecondary transcript data collected by National Center for Education Statistics.

Population studied: 2,160 full-time, year-round workers who have obtained at least a 4-year degree.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X		X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X (continuous).		College selectivity, field of study, self-reported importance of having money.

Ma and Savas (2014) estimated the roles field of study and institutional selectivity play in the gender earnings gap using ordinary least squares regressions and traditional decomposition methods.

Key findings: The study found that, while women and men receive similar earnings advantages from entering lucrative fields of study, women receive less of an earnings advantage than men receive for attending a selective institution. The authors concluded that field of study is more important than institutional selectivity in contributing to the gender pay gap for both privileged and less privileged classes. Women receive more benefit in earnings when they choose lucrative fields than they receive when they attend selective institutions.

Citation: Olitsky, N. H. (2014). How do academic achievement and gender affect the earnings of STEM majors? A propensity score matching approach. *Research in Higher Education*, *55*(3), 245–271. doi: 10.1007/s11162-013-9310-y

Data source: ACT Alumni Outcomes Survey between 1991 and 2006.

Population studied: 7,779 female and 3,607 male graduates of a 2- or 4-year degree program across approximately 300 colleges in 42 U.S. states, who have available ACT scores.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X				X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Student loan debt to indicate individuals' socioeconomic status, ACT score to indicate individual cognitive achievement, college major, measure of vocational interest using the ACT Interest Inventory.

Olitsky (2014) used ordinary least squares (OLS) regressions to analyze the impact of choosing a science, technology, engineering, and mathematics (STEM) major on annual earnings. The study employed propensity score matching to estimate the average difference in earnings between the actual earnings that STEM majors receive and the counterfactual earnings of STEM majors, had they chosen a non-STEM major. The author estimated separate OLS regressions and propensity scores for each gender in order to understand how the effects of STEM major choice varies by gender.

Key findings: The study found that although both genders benefit from choosing a STEM major, high-achieving men benefit more from STEM majors than high-achieving women, using ACT score quartile to determine high-achieving status. Male STEM majors in the top ACT quartile receive an average of a 27.5 percent initial earnings premium, while their high-achieving female counterparts only receive an 18 percent initial earnings premium. Men's earnings premium for STEM major increases between the first and second quartile of ACT scores and then levels out for the third and fourth quartiles. For women, the earnings premium increases throughout the first three quartiles but then decreases in the top quartile.

Citation: Strain, M. R., & Weber, D. A. (2017). High school experiences, the gender wage gap, and the selection of occupation. *Applied Economics, 49*(49), 5040–5049. doi: 10.1080/00036846.2017.1299100.

Data source: National Longitudinal Study of the High School Class of 1972 from the National Center for Education Statistics.

Population studied: 16,683 respondents who attended public and private schools in the United States and were high school seniors in spring 1972.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X		X	X	X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X					High school club or class officer status, other club and sport participation; math scores, delta-HS (set of 939 high school fixed effects).

Strain and Weber (2017) estimated the pay gap using sequential ordinary least squares regression, with gender and leadership as the key independent variables. They also included math percentile score and high school fixed effects to account for cognitive and cultural factors that may influence women's leadership roles and their gender pay gap.

Key findings: Overall, the authors found a strong relationship between high school leadership experience and female wages, which invariably explained 10 percent of the residual gender wage gap. However, the gender pay gap varied by occupational choice. Within higher income management occupations, the gap reduced as much as 75 percent when accounting for leadership.

Citation: Robst, J. (2008). Childhood sexual abuse and the gender wage gap. *Economics Letters, 99*(3), 549–511. doi: 10.1016/j.econlet.2007.09.044

Data source: Survey data from the 1992 National Health and Social Life Survey.

Population studied: The sample is restricted to ages 18–45 years and included 1,473 women and 1,183 men.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X		X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Childhood sexual abuse (CSA).

Robst (2008) estimated separate regressions for men and women to examine childhood sexual abuse's effect on hourly wages.

Key findings: The study found that women report a higher rate of CSA than men. Adult earnings for women who were victims of CSA were 20 percent lower than for women who were not. The effects for men were a statistically insignificant 5 percent. The portion of the 25.9 percent gender wage gap explained by characteristics is 5.2 percent. Of this portion, 1.7 percent was attributed to a higher prevalence of CSA among women, and 3.5 percent was attributed to differences in remaining characteristics. Of the 20.7 percent unexplained gender differences in characteristics, 1.4 percent stemmed from CSA's greater wage effect for women. Therefore, a total of 3.1 percent of the 25.9 percent gender wage differential was attributed to gender differences in the prevalence and wage effects from CSA.

Personality Traits, Cognitive, and Non-Cognitive Skills

Citation: Bacolod, M. O., & Blum, B. S. (2010). Two sides of the same coin: U.S. "residual" inequality and the gender gap. *Journal of Human Resources, 45*(1), 225–254.

Data source: Dictionary of Occupational Titles; Current Population Survey; National Longitudinal Survey of Youth 1979 data over the period 1968–1990.

Population studied: Employed individuals ages 18 through 64 who had worked full-time at least 3 months, 1968 through 1990.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X			X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Skills: cognitive, motor, strength, and people.

Bacolod and Blum (2010) examined the extent to which the growth in various skill (cognitive, motor, strength, people) prices over time is associated with the gender pay gap. Specifically, they studied whether growth in prices was larger for skills with which women are more likely to be endowed.

Key findings: The study found that changes in returns to strength, cognitive, motor, and people skills contributed to around 20 percent of the convergence in the gender pay gap during the 1980s. In addition, changes in returns to these skills accounted for between 20 and 40 percent of changes in inequality for various education groups.

Citation: Chen, W., & Grove, W. A., & Hussey, A. (2017). The role of confidence and noncognitive skills for post-baccalaureate academic and labor market outcomes. *Journal of Economic Behavior & Organization*, *138*, 10–29. doi: 10.1016/j.jebo.2017.03.020

Data source: GMAT Registrant Survey, conducted in four waves from 1990 to 1998.

Population studied: 3,878 GMAT registrants, 38 percent of whom obtained an MBA by the end of the sample period.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X	X	X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X			X		Noncognitive skills (self-rating on 16 skills or attributes), verbal confidence, quantitative confidence, parents' education, quantitative GMAT, verbal GMAT.

Chen, Grove, and Hussey (2017) conducted Oaxaca-Blinder decomposition to examine the impact of noncognitive skills and confidence on the gender wage gap (measured both with hourly wages and annual salaries). Since the GMAT Registrant Survey was a multiwave longitudinal study, Chen et al. were able to use Wave 1 of the survey to assess confidence levels prior to the GMAT and Waves 3 and 4 of the survey to assess hourly wage/annual salary. The decomposition was conducted in two specifications: one with only the education and human capital variables reported in Wave 1 and one that updated these variables as of Wave 3.

Key findings: The study found a raw gender salary gap of about 24 percent (8.5 percent was explained by included predictors [e.g., noncognitive skills, test scores, education, industry], and 14.5 percent was explained by the updates to these variables [e.g., tenure, employment industry, graduate degrees]; a 10 percent gender wage gap remained unexplained). The variable of "quantitative confidence" explained about 13 percent of the gender wage gap in the model using Wave 1 predictors. Interestingly, women who were high in verbal confidence experienced 12.3 percent decrease in earnings.

Citation: Hussey, A. (2011). The effect of ethics on labor market success: Evidence from MBAs. *Journal of Economic Behavior & Organization, 80*(1), 168–180. doi: 10.1016/j.jebo.2011.03.005

Data source: Longitudinal survey of registrants for the Graduate Management Admissions Test (GMAT), administered in four waves, from 1990 to 1998.

Population studied: The first wave of the survey included responses from 5,853 individuals; due to some attrition, 3,771 of these individuals responded to the fourth wave. The sample only included individuals holding current, full-time jobs.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X			X	X	X	X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X			X		Quantitative GMAT; verbal GMAT; undergrad GPA; mother's education; skill index; lower-level manager; upper-level manager; self-employed; MBA by Wave 4; other advanced degree; wealth important, family important; career important; religion important; ethics.

Hussey (2011) estimated wage equations (where the outcome of interest was the log hourly wage) for up to four survey waves for each person in the sample. Controlling for several other factors, such as individual ability, attitudes, and employment, the authors regressed the effect of individuals' ethics and gender on wage.

$$\ln W_{it} = X_{it}\beta_1 + Ethics \times \beta_2 + Ethics \times Female \times \beta_3 + MBA_{it} \times \beta_4 + \varepsilon_{it}.$$

Key findings: The study found that ethical characteristics were negatively associated with males' wages but not with females' wages. For males, the greater the degree to which business education was reported to enhance their ethical character, the lower their wages were. For females, however, Hussey (2011) found that enhanced ethics through business school were positively and significantly associated with returns to the MBA degree.

Citation: Judge, T. A., Livingston, B. A., & Hurst, C. (2012). Do nice guys—and gals–really finish last? The joint effects of sex and agreeableness on income. *Journal of Personality and Social Psychology, 102*(2), 390–407. doi: 10.1037/a0026021

Data source:
Study 1: National Longitudinal Surveys of Youth 1997, annual interview data from 1997–2008.
Study 2: National Survey of Midlife Development in the United States, interview data from 1995–1996.
Study 3: Wisconsin Longitudinal Study, survey data from in 1957, 1964, 1975, and 1992–1993.
Study 4: survey of a business management class at a Southeastern university.

Population studied:
Study 1: 560 youths who were aged 16–20 years in 1997 and were working outside the home (e.g., not enrolled in college full-time) at least 1,000 hours per year.
Study 2: 1,681 noninstitutionalized, English-speaking individuals (1,000 men and 681 women) aged 25–74 years old who were employed full-time outside of the home.

Study 3: 1,691 individuals (1,157 men and 534 women) who graduated from Wisconsin high schools in 1957 and who were employed full-time and reported positive income for the year.
Study 4: 460 undergraduate students in a business management class at a Southeastern university.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X			

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X						Agreeableness, neuroticism, extraversion, conscientiousness, openness, job responsibility, management potential, agreeableness of rater.

For studies 1 through 3, Judge, Livingston, and Hurst (2012) ran descriptive statistics and correlations, estimated a pooled regression for men and women combined, and performed separate regressions for each gender. For study 4, they used the Hierarchical Linear and Nonlinear Modeling 6 model.

Key findings: All four studies showed that while agreeableness or lack thereof had no effect on women's incomes, men earned a substantial premium for being disagreeable and were penalized when they were highly agreeable. In general, men earned more than women regardless of agreeableness.

Citation: Keaveny, T. J., Inderrieden, E. J., & Toumanoff, P. G. (2007). Gender differences in pay of young management professionals in the United States: A comprehensive view. *Journal of Labor Research*, *28*(2), 327–346. doi: 10.1007/BF03380049.

Data source: Two surveys sponsored by Graduate Management Admissions Council (GMAC).

Population studied: Sample includes participants currently enrolled in MBA programs or registered to take the GMAT, with undergraduate degrees pursuing careers in professional and managerial fields. The first sample questionnaire was given in 1985 for first-year grad students, totaling 2,054 responses; after exclusions, the sample was 519 (working full-time and attending part-time). The second sample questionnaire was given between June 1990–March 1991, totaling 5,790 responses; of this total, there were 2,460 full-time employed respondents.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X	X	X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X			X (Continuous).	X	College major, gaps in employment; length of service with current employer, hours worked, number of persons supervised, budgetary responsibilities, job training, gender density of occupation, and verbal and quantitative skills.

Keaveny, Inderrieden, and Toumanoff (2007) used Oaxaca-Blinder decomposition to analyze the gender earnings differences by men and women.

Key findings: The study found that (1) the gender salary differential disappears when cognitive skills are accounted for; (2) all four categories of human capital variables, job characteristics, employer characteristics, and cognitive skills are jointly significant except the race variables; (3) men are rewarded more for work experience and verbal skills, but women are rewarded more for quantitative skills; and (4) unexplained differences are still present. Results from model decompositions are consistent with single equation models.

Citation: Negrey, C., & Rausch, S. D. (2009). Creativity gaps and gender gaps: Women, men and place in the United States. *Gender Place and Culture*, *16*(5), 517–533.

Data source: 2000 U.S. Census.

Population studied: Men and women in the 11 most creative and 10 least creative U.S. regions.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X		X			X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X		X				11 most creative regions and 10 least creative regions; class categories (super-creative core, creative professionals, working class, service class); female householder—no husband present.

Negrey and Rausch (2009) utilized analysis of variance and multiple analysis of variance methods to examine the wage distributions of men and women in the United States' most and least creative regions, as well as to analyze the impact on earnings of the interaction between region and gender.

Key findings: The study found that the average gender earnings gap was relatively similar (approximately $10,000) in both the most and least creative regions. The authors also found that gender was more important than region in determining a worker's earnings. While it is advantageous for both men and women to work in the most creative region, it is more advantageous for women to move into occupations traditionally dominated by men, no matter what region the women work in. The authors concluded that region appears to make little difference in the gender earnings gap because occupational gender segregation is so deeply entrenched in the United States.

Citation: Reuben, E., Sapienza, P., & Zingales, L. (2015). *Taste for competition and the gender gap among young business professionals*. National Bureau of Economic Research Working Paper 21695.

Data source: Four data sources on University of Chicago MBA Graduates: (1) laboratory experiment and survey questionnaire; (2) business school admissions; (3) business school career office; (4) data from tracking participants 7 years after graduation.

Population studied: 129 University of Chicago MBA graduates.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
	X		X	X		X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Choose the tournament, expected tournament rank, discount rate, reciprocity, cooperation, cognitive reflection test (CRT) score, empathy, self-efficacy, religious, U.S. resident.

Reuben, Sapienza, and Zingales (2015) examined the role that preferences for competition may play in explaining the gender wage gap. Through a lab experiment, the authors collected data on competition, which was then merged with administrative and survey data to provide evidence of the relationship between competition and gender pay disparities.

Key findings: The study found that mean earnings for men ($175,000) were significantly higher than those for women ($149,000) immediately following graduation, and the gap exists even when controlling for industry. However, evidence suggested that women select into lower paying industries. Results for competition indicated that those men and women classified as competitive in the lab experiment earned nine log points more than those who were not competitive. Finally, these gender differences in preference for competition accounted for around 10 percent of gender pay disparities.

Citation: Stinebrickner, T. R., Stinebrickner, R., & Sullivan, P. J. (2018). *Job tasks and the gender wage gap among college graduates*. National Bureau of Economic Research Working Paper 24790.

Data source: Berea Panel Study, 2000–2014.

Population studied: The sample consists of 526 students who entered Berea College in fall 2000 and 2001.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X		X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						College major, weekly hours worked, tasks required for current job, task-specific experience, college GPA.

Stinebrickner, Stinebrickner, & Sullivan (2018) used a regression to quantify the role that gender differences in tasks play in generating the gender wage gap; the outcome of interest was log-wage, and the predictor variables included gender, current job tasks, task-specific experience, college GPA, and college major.

Key findings: The study found that unique measures of task-specific experience, such as high-skilled information experience, were particularly significant in explaining the increase in the wage gap detected early in the career, whereas current-period tasks did not account substantially for the gender wage gap. More specifically, the raw gender wage gap was 8.6 percent; however, when all predictors were included in the model, the gender wage gap was decreased to 4.7 percent. Although gender differences in job tasks persisted over time, current-period tasks did not differentially change for men and women over their careers. These findings also indicate that men did not strictly work in jobs with the highest paying tasks; however, did suggest that men accumulated substantially more high-skilled information experience, and this particular experience was strongly associated with higher wages.

Compensation and Benefits

Citation: Abraham, M. (2018). Pay formalization revisited: Considering the effects of manager gender and discretion on closing the gender wage gap. *Academy of Management Journal*, *60*(1), 29–54. doi: 10.5465/aml.2013.1060

Data source: FinServ HR records, January 1996–May 1999.

Population studied: 857 full-time nonmanagerial employees and 156 full-time branch managers from 120 retail branches of a globally diversified financial services firm (FinServ).

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X		X	X		X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
		X			X	Organizational positions; employee-level variables (experience defined using organizational tenure, performance, and promotion of employee); manager-level variables (organizational tenure); branch-level variables (branch size, revenues).

Abraham (2018) examined how the pay system formalization and inequality differs depending on the gender of the branch manager, using an estimated various cross-sectional time series. Abraham used multivariate analyses with the logarithm of "less formalized pay" and "formalized pay" (i.e., bonus pay) as the dependent variables to examine whether relative pay for male and female employees differs by manager gender and the organizational position of the nonmanagerial employee.

Key findings: The study found an overall gender wage gap for less formalized pay (but not for formalized pay). The study found that, on average, male employees who reported to male managers earned approximately 5 percent higher base salaries than male employees who reported to female managers. Conversely, there was no difference in female employees' base salaries based on their manager's gender. The study also found that female nonmanagerial employees earned lower base salaries across all occupational positions compared to male employees in similar branch positions; however, male and female employees earned comparable formalized pay in each organizational position. Findings show that female managers only compensate employees differently than male managers for less formalized pay. However, this effect was only present in employees of the lowest organizational ranks.

Citation: Bowles, H. R., & Babcock, L. (2012). How can women escape the compensation negotiation dilemma? Relational accounts are one answer. *Psychology of Women Quarterly 00*(0), 1–17. doi: 10.1177/0361684312455524

Data source: MarketTools.

Population studied: 402 college-educated Americans with work experience (197 women and 205 men) with a median age of 39.5 (range: 20–79) and a median of 19 years of work experience (range: 1–55). A total of 249 (62 percent) had management experience, with a median of 10 years of experience (range: 1–50).

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X			X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Measures (social outcome, negotiation outcome, relational, deferential, legitimate) x Negotiation Scripts (simple negotiation, relational script, outside-offer account, relational script plus account).

Bowles and Babcock (2012) conducted two studies. Both studies examined social and financial outcomes of strategies used by men and women when negotiating compensation.

Bowles and Babcock conducted regression analyses to test the significance of proposed mediators: relational as an explanation for willingness to work with female negotiators and legitimate as an explanation for willingness to grant negotiation requests. Deferential was used only as a control for tests of the mediating effect of relational on willingness to work. For all mediation tests, researchers calculated the Sobel statistic and bootstrapped the distribution of the coefficients' product along the indirect path of mediation. For all mediation analyses, the bootstrapping method and Sobel calculation produced the same results. For efficiency, the study reported only the Sobel statistic following each mediation test.

Key findings: The findings of Study 1 showed that when female negotiators communicated their concern for organizational relationships and provided a legitimate compensation request, social outcomes improved but not financial outcomes. Study 2 found that when female negotiators communicated their concern for organizational relationships using a relational account (defined as a strategy that makes a female negotiator appear more relational and, therefore, more gender-stereotype-conforming, while simultaneously making a female negotiator's compensation requests seem more legitimate), both social and financial outcomes improved.

Citation: Bugeja, M., Matolcsy, Z. P., & Spiropoulos, H. (2012). Is there a gender gap in CEO compensation? *Journal of Corporate Finance, 18*(4), 849–859. doi: 10.1016/j.jcorpfin.2012.06.008

Data source: Cross-sectional data for U.S. firms between 1998–2010, collected from the Investor Responsibility Research Center, Compustat Fundamentals Annual and Execucomp databases.

Population studied: 14,759 firm-years of U.S. publicly listed companies with female CEOs for 1998–2010. Observations with missing CEO compensation data and observations with reported total CEO compensation of $0 were excluded.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X			X	X			X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X	X (percentage of female directors)				Corporate governance (size of board, percentage of independent directors, and compensation committee independence) and CEO managerial power (is CEO also the board chairperson).

Bugeja, Matolcsy, and Spiropoulos (2012) measured the natural log of CEO total compensation. Due to the large disparity between male and female CEO firm years, Bugeja et al. conducted an analysis of the difference in CEO pay between males and females using a propensity score matching methodology. The likelihood of a firm having a female CEO was modeled within a year using a logistic regression with independent variables, including firm size, board size, and percentage of female directors. Using these results, Bugeja et al. matched firms led by female CEOs to firms led by male CEOs within their respective industries. The authors estimated a pooled cross-sectional regression to examine if CEO gender influences the level of CEO compensation.

Key findings: The study found no significant difference in total compensation, salary, or bonus for female CEOs compared to male CEOs. Bugeja et al. found that total compensations were lower for female CEOs, but the differences were not significantly different compared to male CEOs. Bugeja et al. found that while the salaries for female CEOs were higher than male CEOs, the difference was insignificant, and though male CEOs tended to receive higher bonuses, there was no significant difference.

Citation: Cowan, B., & Schwab, B. (2016). Employer-sponsored health insurance and the gender wage gap. *Journal of Health Economics, 45*, 103–114.

Data source: National Longitudinal Survey of Youth, 1979 cohort from the 2002, 2004, 2006, and 2008 waves; Medical Expenditure Panel Survey from the 2002–2008 waves.

Population studied: Individuals who are between 37 and 51 years old, work full time, and are employed in private for-profit firms or nonprofit organizations.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X	X	X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X				X	Health insurance through employer or elsewhere; AFQT score (0–24th percentile, 25th–50th percentile, 51st–75th percentile, 76th–100th percentile); year; smoking status; obesity status; other fringe benefits (training or educational opportunities, profit sharing, retirement plan, life insurance).

The authors used a difference-in-differences approach by comparing workers who receive insurance from their own employer to workers who receive their insurance elsewhere. They also utilized regression analysis and traditional decomposition methods to estimate the gender wage gap.

Key findings: The study found that female employees face a larger gender wage gap when they have employer-sponsored health insurance (ESI). ESI accounts for about 10 percent of the overall gender wage gap. Authors concluded that this phenomenon is due to differing use of healthcare resources by gender. When comparing women's wages with ESI and actual healthcare cost differences by gender, estimates suggest an hourly loss in wages of $0.50–$1.50 and a yearly loss in wages of $1,000–$3,000.

Citation: Daneshvary, N., & Clauretie, T. M. (2007). Gender differences in the valuation of employer-provided health insurance. *Economic Inquiry, 45*(4), 800–816. Doi: 10.1111/j.1465-7295.2007.00057.x

Data source: Medical Expenditure Panel Survey data from the Agency for Healthcare Research and Quality.

Population studied: 3,723 working married men and 3,042 working married women between the ages of 19 and 65 who are not college students, non-civilian labor-force workers, or farm workers.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X		X	X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X			X (categorical).	X	Health status and health insurance variables (annual health expenditure; work limiting disability; number of half-days missed work; contribution to premium; total annual healthcare benefits; whether plan is a health maintenance organization; job characteristics [paid sick leave and paid vacation leave]).

The authors aim to account for the endogeneity of health insurance decisions by examining an empirical model that estimates the effect of a dichotomous variable representing employer-provided health insurance on annual earnings. They conducted separate ordinary least squares regressions for men and women, including variables related to health status and job characteristics.

Key findings: The study found that married female workers accepted wages that were about 20 percent lower in return for insurance compared to 16.5 percent lower wages for married male workers. In addition, out-of-pocket premiums boost annual earnings by 2.2 percent for men and 2 percent for women. Authors conclude that preference for employer-provided health insurance and healthcare needs accounts for about 5 percent of the explained gender wage gap, as decomposition showed that employer-provided health insurance explains 3 percent and health- and job-related characteristics explain 2 percent. However, results do not indicate that health insurance contributes to the unexplained portion of the gender pay gap.

Citation: Gayle, G. L., Golan, L., & Miller, R. A. (2012). Gender differences in executive compensation and job mobility. *Journal of Labor Economics, 30*(4), 829–871. doi: 10.1086/666615

Data source: Standard & Poors (S&P) ExecuComp Database 2006, supplemented by the S&P COMPUSTAT North America database 1991–2006 and monthly stock price data from the Center for Securities Research database.

Population studied: 16,300 executives from 2,818 firms in primary, consumer goods, and services industrial sectors.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
					X	Rank (determined by algorithm based on job titles and probability of job transition); four measures of experience: number of years of managerial experience, tenure at current firm, number of different firms worked at, and whether promoted in the previous year).

Gayle, Golan, and Miller (2012) created decompositions to illustrate the quantitative impact of different factors on the gender differences in length of careers, executive level, executive compensation over time, and lifetime compensation.

Key findings: Gayle et al. found that women are paid more, both in total pay and pay for performance, for the same experience at most ranks. In addition, female executives are promoted internally more often than male executives. However, the study finds that female executives earn less than their male counterparts in average career compensation. The findings explain this phenomenon by showing that women and men have different characteristics when they become top executives. Female executives are, on average, 2 years younger and have less job experience than male executives, and this may impact their career trajectories. Additionally, women exit the occupation at a much higher rate than men, and this could impact their earnings in an occupation that rewards experience. Finally, the study shows that women are less than half as likely as male executives to become a CEO at any age; it is less likely for women compared to men to reach the highest ranks of the career.

Citation: Gupta, V. K., Mortal, S. C., & Guo, X. (2018). Revisiting the gender gap in CEO compensation: Replication and extension of Hill, Upadhyay, and Beekun's (2015) work on CEO gender pay gap. *Strategic Management Journal, 39*(7), 2036–2050.

Data source: ExecuComp (compensation data), RiskMetrics (data on board characteristics), Compustat (accounting data and equity market value), Center for Research in Security Prices (return information).

Population studied: 19,170 firm-year observations from 2,282 unique firms, including 469 firm-year female observations and 105 unique female-CEO firms.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X		X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X				X	Return on assets for firm performance; equity return, firm risk, CEO/Chair duality, board size, board independence, officer and board ownership.

Gupta, Mortal, and Guo (2018) used multivariate regressions to replicate and update the work of Hill, Upadhyay, and Beekun (2015) that found female CEOs are compensated substantively more than male CEOs. They updated the study including more comprehensive measures of compensation, including salary, bonus, total value of restricted stocks granted, total value of stock options granted, and long-term incentive payouts.

Key findings: Overall, the authors found no significant evidence of substantive pay differences between male and female CEOs. The authors concluded that they cannot reject the null hypothesis of no difference between male and female compensation. The lack of evidence for significant gender differences in CEO compensation is consistent over the time periods studied, indicating that time does not seem to be an important contextual influence on gender differences in CEO compensation.

Citation: Heywood, J. S., & Parent, D. (2017). Performance pay, the gender gap, and specialization within marriage. *Journal of Labor Research, 38*(4), 387–427. doi: 10.1007/s12122-017-9256-5

Data source: National Longitudinal Survey of Youth from 1980–2012 and the Panel Study of Income Dynamics.

Population studied: Married couples in which the male was between 18–64 years of age and had positive earnings in any year between 1980 and 2010. Heywood and Parent (2017) constrained average hourly earnings to between $4 and $300 (in 2011 dollars). Although the study allowed for wives to have annual hours of work, those wives who work are constrained by the same $4 and $300 hourly limits. With these restrictions, the study included a sample of 130,750 individual-year observations for 7,232 couples of whom the husbands reported positive earnings.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X			X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Performance vs. nonperformance pay job.

To examine the gender earnings gap, Heywood and Parent used a modified version of the DiNardo, Fortin, and Lemieux (1996) methodology ("DFL") to account for the combined effect of both job type (i.e., performance vs. nonperformance) and whether the individual was a parent by focusing on these two outcomes together (i.e., being both in a performance pay job [pay earnings based on objective performance] and being a parent).

Key findings: The study found that the large gender earnings gap at the top of the distribution was associated with the motherhood penalty, and both were uniquely associated with performance pay. Parents drove both the larger gap and its growth at the top of the distribution. Mothers in performance pay jobs earn significantly less than childless females; the reverse is true for fathers. In jobs without performance-based pay, these differences were tempered or absent. Heywood and Parent also found that these patterns appear consistent with specialization by gender. Among married couples with children, the hours wives work was strongly and persistently negatively correlated with husbands' earnings only when those husbands work in performance pay jobs. There was no correlation, however, between husbands' hours and wives' earnings. The glass ceiling and the "motherhood penalty" (i.e., women with children earn less than women without children) both seem related to performance pay. Thus, Heywood and Parent suggest that wives, especially mothers, perform most of the adjustments to family labor supply; these adjustments then influence the wage distribution through the selection process. The authors further indicated that differential pay between mothers and fathers in performance pay may reflect unmeasured differences in labor force attachment.

Citation: Leibbrandt, A., & List, J. A. (2012). *Do women avoid salary negotiations? Evidence from a large-scale natural field experiment*. National Bureau of Economic Research Working Paper No. 18511.[4]

Data source: Experiment questionnaire and job advertisement.

Population studied: 2,500 job seekers.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X					X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other

Leibbrandt and List (2012) investigated how ambiguity affects gender differences in salary negotiations by comparing job-seeking behavior in two contract environments. The experiment used a job advertisement for an actual job arranged across nine cities. Randomized jobseekers who expressed interest in the position were assigned to one of two contract environments: a treatment in which wages were not explicitly advertised as negotiable and another in which wages were explicitly advertised as

[4] The study team reviewed the National Bureau of Economic Research working paper listed above. The study has since been published as Leibbrandt, A., & List, J. A. (2015). Do women avoid salary negotiations? Evidence from a large-scale natural field experiment. *Management Science*, *61*(9), iv–ix. doi: https://doi.org/10.1287/mnsc.2014.1994

negotiable. To test the relevance of gender-based performance stereotypes for salary negotiations, ads were posted for two openings for administrative assistant positions: one general, "gender-neutral" version of the job and one more "masculine" version of the job.

Key findings: The study found that men prefer workplaces where wage negotiations are ambiguous and that in such environments, they tend to negotiate more often than women. The authors found no statistically significant gender differences in the willingness to negotiate wages. Both findings hold even for a job with a masculine job task, a workplace environment in which one would expect men to have an advantage. This study suggests that the gender wage gap cannot be universally or easily explained by gender-dependent sorting based on preference for salary negotiation.

Citation: Shin, T. (2012). The gender gap in executive compensation: The role of female directors and chief executive officers. *Annals of the American Academy of Political and Social Science, 639*(1), 258–278. doi: 10.1177/0002716211421119.

Data source: Standard and Poor's (S&P) ExecuComp database.

Population studied: Companies in the S&P 1500 index (S&P 500, S&P MidCap 400, and S&P SmallCap 600) in 1998 and their executives.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X							

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
					X (log of total sales).	Women on compensation committee; women on board of directors; total shareholder returns; compensation committee members appointed by CEO; directors appointed by CEO; directors from outside the committee; membership on company's board of directors; job title (CEO, CFO, etc.); return on assets; other characteristics of company's board of directors.

Shin (2012) used random-effects models (with gender as the key variable of interest) to estimate the effects of social-psychological factors on the gender gap in executive compensation. As a check of robustness, Shin used alternative estimation techniques including ordinary least squares, generalized linear model, and a three-level hierarchical linear model with random intercepts.

Key findings: The study found a significant gender gap in executive compensation, although it varied substantially by the gender composition of the board of directors. The gender gap in compensation narrowed significantly as the representation of women on the board of directors increased. It is worth noting, however, that the presence of a female CEO did not affect the compensation of female executives working under the female CEO.

Firm- and Industry-Specific Employment Characteristics

Citation: Addison, J. T., Ozturk, O. D., & Wang, S. (2018). The occupational feminization of wages. *ILR Review, 71*(1), 208–241. doi: 10.1177/0019793917708314

Data source: (1) Panel and cross-sectional data from the Current Population Survey Merged Outgoing Rotation Groups (CPS-MORG) from 1996–2010, (2) National Longitudinal Survey of Youth 1979 (NLSY79), (3) the Occupational Information Network from 2008, (4) Occupational Projections and Training Data from 2002, and (4) Current Population Survey (CPS) Annual Social and Economic.

Population studied: Workers aged 16 years and older. Individuals who were full-time students, self-employed, worked for no pay, in the military, who earned real hourly wages lower than $1, and who allocated or imputed their wages were excluded.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X		X		X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X	X	X	X		Variable measuring female intensity of an occupation (i.e., share of female workers in the relevant three-digit part time employment shares).

Using CPS-MORG data from 1996 to 2010, Addison, Ozturk, and Wang (2018) used cross-sectional estimates of the effect of occupational feminization of wages and its effects on the gender wage gap. Addison et al. examined cross-sectional and longitudinal evidence in standard and expanded models and analyzed various sensitivities and decomposition effects on the female intensity of an occupation (i.e., the share of female workers in the relevant three-digit occupation). This study updated Macpherson and Hirsch's 1995 study, which used monthly CPS data from 1973–1993 to examine the relationship between occupational gender composition and earnings. Further, Addison et al. corrected the dataset for biases attributable to the inclusion of imputed earners and the misreporting of occupation.

Key findings: This study found that occupational gender composition explained only a portion of the gender wage gap. Indeed, findings indicate that men and women self-selected into predominantly gender-homogenous jobs, as evidenced by lower unobserved skills or unobserved differences in taste, both of which were correlated with gender composition and job characteristics. Interestingly, the impact of gender composition on earnings was decreased when observed heterogeneity was controlled for and was also decreased when controlling for unobserved heterogeneity. Additionally, findings suggested the largest wage penalties affected the younger cohorts in predominantly female jobs.

Citation: Apaydin, E. A., Chen, P. G. C., & Friedberg, M. W. (2018). Differences in physician income by gender in a multiregion survey. *Journal of General Internal Medicine*, *33*(9), 1574–1581. doi: 10.1007/s11606-018-4462-2

Data source: 2013 study of physician professional satisfaction.

Population studied: 439 practicing physicians in 30 practices across Colorado, Massachusetts, North Carolina, Texas, Washington, and Wisconsin.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X		X			X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
					X	Medical specialty group, ethnicity, hours worked per year, work hours composition, percent of patient care hours spent performing procedures with or without anesthesia, compensation type, practice ownership model (physician owned or partnership), hospital or corporate owner.

Apaydin, Chen, and Friedberg (2018) estimated seven multilevel mixed-effects generalized linear models of annual income as a function of several different covariates.

Key findings: The study found that male physicians earned $27,404 more than female physicians after controlling for various characteristics. Adjusting for these factors in the full model explained 69.8 percent of the unadjusted winsorized income difference between men and women in the sample, leaving approximately 30 percent of the unadjusted income difference unexplained.

Citation: Bender, K. A., & Roche, K. (2016). Self-employment and the paradox of the contented female worker. *Small Business Economics, 47*(2), 421–435. doi: 10.1007/s11187-016-9731-z

Data source: National Survey of College Graduates, 2003.

Population studied: 82,572 employees who have at least a bachelor's degree in a science, technology, engineering, or mathematic (STEM) area, and/or are currently working in a STEM-related field.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X		X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X				X		Each worker was asked to evaluate the following criteria on a scale of "very important," "somewhat important," "somewhat unimportant," or "not important at all:" job's opportunities for advancement, benefits, intellectual challenge, degree of independence, location, level of responsibility, salary, security, contribution to society.

Bender and Roche (2016) estimated a series of ordered probit regressions using overall job satisfaction as the dependent variable and controlling for a set of standard covariates including educational mismatch, supervisory status, citizenship, disability, earnings, hours worked per week, years in job, full-time status, educational degree, age (and its square), marital status, race/ethnicity, region of residence, and broad field of occupation.

Key findings: The study found that women earned 18 percent less than men among wage and salary workers and 25 percent less among self-employed workers. Job attributes including advancement, benefits, responsibility, salary, and contribution to society were reported as "very important" by women in both sectors (wage/salary and self-employed). After controlling for differences between desired and actual job attributes, no statistical correlation between gender and job satisfaction was found.

Citation: Bernal, A. T, Vasquez, W. F., Edwards, L. L., & Giles, M. (2018). Exploring gender wage disparity in MFT academic programs. *Contemporary Family Therapy*, *40*(4), 372–379. doi: 10.1007/s10591-018-9462-1

Data source: Merged data from preexisting sources that contain information about faculty members in accredited marriage and family therapy (MFT) programs in the United States.

Population studied: 160 MFT faculty housed in 35 programs at 33 public institutions. Salary information was available for 86 women and 74 men, while data for all the academic attributes were only available for 37 women and 34 men.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X			X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Number of book chapters, number of refereed articles, amount of money from external grants, administrative appointments.

Bernal, Vasquez, Edwards, and Giles (2018) used Oaxaca-Blinder decomposition of annual salary to assess the gender salary differences of MFT faculty. They also examined whether there were gender differences in academic attributes and how these differences in academic attributes could relate to differences in salary.

Key findings: The study found a difference of $9,000 in annual salary between the male and female MFT faculty studied. The results showed that certain academic attributes, such as number of peer-reviewed publication and years in academia, can partially explain this gap. Women have published significantly fewer peer-reviewed journal articles and have spent significantly less time in academia when compared with their male counterparts. However, the study found no evidence of salary discrimination against female MFT faculty.

Citation: Binder, M., Krause, K., Chermak, J., Thacher, J., & Gilroy, J. (2010). Same work, different pay? Evidence from a U.S. public university. *Feminist Economics, 16*(4), 105–135. doi: 10.1080/13545701.2010.530605

Data source: University of New Mexico records of each faculty member's teaching portfolio.

Population studied: 316 tenure track faculty in the College of Arts and Sciences at University of New Mexico faculty in the 2004–05 academic year.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X			X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Department; productivity (primary variable of interest—vector of direct teaching, grant, and publications productivity measures); mobility (consists of two indicator variables: ''had pension choice,'' which takes the value of one if the faculty member began at UNM in 1991 or after).

Binder, Krause, Chermak, Thacher, & Gilroy (2010) used ordinary least squares and Oaxaca-Blinder decomposition to explore the extent to which gender wage differentials were explained by differences in rewards to productivity characteristics.

Key findings: The study found wage penalties for women at the department level rather than the university level. Departmental affiliation accounted for half of the gender gap. The study also found that while women received greater returns than men for taking administrative positions, women received lower returns on the constant term and for years of service at the university. Consistent with the finding of no discrimination at the university level, there were high rewards for serving as the department chair or assistant dean. There was no additional penalty for being Hispanic, as Hispanic women faced the same wage gap as non-Hispanic women. Binder et al. found a 15 percent raw gender wage gap with a 3 percent unexplained gender wage gap when all control variables were included. In departments with a low proportion of women, the unexplained gender pay gap was closer to 10 percent.

Citation: Bolitzer, B., & Godtland, E. M. (2012). Understanding the gender-pay gap in the federal workforce over the past 20 years. *American Review of Public Administration, 42*(6), 730–746. doi: 10.1177/027507401143801

Data source: Status file of the Central Personnel Data File produced by the Office of Personnel Management.

Population studied: A random sample of 20 percent of the federal workers during the month of September in 1988, 1998, and 2007.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
		X	X			X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X			X	X		Work schedule, health plan type, disability status, state, agency bargaining status, and veteran status.

Bolitzer and Godtland (2012) used Oaxaca-Blinder decomposition to examine potential causes of the gender pay gap measured in annual federal salary, controlling for demographics, education, experience and other characteristics.

Key findings: The study suggests that the significant decline in the gender pay gap for the federal workforce, primarily because men and women have become more similar in labor market characteristics than they were in previous years. However, the study found a persistent pay gap of approximately 8 percent throughout the previous 20 years.

Citation: Carvajal, M. J., Armayor, G. M., & Deziel, L. (2012). The gender earnings gap among pharmacists. *Research in Social and Administrative Pharmacy, 8*(4), 285–297.

Data source: An October 2006 survey of licensed pharmacists.

Population studied: 1,478 registered pharmacists (626 men and 590 women) in South Florida.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X		X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Type of primary practice site, primary work activity, overall job satisfaction rating, perception of advancement opportunities, perception of job security.

Caravajal, Armayor, and Deziel (2012) estimated the gender gap in log (and unlogged) earnings for male and female pharmacists and conducted separate earnings functions by gender in order to determine whether the two equation forms yielded similar estimates.

Key findings: The study found that different sets of independent variables impacted male and female earnings, with coefficients on variables occasionally differing in sign as well. Estimates were consistent across both functional forms (the unlogged and log earnings models), with almost identical male–female earnings ratios. However, some of the included independent variables had differing effects on earnings, depending on the functional form of the dependent variable. The authors also found that controlling for number of hours worked, human-capital stock, job preferences, and opinion variables only slightly lessened the unadjusted male–female earnings ratios, suggesting the existence of a gender bias.

Citation: Cech, E. A. (2013). Ideological wage inequalities? The technical/social dualism and the gender wage gap in engineering. *Social Forces, 91*(4), 1147–1182. doi: 10.1093/sf/sot024

Data source: National Science Foundation's National Survey of College Graduates, 2003.

Population studied: 9,936 college graduates (1,120 women and 8,816 men) employed in engineering as their primary occupation.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X	X	X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X				X	Work activity (primary work activity, level of relevance to engineering major, whether they spend more than 10 percent of work activity on a list of activities); private/public educational institution; Carnegie classification; engineering subfield (i.e., type of engineering field); publications or patents; number of people supervised; importance of monetary compensation; importance of nonmonetary compensation; sector.

Cech (2013) used univariate and bivariate statistics, ordinary least squares regression models, and interaction models to investigate the role of cultural ideologies within the engineering profession and workplace gender wage inequality. The outcome of interest was the log salary.

Key findings: The study shows that cultural ideology within professions contributed significantly to workplace gender inequality within professions. The initial findings indicated a gender wage gap of about 16 percent ($13,000) between men and women. Interestingly, women were significantly more likely than men to be employed in non-core technical subfields (technical subfields were defined as basic research, applied research, product design, development, accounting, quality management, computer applications and production/applications work) or engage in mostly social work activity (defined as management, employee relations, sales, teaching), which partially explained the gender wage gap.

Citation: Chen, M. K., & Chevalier, J. A. (2012). Are women overinvesting in education? Evidence from the medical profession. *Journal of Human Capital, 6*(2), 124–149. doi: 10.1086/665536

Data source: Robert Wood Johnson Community Tracking Physician Survey of 2004–2005 and the American Academy of Physician Assistants' annual survey for 2005, Community Tracking Physician Survey for 2005, Medical Group Management Association's Physician Compensation and Production Survey 2005.

Population studied: Physician's assistants (PAs) and physicians in primary-care fields.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X			X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X				X	Private/public sector, permanent/temporary job, grade/score.

The analysis focused on a comparison of the investments and outcomes of PAs and physicians in primary care fields using the Oaxaca-Blinder decomposition method.

Key findings: The study found that male physicians earned higher hourly wages compared to female physicians at all experience levels after the lowest experience level. A gender wage gap also existed for PAs, though it was much smaller in both absolute and percentage terms than the gender wage gap for physicians. The study found that although the up-front investment required of male and female physicians was the same, male physicians earned wages over many more hours (and at higher rates) than female doctors, in order to repay the up-front investment.

Citation: Choi, S. (2018). Pay equity in government: Analyzing determinants of gender pay disparity in the US Federal Government. *Administration and Society, 50*(3), 346–371. doi: 10.1177/0095399715581623

Data source: Central Personnel Data File 2005; Merit Principles Survey 2005.

Population studied: 36,926 federal employees from 59 agencies.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X			X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X		X				Supervisory status, organizational tenure, average grade of female employees, agency type.

Choi (2018) used ordinary least squares to analyze how agency type and occupation impact disparities in earnings by gender.

Key findings: The study found that there are significant differences in the organizational climate variables between different types of agencies. While redistributive agencies (e.g., education and health care) tend to pay less than distributive agencies, more women in redistributive agencies are in high-paying occupations. In contrast, women working in distributive agencies are in low-paying jobs. Therefore, the agency and occupation effects may offset each other.

Citation: Kronberg, A. K. (2013). Stay or leave? Externalization of job mobility and the effect on the US gender earnings gap, 1979–2009. *Social Forces, 91*(4), 1117–1146. doi: 10.1093/sf/sot041

Data source: Panel Study of Income Dynamics; Integrated Public Use Microdata Series.

Population studied: Non-Hispanic white and black full-time employed individuals between 18 and 65 years old.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X	X	X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X	X	X			Continuous measure that gauges how bad or good a job is, leavers vs. stayers, voluntary vs. involuntary employer changes, unemployment rate by state.

Kronberg (2013) used growth curve models to predict individual earnings and how gender and job mobility can impact earnings. Using these growth curve estimates, the author calculated the predicted gender pay gap in hourly income among employees who had stayed at their employer and employees who had left their employer in the last year.

Key findings: The study found that externalization affects gender earnings disparities differently depending on whether employees leave their employer voluntarily or involuntarily and whether employees work in good or bad jobs. For employees who leave their job voluntarily, the gender gap is narrowing quickly in good jobs and stagnating in bad jobs. For employees who leave their job involuntarily, the gender gap in good jobs at first closed but then swiftly widened in the 1990s. Among involuntary leavers in bad jobs, disparities have narrowed. Overall, externalization seems to create opportunities mostly for employees who already occupy good positions.

Citation: Flabbi, L. (2010). Prejudice and gender differentials in the US labor market in the last twenty years. *Journal of Econometrics*, *156*(1), 190–200. doi: 10.1016/j.jeconom.2009.09.016

Data source: Annual Social and Economic Supplement of the Current Population Survey from 1985, 1995, 2005.

Population studied: White individuals aged 30 to 55 with a college degree or more who are not self-employed.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X		X			

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Monthly unemployment duration.

Flabbi (2010) aimed to characterize labor market dynamics in order to evaluate whether explicit prejudice contributed to the 1990s slowdown in the convergence of gender earning differentials and to estimate the proportion of prejudiced employers over time. The author estimated a search model

assuming two types of employers (prejudiced and unprejudiced) and two types of workers (males and females). He parameterized prejudice by the proportion of prejudiced employers and by their disutility from hiring female employees and then analyzed the impact of prejudice on the gender gap in hourly earnings.

Key findings: The study found that the proportion of prejudiced employers has decreased at an increasing rate, from 69 percent in 1985 to 57 percent in 1995 to 32 percent in 2005. This decreasing proportion of prejudiced employers indicates that employer prejudice does not explain the slowing of convergence in gender earnings differentials. Rather, results indicated that most of the slowdown is due to the relative increase in average male productivity compared to female productivity. The ratio of average female productivity over average male productivity dropped from around 95 percent in 1995 to 82 percent in 2005.

Citation: Fleming, S. S. (2015). Déjà vu? An updated analysis of the gender wage gap in the US hospitality sector. *Cornell Hospitality Quarterly, 56*(2), 180–190. doi: 10.1177/1938965514567680

Data source: 2010 American Community Survey Public Use Microdata Sample.

Population studied: 112,990 people working in the U.S. hospitality sector in 2010.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X					

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X		X				Hours worked in the preceding year; occupational crowding.

Fleming (2015) estimated an ordinary least squares regression of log income on gender controlling for other variables.

Key findings: The study showed that women earn substantially less than men in the hospitality industry. Women experience a loss of income of $620 across the entire hospitality industry, compared to a mean income of $11,271 per year. In the food service sector, women's income was less by $542 relative to a mean income of $9,339. In the lodging sector, women earned $2,368 less compared to a mean income of $17,783. Managers face the most severe penalties, with women managers making $6,617: 21.6 percent less than the mean income of $30,577.

Citation: Fernandez-Mateo, I. (2009). Cumulative gender disadvantage in contract employment. *American Journal of Sociology, 114*(4), 871–923.

Data source: Longitudinal dataset on workers affiliated to a staffing agency, specializing in job placements for "highly skilled 'creative information technology' contractors."

Population studied: 250 contractors who joined the staffing agency in 1998 and 1999.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
		X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
					X	Job-specific training, project duration.

Fernandez-Mateo (2009) used ordinary least squares regression to estimate the project-specific wage gap of highly skilled contractors.

Key findings: The study found there was no gender-based pay gap for the first project a contractor was staffed on. However, when examining all projects, estimates suggested women earn about 5 percent less than men.

Citation: Goldin, C., Kerr, S. P., Olivetti, C., & Barth, E. (2017). The expanding gender earnings gap: Evidence from the LEHD-2000 Census. *American Economic Review: Papers & Proceedings 2017, 107*(5), 110–114. doi 10.1257/aer.p20171065

Data source: Longitudinal Employer-Household Dynamics (LEHD) database linked to the 2000 census.

Population studied: Individuals with earnings greater than 10 hours per week at minimum wage for half the quarters in the dataset. In addition, only the 26 largest Primary Metropolitan Statistical Areas across 18 states that provided unemployment insurance data are included in the LEHD.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X				X	X (state)

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X					Natural log of mean establishment earnings.

Goldin, Kerr, Olivetti, and Barth (2017) examined the relationship between the gender wage gap and job shifting, or the extent to which women are more likely to be in low wage establishments and move to higher wage jobs (within establishments) and establishments. The authors used regression analysis to

examine the impact of within- and between-establishment shifting on the natural log of mean quarterly earnings.

Key findings: The study found that the gender earnings gap for college graduates expanded by 33.7 log points between 1995 and 2008 but most of the increase occurred during the first half of the time period. When the authors controlled for mean establishment earnings and occupation, they found a gap of 18.9 log points. Therefore, they suggested that 44 percent of the wage gap is due to varying levels of between-establishment mobility by gender, while 56 percent is due to within-establishment mobility.

Citation: Goldin, C. (2014). A pollution theory of discrimination: Male and female differences in occupations and earnings. In L. P. Boustan, C. Frydman, & R. A. Mango (Eds.), *Human capital in history*: *the American record* (pp. 313–348). Chicago, IL: University of Chicago Press.

Data source: 1940 Office Worker Survey from DOL Women's Bureau.

Population studied: 3,000 workers in Philadelphia, Pennsylvania.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
		X	X	X			

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X		X		X	

Goldin (2014) presented a model based on the pollution theory of discrimination. The model treats discrimination as the result of men's desire to maintain occupational status and representation in the workplace. Men in a previously male-dominated occupation may want to prevent women from entering the workplace if "female" traits are more highly compensated.

Key findings: The study found median income for women was $1,318 per year, while 35 percent of men made less than that amount. For men, the median income was $1,560.

Citation: Goldin, C., & Katz, L. F. (2016). A most egalitarian profession: Pharmacy and the evolution of a family-friendly occupation. *Journal of Labor Economics, 34*(3), 705–746. doi: 10.1086/685505

Data source: Pharmacist Workforce Survey 2000, 2004, 2009; American Community Survey 2009–2011; Current Population Survey Merged Outgoing Rotation Group 2005–2013.

Population studied: 5,300 pharmacists.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X	X	X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X		Setting type of pharmacist, position.

Goldin and Katz (2016) examined how the linearity of pay with respect to hours can impact gender pay gaps within professions. Specifically, the authors studied pharmacists in the United States. For pharmacists, compared to other occupations, there is no hourly wage penalty for part-time work. Using ordinary least squares regressions, the authors explored the gender earnings gap among pharmacists, controlling for hours, self-employment, industry, and family composition.

Key findings: The study found that pharmacy has a relatively low gender earnings gap compared to similar occupations. Conditional on number of hours worked, female pharmacists earn only 4–7 log points less than their male counterparts. This represents a radical decrease, as the gap was 34 log points in 1970. In addition, having children no longer significantly widens the gender gap. The authors attribute the closing of the pay gap among pharmacists to the high degree of substitutability among pharmacists due to specialized and standardized training.

Citation: Hoisl, K., & Mariani, M. (2017). It's a man's job: Income and the gender gap in industrial research. *Management Science*, *63*(3), 766–790. doi: 10.1387/mnsc.2015.2357

Data source: Worldwide survey sponsored by the European Commission, titled "Innovative S&T indicators combining patent data and surveys: Empirical models and policy analysis," 2009–2011.

Population studied: 9,692 inventors with complete survey data.

Country/Countries: 20 European countries, Israel, the United States, and Japan.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X	X		X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X				X	X	Selection of inventors into types of jobs and tasks; potential parenthood; motivations to work (advancement, independence, contribution to society); number of working hours per week; hours of leisure time per week; past mobility; attitude towards taking risks; time devoted to certain tasks (inventing or more routine tasks); whether person had a top management position; country; technological class; priority year.

Hoisl and Mariani (2017) ran descriptive statistics to examine whether gender differences in income and inventive performance existed. Then, they estimated a series of ordinary least squares regressions to determine whether these gender differences still persisted after controlling for other relevant variables. The authors also conducted separate instrumental variable regressions, where religious activities serve as an instrument for fertility. Finally, they performed Oaxaca-Blinder decomposition to understand what portion of the gender gap can be attributed to the independent variables and what portion remains unexplained.

Key findings: The study found that females represented only 4.2 percent of all inventors, and they earned approximately 14 percent less than male inventors. The authors showed that this disparity was not due to difference in quality of inventions. The study also discovered that examined observable characteristics did not fully explain the income gap; female inventors performed as well as male inventors in production of high-quality patents, but they made less money. Of the characteristics studied, task and job selection (time devoted to invention or routine tasks, level of managerial responsibility, and work in the Research & Development department) were found to be strong predictors of income differentials.

Citation: Kongar, E., & Price, M. (2010). Offshoring of white-collar jobs in the United States and gendered outcomes. *International Journal of Manpower, 31*(8), 888–907. doi: 10.1108/01437721011088566

Data source: March Current Population Survey for 1996 through 2006 and the Displaced Worker Survey for 2004 and 2006.

Population studied: Workers, displaced workers, and formerly displaced workers.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X		X	X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X		X	X		Tradable sector, non-tradable sector, metropolitan status, job tenure, share of with health insurance, share reemployed, median change in earnings, and share with no loss in earnings.

Kongar and Price (2010) examined the role of offshoring in explaining the gender wage gap. To the extent that offshoring shifted the gender composition of various occupations, it may have a differential impact on the wage gap within and between various occupations. The authors estimated the gender wage gap using a regression analysis of mean wages and standard decomposition methods.

Key findings: The study found that the offshoring of white-collar jobs had impacts on women's employment and wages. In both tradable and non-tradable sectors, women who were in predominately

low-wage occupations had disproportionate job losses, which reduced the wage gap for women who remained. For tradable occupations, the gender wage gap stagnated due to two opposing effects: women's entry into high-paying occupations and their decline in employment in low-paying clerical occupations. Results also show that displaced women were less likely to be re-employed compared to men.

Citation: Kurtulus, F. A., & Tomaskovic-Devey, D. (2012). Do female top managers help women to advance? A panel study using EEO-1 records. *The Annals of the American Academy of Political and Social Science, 639*(1), 173–197. doi: 10.1177/0002716211418445

Data source: U.S. Equal Employment Opportunity Commission annual EEO-1 reports 1990–2003.

Population studied: *N* = 121,467 firm-years from more than 20,000 firms from 1990–2003.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X						X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X	X		X	X	%female manager, %female top manager, %female mid manager, Fed (dummy for federal contractor), %female nonmanager, %manager, workforce composition, federal contractor status, year fixed effects (dummies 1990–2003), industry-specific trends (interactions of a linear time trend with nine industry dummies).

Kurtulus and Tomaskovic-Devey (2012) examined the influence that top female managers may have on subsequent female presence in middle management at a firm, net of economy-wide and firm-specific factors that may also influence the evolution of female representation in midlevel management. Besides industry and time fixed-effects, other controls included a set of observable time-varying firm characteristics that are likely correlated with unobservable factors (e.g., firm culture, diversity policies); share of female nonmanagerial employees; share of black and Hispanic employees; share of employees who are managers; and federal contractor status, as the status requires compliance with diversity programs and affirmative action mandates.

Key findings: The study found that an increase in the share of female top managers is associated with subsequent increases in the share of females in midlevel management, a result which is robust even after controlling for all the effects noted. Although the influence of female top managers is strongest among white women, the study noted that black, Hispanic, and Asian women in top positions also have positive effects on subsequent increases in these groups for women in middle management, respectively. Furthermore, the influence of women in top managerial positions is stronger among federal contractors and within firms with larger female workforces. Because the authors also found evidence that the positive influence of female top managers on management-level gender diversity

diminishes over time, they concluded that women in the former group play positive yet transitory roles in women's career advancement in U.S. firms.

Citation: Le, T. A. N., Sasso, A. T. L., & Vujicic, M. A. (2017). Trends in the earnings gender gap among dentists, physicians, and lawyers. *Journal of the American Dental Association*, *148*(4), 157–262. doi: 10.1016/j.adaj.2017.01.004

Data source: Integrated Public Use Microdata Series for 1990 and 2000 and the 5-year American Community Survey sample for 2007–2011.

Population studied: 282,109 individuals who were identified as physicians (*n* = 113,586), lawyers (*n* = 143,113), or dentists (*n* = 25,410) on the basis of reported occupation.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X			X	X	X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X						Hours worked per week, weeks worked per year, self-employment.

Le, Sasso, and Vujicic (2017) used Oaxaca-Blinder decomposition to estimate differences in mean earnings across sexes, controlling for various characteristics, including age, work hours, and other factors.

Key findings: This study found a reduction in earnings gap, largely due to a general convergence between men and women in observed characteristics over time. Of the observable characteristics studied, age and hours worked per week played a significant role in explaining differences in earnings. Despite evidence of convergence, the study found large unexplained earnings differences between men and women despite differences narrowing over time. Unexplained differences in earnings varied by profession and ranged from 62–66 percent for female dentists and 52–57 percent for female physicians. Lawyers had the smallest unexplained differences.

Citation: Leslie, L., Manchester, C., & Dahm, P. (2017). Why and when does the gender pay gap reverse? Diversity goals and the pay premium for high potential women. *Academy of Management Journal, 60*(2)*,* 402–432. doi: 10.5465/amj.2015.0195

Data source: A survey of employees at a Fortune 500 organization; an experiment with graduate business students; pay data of top executives in S&P 1500 organizations (ExecuComp, COMPUSTAT North America, Center for Securities Research, Marquis Who's Who); participants from the Amazon Mechanical Turk platform.

Population studied: 1,311 employees from a Fortune 500 company; 270 graduate business students; 35,602 observations (8,968 executives in 2,320 organizations); 303 participants from Amazon's Mechanical Turk.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X		X			

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X					Hours worked, organizational tenure, career interruption, primary breadwinner, weekly hours on chores, work-life conflict, person-life identity, career aspirations, organizational commitment, work identity, task performance, leadership performance, potential.

Leslie, Manchester, and Dahm (2017) tested the proposition that diversity goals create a pay premium for certain women. The hypothesis is that firms with diversity goals view high-potential women as more valuable toward achieving those goals and tend to reward high-potential women with higher pay. Specifically, they examined a set of determinants of the female pay premium such as perceptions of high earnings potential, diversity values, industry effect on pay and female potential, and the presence of diversity goals within an organization.

Key findings: The study established that a high-potential female premium exists even after including extensive human capital controls. Authors also found a larger premium among executive women in consumer industries compared to manufacturing.

Citation: Levanon, A., England, E., & Allison, P. (2009). Occupational feminization and pay: Assessing causal dynamics using 1950–2000 U.S. Census data. *Social Forces, 88*(2), 865–892. doi: 10.1353/sof.0.0264

Data source: U.S. Census Integrated Public Use Microdata.

Population studied: Occupations of respondents in prime working ages 25–64, salaried, civilian labor force.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X							

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X						Logit of proportion female.

Wage regressions are estimated by decade for 1950–2000, followed by additional models that divided each decade into four groups in order to check whether the variables had similar effects each period. The models show deviations from each occupation's mean and from the mean for all occupations at each point in time, demonstrating this method is mathematically equivalent to a conventional regression using change scores when used with only three decades.

Key findings: The study found evidence that long-term devaluation effects (where pay offers in an occupation affect its proportion of women due to employer preference for men) of female wages from earlier lagged female proportions have an impact on later wage rates, with no lessening of the devaluation effect over time over the four divided periods—and even an increase in the 1980s. In this regard, the neoclassical view of equalizing differences between genders is not supported. Except in the 1950s, little evidence exists for queuing effects for the proportion of women having an effect on pay in an occupation. Pooled results for all years showed very little evidence of negative effects of early wage on later percentage female, results which are consistent with previous longitudinal queuing studies. While the authors make no claims that the devaluation of predominantly female jobs explains most of the gender gap in pay, they believe this study shows that this devaluation is an ongoing, important contributor to gender inequality.

Citation: Lo Sasso, A. T., Richards, M. R., Chou, C., & Gerber, S. E. (2011). The $16,819 pay gap for newly trained physicians: The unexplained trend of men earning more than women. *Health Affairs, 30*(2), 193–201. doi: 10.1377/hlthaff.2010.0597

Data source: New York State Survey of Residents Completing Training, 1999–2008 (excluding 2004 and 2006).

Population studied: 8,233 graduating residents and fellows (4,918 men and 3,315 women) who reported that upon completing their current training program that their primary activity would be "patient care and clinical practice (in a non-training position)" and who accepted a job.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X							X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X					Category of specialty training, patient care hours per week.

Lo Sasso, Richards, Chou, and Gerber (2011) used ordinary least squares regressions to estimate the adjusted differences in salary between men and women over time. In order to account for differential trends in salary for men and women over time, year dummy variables were used, as well as interaction terms between gender variable and year.

Key findings: The study found that, although there was an increase in the number of women who entered typically higher paying specialty fields over time, a gender wage gap remained between men and women. Among this sample, the gender wage gap appeared to *increase* over time. More specifically, after controlling for observable characteristics, Lo Sasso et al. found a significant and unexplained starting salary difference of $16,819 between men and women in 2008 compared to a difference of $3,600 in 1999.

Citation: Ransom, M. R., & Lambson, V. E. (2011). Monopsony, mobility, and sex differences in pay: Missouri school teachers. *American Economic Review: Papers and Proceedings, 101*(3), 454–459. doi:10.1257/aer.101.3.454

Data source: Administrative data from the Missouri Department of Elementary and Secondary Education (MSDESE) for 1989–1990 school year; Census data from the Public Use Micro Sample for the 1990 U.S. Census.

Population studied: Public school teachers in Missouri in 1989–1990.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X			X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Specific cities, population density.

Ransom and Lambson (2011) used a series of regression models to examine gender pay disparities between male and female teachers in Missouri. Specifically, the authors examine the extent to which the gender pay gap is the result of sorting into additional paid duties and marital status.

Key findings: The study found that female teachers earn less than male teachers even after controlling for experience and education (gender wage gap of 6.3 percent and 5.6 percent for the MSEDESE and Census data, respectively). Furthermore, the authors found that controlling for region, similar female and male teachers are differentially compensated. Finally, married women in the sample were the lowest paid subgroup.

Citation: Ransom, M. R., & Oaxaca, R. L. (2010). New market power models and sex differences in pay. *Journal of Labor Economics, 28*(2), 267–289. doi: 0734-306X/2010/2802-0004

Data source: Pooled year-end payroll data from a regional chain grocery retailer in the southwestern United States between 1977–1985 and 1977–1982.

Population studied: Between 54–61 stores and 1,500–2,000 retail employees.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X		X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Year dummies.

Ransom and Oaxaca (2010) estimated a reduced-form Burdett-Mortensen-Manning search model using probit regression to calculate firm-specific elasticities of labor supply in the retail grocery industry. The labor supply elasticities are inferred from the elasticity of the separation rate (i.e., quit rate) with respect to wage.

Key findings: The results indicated that men have a higher elasticity of labor supply than women. Specifically, the authors found a labor supply elasticity of 2.4 to 3 for men and 1.5 to 2.5 for women. This difference in elasticities by gender suggests monopsony power may play an important role in explaining the gender pay gap.

Citation: Renzulli, L. A., Reynolds, J., Kelly, K., & Grant, L. (2013). Pathways to gender inequality in faculty pay: The impact of institution, academic division, and rank. *Research in Social Stratification and Mobility, 34*, 58–72. doi: 10.1016/j.rssm.2013.08.004

Data source: The National Study of Postsecondary Faculty 2003–2004 collected by the National Center for Educational Statistics from the U.S. Department of Education.

Population studied: A sample of 6,330 individuals, representing 6 academic divisions and 480 institutions.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X					

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X					Institution type, discipline, rank, productivity, and administrative status.

Renzulli, Reynolds, Kelly, and Grant (2013) used regression analysis to explore the association between salary in academia and institution type, division, and rank. The outcome of interest was the natural log of annual base income (excluding supplemental pay). First, the authors examined whether institution type, division, and rank were independent or interdependent. Then, they examined how location

mitigates the effect of gender on pay (to explicitly examine whether men and women in the same location are financially compensated differently).

Key findings: This study found that both tenured and tenure-track position women are paid 4.4 percent less than men, holding control variables constant. Because the authors found that institution, division, and rank are interdependent, they examined whether location mediated gender's effect on pay. Findings from the mediational analysis indicate that women earn less than men but are located in "niches" (i.e., the interdependent effects of institution type, division, and rank) that pay less. Finally, the authors found very little mitigating effect of these "niches" on pay.

Citation: Roche, K. (2017). Millennials and the gender wage gap in the U.S.: A cross-cohort comparison of young workers born in the 1960s and the 1980s. *Atlantic Economic Journal, 45*(3), 333–350. doi: 10.1007/s11293-017-9546-6

Data source: Two birth cohorts from the 1979 and 1997 National Longitudinal Survey of Youth (NLSY).

Population studied: Working individuals born between 1960 and 1962 (NLSY79) and working individuals born between 1980 and 1982 (NLSY97).

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X	X	X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X		X	X		Self-employment, public sector, and annual weeks worked.

Roche (2017) examines gender inequality in the labor market for two different birth cohorts to determine whether there were any changes in the gender wage gap over time. The author used ordinary least squares (OLS) and quantile regression analysis techniques to estimate the gender wage gap for two birth cohorts. The outcome variable for the regression specifications was log hourly wages. Pooled OLS and fixed-effects models were then utilized to determine temporal changes in the predictors of the gender wage gap for men across the various cohorts.

Key findings: The study's findings indicated that, after including a series of controls, the gender wage gap narrowed between the two cohorts (gender wage gap of 18.6 percent in the 1960s cohort versus 14.4 percent in the 1980s cohort). Interestingly, for both the 1960s and 1980s birth cohorts, women in the highest 10 percent of the wage distribution experienced a larger gap in wages compared to the bottom 10 percent of the distribution. Additionally, Roche found a favorable shift in the marriage premium for women, so marriage for the 1980s cohort was as beneficial on wages for women as it was for men. When explicitly examining the decomposition of the changes between the 1960s and 1980s birth cohorts in the gender wage gap, Roche found that the gender wage gap closed by almost 5 percent. The variables included in the model accounted for only about 17 percent of the closing.

Citation: Smith, N., Cawley, J. F., & McCall, T. C. (2017). Examining the gap: Compensation disparities between male and female physician assistants. *Women's Health Issues, 27*(5), 607–613. doi: 10.1016/j.whi.2017.05.001

Data source: Archival data from census and salary surveys from the American Academy of Physician Assistants 1998–2015, excluding 2011 and 2013.

Population studied: 6,164 certified physician assistants (PAs) who provided responses for all variables of interest.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X		X			X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
		X		X (dummy)		Specialty field, number of patients seen weekly, hours taking call.

To examine the gender pay gap among PAs, Smith, Cawley, and McCall (2017) estimated ordinary least squares regressions, controlling for experience, specialty field, and hours worked. They aimed to assess the extent and trend of the compensation disparity between male and female PAs, which was measured as the ratio of mean and median total compensation (including bonus if received) of women compared to men.

Key findings: The study found that the PA profession has a smaller gender compensation disparity than that of all workers on average. The average disparity of median male and female PA compensation is 77 percent for all fields and 86.8 percent for the PA field. However, there is still a significant gender gap in the compensation of male and female PAs. PA gender compensation disparity is $9,695, which represents about 9.5 percent of the national mean total compensation. The gap has decreased over the past several years but still exists throughout the PA field.

Citation: Tao, Y. (2018). Earnings of academic scientists and engineers: Intersectionality of gender and race/ethnicity effects. *American Behavioral Scientist, 62*(5), 625–644. doi: 10.1177/0002764218768870.

Data source: Five waves (2003, 2006, 2008, 2010, and 2013) of Survey of Doctorate Recipients data from the National Science Foundation.

Population studied: Full-time research and teaching faculty employed in one of the four broad STEM fields.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X	X	X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Immigration status; doctoral origin (research activity); change employer since last survey; rank of employer; type of employer (research intensity, location, field); federal support; work activity (research vs. development); gender and race/ethnicity interactions.

Tao (2018) estimated the gender earnings gap among academic scientists and engineers using ordinary least squares regression. This estimation was done first for the full and then for each racial/ethnic group. Subsequently, the author conducted a marginal effect tests to examine changes in the gender wage gap over time.

Key findings: From the regression and marginal effect tests, the study found a significant gender wage gap in favor of men in 2006, 2008, 2010, and 2013, ranging from 4 percent in 2010 to 4.9 percent in 2006.

Citation: Tate, G., & Yang, L. (2015). Female leadership and gender equity: Evidence from plant closure. *Journal of Financial Economics*, *117*(1), 77–97. doi: 10.1016/j.jfineco.2014.01.004.

Data source: Longitudinal Business Database, Longitudinal Employer-Household Dynamics.

Population studied: Workers displaced from closing plants with at least 50 employees who were employed at the closing plant two quarters prior to the last quarter.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X			X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X				X	Female leadership, worker is foreign, worker is native of state where plant is located, diversified firm, year.

Tate and Yang (2015) regressed the natural log of annual real wages on a variety of demographic and employment characteristics (including fixed effects for state, industry, and year) to compare the wage changes between genders of employees who were displaced (rather than voluntarily switching jobs/firms) from the same closing plant and moved to the same new firm within the first four quarters following displacement. They also examined the association between the gender wage gap within firms and managerial style using a series of regressions.

Key findings: The study found that female leadership lessens the gender pay gap in the firm by about 20 percent. In addition, it found significant differences in the impact of closure on male and female wage changes. When compared to men who move from the same closing plant to the same new firm, women experienced approximately 5 percent more in lost wages. However, findings showed a significantly smaller gap when the hiring firms had female leadership.

Citation: Travis, C. B., Gross, L. J., & Johnson, B. A. (2009). Tracking the gender pay gap: A case study. *Psychology of Women Quarterly, 33*(4), 410–418.

Data source: Administrative database of all faculty at an unnamed regional university.

Population studied: 1,193 full-time assistant, associate, and full professors.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Research field; rank (assistant, associate, or full professor).

Travis, Gross, and Johnson (2009) use two methods (multiple regression and resampling simulation) to estimate the gender salary difference between male and female professors.

Key findings: The study found that both methods produced similar results, with salary differences of $3,278 and $2,986 for multiple regression and resampling simulation, respectively. Salary differences existed in the presence of controls for rank, research field, and years of service.

Citation: Lee, Y., & Won, D. (2014). Trailblazing women in academia: Representation of women in senior faculty and the gender gap in junior faculty's salaries in higher educational institutions. *Social Science Journal, 51*(3), 331–340. doi: 10.1016/j.soscij.2014.05.002.

Data source: 2010 Integrated Post-secondary Education Data System, which is a system of interrelated surveys conducted annually by the National Center for Educational Statistics of the U.S. Department of Education.

Population studied: Full-time tenure-track faculty in 4-year institutions that grant bachelor's degrees and higher, excluding community and technical colleges and non-degree granting institutions.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X							X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
					X	Percentage of women at the full rank, percentage of women at the associate rank, percentage of women at the assistant rank, female top administrators, institutional size, public-private status, research university status, concentration of high-paying disciplines, gender wage gap within the state, region.

Using ordinary least squares regressions, Lee and Won (2014) estimated the difference in mean salaries for male and female assistant professors in higher education institutions.

Key findings: The study found that the average gender wage gap among assistant professors within higher education institutions, in which women represent 10 percent of the total full professor population, is greater by $28,254 compared to institutions in which women represent 20 percent of the total full professor position.

The findings suggest that representation of women at the full professor rank is positively associated with improved gender equity in salaries for assistant professors, while women's representation at lower ranks, including both associate and assistant ranks, does not explain the salary disparity.

Citation: Newton, D., & Simutin, M. (2015). Of age, sex, and money: Insights from corporate officer compensation on the wage inequality between genders. *Management Science, 61*(10), 2355–2375. doi: 10.1287/mnsc.2014.1998.

Data source: Compustat ExecuComp dataset.

Population studied: Large and publicly traded U.S. companies and their officers.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X		X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X					Officer title.

To examine whether the gender and age of CEOs played a role in gender wage disparity, Newton and Simutin(2015) estimated pooled regressions, including fixed effects for years, for officer titles, and for 48 industries.

Key findings: The study found that CEOs pay officers of the opposite gender less than officers of their own gender. Authors found this effect to be pronounced when the wage setter was a male. Specifically, male CEOs paid female officers at least 12 percent less than male officers in the same firm. Furthermore, in firms where the CEO was a male, female officers received significantly lower increases in compensation compared to their male counterparts.

Citation: Rabovsky, T., & Lee, H. (2018). Exploring the antecedents of the gender pay gap in US higher education. *Public Administration Review, 78*(3), 375–385. doi: 10.1111/puar.12827.

Data source: Integrated Postsecondary Education Data System.

Population studied: Full-time male and female assistant professors at all U.S. public and private nonprofit 4-year, degree-granting colleges and universities that are classified under the Carnegie classification system as research/doctoral institutions between 1993 and 2013.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X							

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Female university president, percentage female managers, percentage female full and associate professors, state appropriations pre-enrollment, federal grants (non-Pell), federal Pell Grants per enrollment, percentage expenditures on research, percentage bachelor's in humanities, percentage bachelor's in STEM, percentage of female students, total student enrollment, average faculty salary, school selectivity.

Rabovsky and Lee (2018) employed linear regression models with fixed effects for both institution and year to estimate the within-unit effects of organization factors on the gender pay gap.

Key findings: The study found the persistence of the gender pay gap in both public and private nonprofit research universities. However, authors also found that gender composition of key positions, especially in private nonprofit research universities, played an important role in narrowing the gender pay gap. Specifically, the authors found evidence that the gender pay gap was smaller when women made up a majority of managerial staff and senior faculty.

Citation: Miller, P. W. (2009). The gender pay gap in the US: Does sector make a difference? *Journal of Labor Research, 30*(1), 52–74. doi: 10.1007/s12122-008-9050-5.

Data source: 2000 U.S. Census of Population.

Population studied: Men and women aged 25–64 from the 2000 U.S. Census of Population, Public Use Microdata Sample (1 percent sample).

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
		X	X	X		X	X (southern state).

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Language other than English spoken at home.

Miller (2009) estimated the gender difference in earnings across the wage distribution using Blinder-Oaxaca decomposition for conditional quantile regression models. Miller used the log of hourly earnings for 1999 as the dependent variable used in the multivariate analyses.

Key findings: Overall, the study found that the size of the gender pay gap differed by sector of employment and according to the part of the earnings distribution. In the private sector, the gender pay gap was found to be larger (29 percent) than among employees in the public sector (20.8 percent). Unlike in the private sector, the author found significant variation in the gender pay gap among government employees, from 26.2 percent at the lowest decile to 16.4 percent at the highest decile of the earnings distribution.

Citation: Morris, M., Chen, H.; Heslin, M. J., & Krontiras, H. (2018). A structured compensation plan improves but does not erase the sex pay gap in surgery. *Annals of Surgery, 268*(3), 442–448.

Data source: Compensation survey administered by the University of Alabama at Birmingham School of Medicine.

Population studied: Full-time faculty in the Department of Surgery from 2014 through 2017, working at least 15 hours per week.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other

Morris, Chen, Heslin, and Krontiras (2018) used survey data to calculate the raw gender pay gap of the faculty of the Department of Surgery at the University of Alabama at Birmingham, following the implementation of a structured compensation plan.

Key findings: The study found that the new compensation plan did not change the overall salaries of male surgeons but did reduce variation in salaries and significantly increased the salaries of female

surgeons. Specifically, female surgeons earned 46 percent of male salaries prior to the implementation of the compensation plan and 72 percent of male salaries following implementation. Furthermore, following implementation, more female surgeons were appointed to leadership positions, such as endowed professorships, which impacted their overall pay.

Citation: Oh, S. S., & Kim, J. (2015). Science and engineering majors in the Federal Service: Lessons for eliminating sexual and racial inequality. *Review of Public Personnel Administration, 35*(1), 24–46. DOI: 10.1177/0734371X13504117.

Data source: The Central Personnel Data File for 1983, 1996, and 2009.

Population studied: Full-time, college-educated, white-collar federal employees.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X			X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X						Field of study (biological sciences, computer and information sciences, engineering, mathematics, and physical sciences).

Oh and Kim (2015) aimed to examine a model that estimates the effect on annual salary of being a female, minority, and in STEM. For the key independent variables, they used a series of ordinary least squares regression, with a series of dichotomous measures of gender and minority status.

Key findings: The authors observed a decrease in the gender pay gap during the study period (1983, 1996, and 2009). Specifically, women earned 90 percent as much as men in 2009, up from 72 percent in 1983. Oh and Kim attributed this progress in the gender pay gap largely to educational attainment, work experience, and to the changing composition of STEM majors in particular.

Citation: Prokos, A. H., Padavic, I., & Schmidt, S. A. (2009). Nonstandard work arrangements among women and men scientists and engineers. *Sex Roles, 6*(1), 653–666. doi: 10.1007/s11199-009-9680-y

Data source: 1997 National Science Foundation's Scientists and Engineers Statistical Data System, a compilation of data from three national sample surveys: the Survey of Doctorate Recipients, the National Survey of Recent College Graduates, and the National Survey of College Graduates.

Population studied: Individuals employed in computer and mathematical sciences, life sciences, physical sciences, social sciences, and engineering with earnings greater than zero, not including those educated but not employed in the field.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X		X	X	X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X				X		Non-standard work arrangements; immigrant status; employment sector dummy: business, education, government.

Prokos, Padavic, and Schmidt (2009) estimated the pay gap using sequential ordinary least squares regression, with logged earnings as the dependent variable and gender and type of nonstandard work arrangements as the key independent variables.

Key findings: The study found that the nature of the gender pay gap in the science and engineering fields differed by the type of nonstandard work arrangements. Specifically, the authors found that the gender wage gap is greater (in men's favor) in the worst nonstandard arrangements. In the best nonstandard work arrangements, however, the gender pay gap was found to be in women's favor.

Citation: Srivastava, S. B., & Sherman, E. L. (2015). Agents of change or cogs in the machine? Reexamining the influence of female managers on the gender wage gap. *American Journal of Sociology, 120*(6), 1778–1808. doi: 10.1086/681960

Data source: Matched employee-manager dataset collected from a large information services firm.

Population studied: 1,701 full-time employees who worked in the company from 2005 to 2009.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X		X			X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X						Characteristics separated by manager and employee, rating (4-point time-varying measure of employees' annual performance lagged by 1 year).

Srivastava and Sherman (2015) aimed to assess whether female managers act in ways that narrow, preserve, or widen the gender wage gap. They estimated multilevel and within-individual models to analyze the impact of a manager's gender on the salaries of male and female employees, focusing on how each gender's salaries changed when employees switched to a manager of a different gender.

Key findings: The study found no evidence that female managers reduce the gender wage gap among their employees. Results indicated that female managers act in ways that amplified, rather than

reduced, the gender wage gap. Women who changed from a male to a female supervisor had a lower salary in the following year than men who made the same change.

Citation: Saure, P., & Zoabi, H. (2014). International trade, the gender wage gap and female labor force participation. *Journal of Development Economics, 111*, 17–33. doi: 10.1016/j.jdeveco.2014.07.003

Data source: Three sources (for 1990/91 and for 2006/07): Current Population Survey; "Origin of Movement" data by World Institute for Strategic Economic Research; GDP data from Bureau of Economic Analysis.

Population studied: U.S. male and female employees from 58 sectors.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X					X		X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Geographic distance, trade shares, trade volume per output.

Saure and Zoabi (2014) exploit U.S. states' variation in exposure to trade with Mexico in order to examine how this trade impacts women's labor force participation and wages. The authors used an overlapping generations model, incorporating the endogenous choice of fertility, assuming that men and women differ in their labor endowments in physical labor units.

Key findings: Overall, the study found that in states with rich economies, international trade with poor countries tends to widen the gender wage gap and reduce female labor force participation.

Citation: Wiswall, M., & Zafar, B. (2016). *Preference for the workplace, human capital, and gender*. National Bureau of Economic Research Working Paper No. 22173.

Data source: Survey administered to New York University undergraduate students over a 2-week period during May 2012.

Population studied: 247 New York University undergraduate students in May 2012.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X				**X**	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						School year (freshman, sophomore, junior, or senior), parental income, parental education, SAT score, intended and current major.

Wiswall and Zafar (2016) used the framework of a model of compensating differentials (Rosen 1984) to examine how worker and employer preferences (for job amenities and discrimination, respectively) impact the observed set of job choices. First, the authors estimated preferences for workplace attributes using a hypothetical job choice framework. Then, the estimates of preference were combined with unique survey data, which allowed the authors to estimate high-ability students' willingness-to-pay for pecuniary and non-pecuniary aspects of jobs and workplace attributes.

Key findings: Overall, the authors found that women exhibited greater preference for flexibility in hours, with a willingness-to-pay 7.3 percent of their salary as compared to 1 percent for men. In addition, women are willing to forego 4 percent of their salary (compared to 0.6 percent for men) for a more secure job with a 1 percentage point lower probability of dismissal. Furthermore, there is substantial heterogeneity within gender among preferences for workplace attributes.

Work Experience, Career Interruptions, and Labor-Force Attachment

Citation: Addison, J. T., Ozturk, O. D., & Wang, S. (2014). Role of gender in promotion and pay over a career. *Journal of Human Capital, 8*(3), 280–317. doi: 10.1086/677942

Data source: 1979 sample of National Longitudinal Survey of Youth.

Population studied: Cohort of individuals ages 14–22 in 1979 (eventually aging to a cohort 23–33).

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
		X	X (quadratic)	X	X	X (and ethnicity).	X (state unemployment rate).

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X		X	X	X	"Unobserved ability" (derived from the Armed Services Vocational Aptitude Battery test score), tenure with current employer (quadratic), local (state) unemployment rate, public vs. private sector.

Addison, Ozturk, and Wang (2014) estimated a log wage growth equation (with promotion as the key independent variable) using logistic regression and conditional fixed effects logistic regression.

Key findings: Overall, the study found a gender gap in favor of men in promotion-related earnings, especially later in their careers. However, women tend to enjoy a positive wage gap over the course of a career—albeit confined to less educated females.

Citation: Bailey, M. J., Hershbein, B., & Miller, A. R. (2012). The opt-in revolution? Contraception and the gender gap in wages. *American Economics Journal: Applied Economics*, *4*(3), 225–254.

Data source: 1970 National Fertility Study; National Longitudinal Survey of Young Women.

Population studied: 5,159 women ages 14 to 24 born between 1943 and 1954.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X					X (state fixed effects).	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Birth control access policies (dummy equal to 1 if woman born in cohort would have had access to oral contraception before 21).

Bailey, Hershbein, and Miller (2012) explored the extent to which access to oral contraception through the 1960s and 1970s contributed to the closing of the gender wage gap in the 1980s. Specifically, the authors exploited variation in the timing of access to contraception, as some states allowed legal access to individuals under age 21, while other states did not. The authors estimated counterfactual wage distributions for men and women.

Key findings: Overall, the authors found that the simulated gender wage gap of workers closed by 0.113 log points between 1980 and 1990 and by 0.051 log points between 1990 and 2000. These estimates implied that 10 percent of the convergence in the 1980s and 30 percent of the convergence in the 1990s is the result of early access to birth control pills.

Citation: Barth, E., Kerr, S. P., & Olivetti, C. (2017). *The dynamics of gender earnings differentials: evidence from establishment data*. National Bureau of Economic Research Working Paper 23381.

Data source: 2000 Decennial Census of the United States, Longitudinal Employer Household Dynamics data.

Population studied: Individuals age 25–44 from the 50 most populated primary metropolitan statistical areas (PMSA) in the United States, who worked more than two quarters per year and earned at least $2,000 per quarter 1995–2008.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X		X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other

Barth, Kerr, and Olivetti (2017) compared the age-earnings profiles of men and women within and between employers by estimating separate earnings regression equations. Fixed effects for individual, career movements between establishments (estimated separately by gender only), and year were included. A decomposition model was then estimated to determine the how much the widening of the gender earnings gap can be attributed to within- or between-establishment characteristics (e.g., job advancements within establishments, differences in earning distributions).

Key findings: The study found that the gender earnings gap widens throughout the first 20 years of working life (age 25–45). However, the increase in the gender wage gap over this period is much larger for college-educated individuals than for those without a college education. Among the college-educated aged 25–45, men's wage earnings growth is 41 log points higher than women's earnings growth compared to 2.4 log points among those without a college degree. The increase in the gender wage gap among those with a college education is largely explained by earnings growth differences between genders within establishments. While there was a small increase in the gender wage gap detected for those without a college education, this gap can be fully explained by the gender differences in moving between establishments.

Within an establishment, men attain senior positions and maintain seniority longer than women. This fact is associated with a steeper increase in earnings for men. For both education groups, the difference in the establishment portion of earnings is likely attributable to marital status; there is a small difference between nonmarried men and women in the increase of the establishment component, but there is an increase in the gap among those who are married. This suggests that married couples' household division of labor tends to limit women's career choices between establishment changes.

Citation: Bertrand, M., Goldin, C., & Katz, L. F. (2010). Dynamics of the gender gap for young professionals in the financial and corporate sectors. *American Economic Journal: Applied Economics*, *2*(3), 228–255. doi: 10.1257/app.2.3.228

Data source: Web-based survey of University of Chicago MBAs; administrative data from the University of Chicago.

Population studied: 1,856 men and 629 women who graduated with an MBA from the University of Chicago between 1990 and 2006.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X							

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Finance classes, post-MBA experience, any non-employment spell, weekly hours worked, pre-MBA characteristics, reason for choosing job, job function, employer type, cohort-by-year dummies.

Bertrand, Goldin, and Katz (2010) examined the evolution of the wage gap between highly educated men and women employed in the corporate and financial sectors using regression analysis, where log annual earnings is the outcome of interest.

Key findings: Overall, the study found that the relative importance of factors changes over time. Specifically, at the beginning of their post-MBA careers, men and women are found to have identical incomes, with a pay gap emerging not long after graduation. The gap increases from 30 log points 5 years after graduation to 60 log points 10 to 16 years after graduation. In addition, a decade after graduation, the share of women not working is 13 percent compared to less than 1 percent of men not working.

Citation: Blau, F. D., & Kahn, L. M. (2013). The feasibility and importance of adding measures of actual experience to cross-sectional data collection. *Journal of Labor Economics, 31*(2), S17–S58. doi: 10.1086/669059

Data source: Michigan Panel Study of Income Dynamics (PSID) 1980, 1990, and 1999; Princeton Data Improvement Initiative 2008.

Population studied: Full-time employed wage and salary workers who are heads of households or wives between 18–65 years old who made $1–$250 per hour in 1983 U.S. dollars.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X	X	X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X		Potential experience vs. actual experience, time out of work.

Blau and Kahn (2013) used wage regression and ordinary least squares regression to examine the impact that including actual work experience in cross-sectional datasets would have on women's post-school human capital accumulation, residual wage inequality, and the gender wage gap.

For variables measuring full- and part-time work experience, the study uses a continuous variable derived from PSID. PSID asks respondents how many years they have worked since they were 18 years old, and of these years, how many years were full-time work. Authors calculated the part-time variable by (total experience minus full-time experience). Since PSID only asks panelists about work experience the first year they join, the authors calculated additional years of experience in the years between surveys by adding 1 total year if the person worked positive hours, 1 full-time year if a person worked more than 15,000 hours, and 1 part-time year if a person worked positive hours but fewer than 15,000 hours.

Key findings: The study found that while men had more potential experience, actual experience, and full-time experience than women in 1980, by 1999 the gender gap has nearly closed. Additionally, on-the-job training proved to be an important component of post-school human capital accumulation. Including information on actual work experience, rather than just potential work experience, can reduce the unexplained gender pay gap.

Citation: Blau, F. D., & Kahn, L. M. (2017). The gender wage gap: Extent, trends, and explanations. *Journal of Economic Literature, 55*(3), 789–865. doi: 10.1257/jel.20160995

Data source: Michigan Panel Study of Income Dynamics, and the March Current Population Survey.

Population studied: Men and women aged 25–64 years, who were full-time, non-farm, and salaried workers, who worked at least 26 weeks during the preceding year.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X			X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X		X	X		

Blau and Kahn (2017) used Oaxaca-Blinder decomposition to estimate the gender gap in average hourly earnings. More specifically, researchers examined the extent to which the gender wage gap may be driven by selection into jobs and occupations and family responsibilities.

Key findings: Several important findings from this study were identified. First, compared to 1980, in 2010 there was a substantially lower but persistent gender wage gap. Second, shifting gender differences in education, experience, occupation, and union status reduced the gender pay gap from

1980 to 2010. Specifically, the authors found that the unexplained portion of the gender pay gap was 21–29 percent in 1980 as compared with 8–18 percent in 1989, with little change from 1989 through 2010. Due to both the reversal of the education gap between men and women and the narrowing of the gender gap in experience, the role of human capital factors in influencing the gender wage gap has diminished. However, the gender differences in both industry and occupation, as in 1980, continue to explain some of the gender wage gap in 2010. Finally, there continues to be a larger gender wage gap at the upper end of the wage distribution that has been narrowing more slowly compared to other salaries.

Citation: Chung, Y., Downs, B., Sandler, D. H., & Seinkiewicz, R. (2017). *The parental gender earnings gap in the United States*. Center for Economic Studies Discussion Paper 17–68.

Data source: Social Security Administration Detail Earnings Records data linked to the Survey of Income and Program Participation (SIPP) from 1978–2011.

Population studied: Heterosexual married couples who were aged 16–65 during the survey years, (1) who were married at the time of the SIPP survey and (2) whose first child was born between 1978 and 2011.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X		X	X	X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Year of first child's birth, number of years after birth, decade, family income level, prebirth gap in education (between spouses), prebirth gap in earnings (between spouses).

In addition to running descriptive statistics, Chung, Downs, Sandler, and Seinkiewicz (2017) measured the within-couple difference in earnings by estimating an equation for the difference in log earnings between the male and female spouses. In their equation, they included a calendar-fixed effect to control for sample-wide changes in the earnings gap across time.

Key findings: The study found that the spousal earnings gap doubled in the 2 years before and the first year after the birth of the first child. The gap continues to grow in the 5 years after the child's birth, although at a much slower rate. This continuation appears to be due to the birth of future children. The gap tapers off and eventually begins to narrow once the child reaches school age. The sharp and persistent increase in the spousal earnings gap after the birth of the first child, driven by a decrease in the earnings of the female spouse, indicates that parenthood is an important factor in the gender wage gap.

Citation: Cortes, P., & Pan, J. (2019). When time binds: Substitutes for household production, returns to working long hours, and the skilled gender wage gap. *Journal of Labor Economics, 37*(2), 351–398.

Data source: 1980 through 2000 decennial censuses; 2011 American Community Survey 3-year estimates.

Population studied: Native-born individuals ages 25 through 64 with a bachelor's degree working full-time (at least 35 hours per week).

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X		X		X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X				X (hours per week).		Works 50 hours/week or more.

Cortes and Pan (2019) examined how the presence of low-skilled migrants impacts the ability of women who work long hours to maintain labor force attachment by outsourcing household production. Theoretically, women who work long hours in areas with more low-skilled immigrants should face lower costs to outsourcing housework. Therefore, women in these areas may be able to increase participation in the labor force. To examine differentials in weekly earnings by gender, the authors utilized a triple-difference strategy (variation over time, across occupations that vary by hours worked, and between cities with varying levels of low-skilled immigration).

Key findings: Overall, the study found that the presence of low-skilled immigrants is associated with lower gender pay gaps. Specifically, the authors showed that an increase in low-skilled immigration reduces the share of women in the bottom quartile of the male wage distribution, with more women in the 75th to 90th percentiles of the male wage distribution. Such cities with high shares of low-skilled immigrants also experienced increases in employment shares of younger college-educated women.

Citation: Erosa, A., Fuster, L., Kambourov, G., & Rogerson, R. (2018). *Hours, occupations, and gender differences in labor market outcomes*. National Bureau of Economic Research Working Paper 23636.

Data source: Integrated Public Use Microdata Series (IPUMS) 1976–2010 Current Population Survey (CPS) and 1985–1996 Panel Study of Income Dynamics (PSID).

Population studied:

Study 1: Ages 16–64 years with 1 employer per year and at least 60 observations in an occupation.

Study 2: Ages of 22 and 64 years for 1986–1995 with at least 30 observations in an occupation.

Study 3: Ages 22–64 years, married, with at least 30 observations in an occupation.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X			X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X		X				Changing occupations.

Erosa, Fuster, Kambourov, and Rogerson (2018) developed a model of time allocation and occupational choice that accounts for differential returns to additional hours of work. This model is based on observed non-convexities between hours worked and earnings, which indicate that individuals with a preference for fewer hours will select occupations for which the penalty is less severe. The authors examined time spent on non-labor market activities (i.e., home production) to estimate labor force outcomes by gender.

Key findings: This study found that household interactions can amplify the impact of gender differences in home production, resulting in substantial gender disparities in labor market outcomes. Specifically, authors found that a 10 percent reduction in the time women allocated to non-market activities decreased the proportion of women in occupations with high hours worked by 14 percentage points and increased the gender wage gap by 11 percentage points. This finding is likely the result of the trade-off between home production (non-market) and labor force participation, so women who spend more time on non-market activities are less likely to work in occupations that require long hours.

Citation: Goldin, C. (2014). A grand gender convergence: Its last chapter. *American Economic Review*, *104*(4), 1091–1119 doi 10.1257/aer.104.4.1091

Data source: University of Michigan Law School Alumni Survey Research Dataset.

Population studied: Individuals who graduated between 1982 to 1991 and returned both the 5-year and 15-year surveys.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Log hours per week, log weeks per year, years not employed, years part-time employed, time off between bachelor's degree and law school, law school performance, survey year, missing job experience.

In this essay, Goldin (2014) presented evidence from several previous studies on the gender wage gap and provided a framework to view the "last chapter" and what is needed to ultimately close the gap. In addition, using regression analysis, the author examined the widening pay gap with age, even among the highly educated.

Key findings: The author found that, while there is no pay gap at the outset of careers and a very small and insignificant gap at year 5, the gap at year 15 is 55 log points. However, that gap is reduced to 22 log points when time worked, absences, and job tenure are controlled for. Furthermore, the author found that labor force participation of female lawyers is also related to spousal income and parental status.

Citation: Hotchkiss, J. L., & Pitts, M. M. (2007). The role of labor market intermittency in explaining gender wage differentials. *American Economic Review: Papers and Proceedings, 97*(2), 417–421. doi: 10.1257/aer.97.2.417

Data source: Health and Retirement Survey public release (1992) and the HRS Covered Earnings Version 3.1. (1951–1991).

Population studied: 1,852 working men and 2,404 working women who were born between 1931–1941 or who were married to an individual who was age-eligible.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X			

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X			X	X		Intermittency of behavior.

Hotchkiss and Pitts (2007) used standard Oaxaca-Blinder decomposition, combined with two-stage least squares (2SLS), to examine the role of intermittent labor market participation on pay disparities. The authors used 2SLS to estimate a standard log wage equation, for which log hourly wages are a function

of demographic, geographic, and job characteristics, as well as intermittency of labor market experience. To control for potential endogeneity of intermittency and wages, the authors used a combination of individual and spousal health and life history characteristics as instruments for labor market intermittency. The second-stage log wage equation is presented as:

$$W_i = \mathbf{X}_i'\boldsymbol{\beta} + \varphi\hat{I}_i + \varepsilon_i.$$

Key findings: Hotchkiss and Pitts found that wages increased with education, union representation, non-wage benefits, and workplace tenure. The study found that men earned a marriage premium while women incurred a marriage penalty. The study also found that, on average, men earned an hourly wage 38 percent higher than the hourly wage earned by women. The authors' main findings suggested intermittency accounted for nearly 61 percent of the total impact of differences in endowments or 19 percent of the overall wage differential.

Citation: Liu, K. (2016). Explaining the gender wage gap: Estimates from a dynamic model of job changes and hours changes. *Quantitative Economics, 7*(2), 411–447. doi: 10.3982/QE295

Data source: Survey of Income and Program Participation, 1996.

Population Studied: Individuals aged 25–35 years, excluding full-time students, self-employed individuals, persons with disabilities, participants who completed fewer than three interviews, and those who were recalled by their previous employer after a separation. Two samples were created: one consisting of 613 women and 564 men with low education levels (high school) and the other consisting of 1,032 women and 782 men with high education levels (college).

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X			X	X	X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X		Metropolitan residence, hours of work per week, employed, full-time work among employed, and hourly wage (full-time and part-time.)

Liu (2016) used a new dynamic decomposition method by establishing and estimating a dynamic model of wage, hours, and job changes. The author used the decomposition method to quantify the relative importance of preferences for part-time work and labor market constraints in explaining the gender gap in wages, employment, number of work hours, and job turnover rate.

Key findings: This study found that, among women, preferences for part-time work increased with marriage, but this fact did not hold true for men; this conclusion accounted for a portion of the gender employment gap and less than 6 percent of the gender wage gap. Most of the gender gap was

accounted for in the job search parameters, the wage cost of part-time work, and the demographic factors affecting part-time work preferences. Among individuals with both high and low levels of education, about 65 percent of the observed gender wage gap stemmed from differences in mean offered wages.

Citation: Machado, C. (2017). Unobserved selection heterogeneity and the gender wage gap. *Journal of Applied Econometrics*, *32*(7), 1348–1366.

Data source: Current Population Survey (CPS) data from 1976 to 2005.

Population studied: White, Non-Hispanic adults between ages 25 and 44.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X			X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other

Machado (2017) built on selection models to include selection heterogeneity, where selection differs across the labor market. Using regression analysis, the author estimated the log hourly wage gap between all employed men and those “always employed” women who have children under the age of 6 but remain in the labor force.

Key findings: The estimates suggest that gender gaps decrease over time and with education. Specifically, main estimates suggested that, for full-time full-year workers, the gap was around -0.5 in 1976 and decreased by more than 20 log points to -0.26 in 2005.

Citation: Monti, H., Reeder, L., & Stinson, R. (2018). *How long do early career decisions follow women? The impact of industry and firm size history on the gender and motherhood wage gaps*. Center for Economic Studies Discussion Paper 18-05.

Data source: 2004 and 2008 panels of the Survey of Income and Program Participation (SIPP), linked W-2 tax form information from the Social Security Administration, Business Register’s Longitudinal Business Database.

Population studied: People who were ≤ 22 years old in 1978 and ≥ 40 years old by the time of the SIPP panel (2004 and 2008), who reported holding a job during the time period covered by the SIPP panel, and whose survey job matched an administrative job.

Country/Countries: United States

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X	X	**X**		X	Job count, duration of jobs, multiunit company, percentage of years with positive earnings, percentage of years in current industry.

After running descriptive statistics, Monti, Reeder, and Stinson (2018) conducted Oaxaca-Blinder decomposition to determine the impact of observable job history characteristics on the gender wage gap.

Key findings: The study found that men and women are very differently represented across industries, and these differences remain stable over time. Furthermore, this difference starts early; rather than beginning their careers in similar jobs before diverging as they age, men and women make different career choices at young ages, and these differences impact their careers at middle age. Of the job characteristics considered, the gender pay gap can be explained mostly by current job industry (16–20 percent) and industry history (12–13 percent). Additional findings suggest that if women had the same level of experience as men in the industries where they currently work, the wage gap would increase by 10 percent. The authors suggested that this effect could be overcome if women reallocated themselves across industries and if their industry-specific experience came from higher paying industries and matched the industry of their current job. Firm size history and number of jobs held did not impact the gender wage gap.

Citation: Moore, T. S. (2018). Occupational career change and gender wage inequality. *Work and Occupations, 45*(1), 82–121. doi: 10.1177/0730888417742691.

Data source: Merged Outgoing Rotation Group (BLS, various years) files of the Current Population Survey for the business cycle peak of 1979, 1989, 1999, 2007, and 2015.

Population studied: Noninstitutionalized, civilian wage earners between 18 and 65 years of age.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
		X	X			X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X			X		

Moore (2018) employed the Juhn, Murphy, and Pierce (1991) wage decomposition framework to estimate the effects on the wage gap of changes in the gender composition and wage returns of the different occupational groups, controlling for other determinants of change.

Key findings: Overall, this study found a significant narrowing of the gender wage gap, especially between 1979 and 2007, with female earnings of the male average rising from 67.3 percent in 1979, to 75 percent in 1989, to 85 percent in 2007. However, this progress ceased after 2007. According to Moore, the relative wage gain for female workers was due largely to the rapid entry of female worker into high-wage managerial occupations, coupled with their exit from low-wage private household work.

Citation: Munasinghe, L., Reif, T., & Henriques, A. (2008). Gender gap in wage returns to job tenure and experience. *Labour Economics*, *15*(6), 1296–1316. doi: 10.1016/j.labeco.2007.12.003

Data source: National Longitudinal Survey of Youth (1979–1994).

Population studied: 31,365 person-year observations of white employees in Current Population Survey-designated jobs who are not self-employed or employed in the government or agricultural sector; do not have missing, erroneous, or inconsistent data; and do not have very low or high number of years of schooling.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X			

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
			X			Usual weekly hours worked, health limits amount or type of work, AFQT score, tenure.

Munasinghe, Reif, & Henriques (2008) used three (Topel's two-step, Topel's instrumental variables, Altonji and Shakotko) models to estimate gender differences in the returns to job tenure and experience. These models are designed to address potential biases that may arise from heterogeneity in individual characteristics and job matches.

Key findings: The study's findings showed that quit and separation rates are higher for women than for men, suggesting that women have lower levels of labor force attachment than men. In addition, the study found that women expect to have more career interruptions than men throughout their prime child-bearing and child-rearing ages. Overall wage returns to an additional year of labor market experience are higher for men than for women. For each additional year of labor market experience, the wage growth rate is 15 percent higher for men than for women.

Citation: Sigle-Rushton, W., & Waldfogel, J. (2007). Motherhood and women's earnings in Anglo-American, Continental European, and Nordic countries. *Feminist Economics, 13*(2), 55–91.

Data source: Luxembourg Income Study, which combines microdata from several industrialized countries.

Population studied: Individuals ages 16 through 45, regardless of labor force status.

Country/Countries: Germany, Netherlands, United Kingdom, United States, Norway, Sweden, and Finland.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other

Sigle-Rushton and Waldfogel (2007) provided descriptive analyses of the long-term earnings of mothers, non-mothers, and men across eight industrialized countries.

Key findings: The authors found that the wage gap was smallest in Nordic countries (Norway, Sweden, and Finland), where among those women with medium education levels, mothers' earnings were 80 to 91 percent of non-mothers' earnings by age 45. In the United States, this ratio was 81 to 89 percent. Conversely, in the Netherlands and Germany, mothers with a medium education earned 42 to 63 percent of non-mothers' earnings by age 45. Furthermore, in the United States, all women earn less than men, with mothers earning less than non-mothers. Non-mothers in the United States have earnings that are 64 percent of men's earnings, while mothers earn between 52 and 57 percent of men's earnings. Non-mothers in Germany have earnings that are 94 percent of men's earnings, while women with children earn 40 to 60 percent of men's earnings.

Other Themes (as relevant)

DATA AND/OR METHODOLOGICAL

Citation: Burkhauser, R. V., & Larrimore, J. (2009, August). Using internal CPS data to reevaluate trends in labor-earnings gaps. *Monthly Labor Review*, 3–18.

Data source: Current Population Survey (CPS) 1975–2007.

Population studied: Full-time, full-year workers.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X				X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Method used to address top-coding.

The study aimed to explain how top-coding wages affects gender earnings gaps by comparing four methods of handling top-coding in the CPS data: No Cell Mean Public Use, Consistent Top-code Public Use, Cell Mean Public Use, and Internal series.

Key findings: The study found that men are more likely than women to be top-coded, and the average top-coded man has a higher wage or salary than the average top-coded woman. The authors do find a difference in the methods used. The ratio of mean women's earnings to mean men's earnings is larger according to the No Cell Mean Public Use and Consistent Top-code Public Use series than it is according to the Cell Mean Public Use and Internal Series.

These results indicated that the choice of method for correcting for top-coding impacts both the size and trend of the gender wage gap. Ignoring cell means and the earnings of men and women above the top-coding thresholds will distort trends in the gender wage gap.

Citation: Hubbard, W. H. J. (2011). The phantom gender difference in the college wage premium. *Journal of Human Resources, 46*(3), 568–586.

Data source: Current Population Survey, 1970–2008, from Integrated Public Use Micro Sample.

Population studied: White, Non-Hispanic, civilians aged 18 to 65 at the time of the survey who worked full-time (35 hours per week for at least 50 weeks) in the previous year.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X				X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other

Hubbard (2011) examined the college wage premium for men and women, accounting for potential bias that results from the top-coding of wage data in the CPS. Because men are more likely to have wages that exceed thresholds for top-coding, this practice can bias the male wage premium downward, relative to females. The author estimated the wage premium several wage regression specifications, including, ordinary least squares, a Tobit censored model, and a median wage model.

Key findings: The study found that controlling for the bias induced by top-coding eliminates gender differences in the college wage premium, regardless of specification. In addition, while using this specification there is no apparent difference in the college wage premium by gender, and the female wage premium to advanced degrees was higher than men during the 1970s and 1980s but converged over time.

GENDER ROLES

Citation: Kosteas, V. D. (2013). Gender role attitudes, labor supply, and human capital formation. *Industrial Relations: A Journal of Economy and Society, 52*(4), 915–940. doi: 10.1111/irel.12040

Data source: National Longitudinal Surveys of Youth 1979 cohort.

Population studied: 4,831 observations for women in the basic highest grade completed models from the 1998 survey, 2,974 observations in the post schooling training samples from the 1998 to 2006 surveys.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X		X	X	X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Gender role attitudes, self-esteem score, Armed Forces Qualifying Test score percentile, attitudes index for 1979.

This study focused on human capital acquisition for female respondents in comparison to men with models that relate employment to human capital, gender attitudes, and demographics from 1988–2006, with several post-schooling training variables in the study.

Key findings: The study found a modest link between traditional gender beliefs and educational attainment but found a stronger link between attitudes and post-schooling investments in human capital in the form of training events. In addition, the author found that holding a traditional view of gender roles indirectly affects human capital acquisition by decreasing labor force participation. The combined indirect plus direct effects of traditional attitudes (compared with moderate attitudes) is a 7.1 percentage-point reduction in the probability of participating in any training. The author noted this study focuses on human capital formation and gives only a brief overview of the effects of traditional views about gender roles on female labor supply. Examining this relationship in greater detail will help complement existing literature.

IMMIGRATION STATUS/COUNTRY OF ORIGIN

Citation: Kusow, A. M., Ajrouch, K. J., & Corra, M. (2018). Socioeconomic achievement among Arab immigrants in the USA: The influence of region of origin and gender. *Journal of International Migration and Integration, 19*(1), 111–127. doi: 10.1007/s12134-017-0524-2.

Data source: 2001–2013 American Community Survey, represented in the Integrated Public Use Microdata Series.

Population studied: Arab immigrants in the United States whose region of birth includes North Africa, Levant, and the Arabian Peninsula.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
		X	X	X			X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X						Region of origin, English proficiency, citizenship.

Kusow, Ajrouch, and Corra (2018) examined variations in hourly earnings among the study population using sequential ordinary least squares regression, with the main explanatory variables being region and gender.

Key findings: Regarding gender, the study found that, on average, the earnings gap between men and women was about 24 percent. The authors' results further revealed that this earnings gap was significant both within regions and across regions.

Citation: Lopez, M. J. (2012). Skilled immigrant women in the U.S. and the double earnings penalty. *Feminist Economics, 18*(1), 99–134. doi: 10.1080/13545701.2012.658429

Data source: U.S. Decennial Census 5-Percent Integrated Public Use Microdata Sample, 2000.

Population studied: 635,872 highly skilled U.S. native and foreign-born men and women ages 25–64 years old who were in full-year, full-time employment, who reported positive earnings from wages or salaries, and who were not currently self-employed or enrolled in school.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X		X	X	X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Spouse income, African descent, Hispanic, Asian, English proficient, years since migration, naturalized citizen, immigrant status.

Lopez (2012) used an augmented Oaxaca-Blinder decomposition technique to measure the individual effects of gender status and nativity status. Researchers decomposed the wage differential between highly skilled U.S.-born men and highly skilled immigrant women into four components: (1) endowment differences between U.S.-born men and immigrant men; (2) differences in returns on endowments between U.S.-born men and immigrant men; (3) endowment differences between immigrant men and immigrant women; and (4) differences in returns on endowments between immigrant men and

immigrant women. The sum of the second and fourth components comprised the double earnings penalty.

Key findings: This study found that highly skilled immigrant women experienced a double earnings penalty; nativity status accounts for a larger component of this penalty than gender. Even when the sample was restricted to fully assimilated immigrants or immigrants who received schooling in the United States, nativity status explained a larger portion of the wage gap (compared to gender status). While Lopez found separate earnings penalties, there was no evidence of a third penalty on account of the intersection of gender and nativity status; the total penalties that immigrant women faced were less than the sum of the separate effects of gender and nativity status.

POLITICAL BELIEFS

Citation: Briscoe, F., & Joshi, A. (2017) Bringing the boss's politics in: Supervisor political ideology and the gender gap in earnings. *Academy of Management Journal, 60*(4), 1415–1441. doi: 10.5465.amj.2016.0179

Data source: Longitudinal data from a large law firm internal survey and 1,243 political donation records from the Center for Responsive Politics.

Population studied: 359 associate lawyers who are supervised by partners (119 distinct supervisors) in a large U.S. law firm between 2002 and 2007.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X		X	X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X					Workers: female, seniority, total billable hours, non-white, parent, law school ranking, clerked in federal court, undergraduate grades, and standard deviation of performance-based pay. Supervisors: department liberalism and department head liberalism, controls for year of birth, female, and non-white.

Briscoe and Joshi (2017) used internal personnel and billings data with publicly available data from a large law firm to examine how supervisors' political ideology influences performance-based bonuses awarded to male and female subordinate lawyers. The study used mixed-effects regression models (multilevel or hierarchical linear models) to account for observable and unobservable characteristics that influence performance-based pay, originating from either worker or supervisor levels. All models used in this research include dummy variables for six of seven departments, three of four locations, and 5 of 6 calendar years. Briscoe and Joshi used an index of four indicators that reflect individual behavioral

commitment, financial commitment, persistence of commitment, and scope of commitment to a political orientation. Dependent variables included performance-based pay and controls included supervisor liberalism, billable hours, and non-white workers.

Key findings: The study found that the gender gap in performance-based pay was reduced for lawyers who were managed by liberal supervisors, compared to conservative supervisors. The study also found that the gender wage gap increased for lawyers with greater seniority present in their firms. In professional organizations in which managerial discretion is more likely to occur and in which restraining mechanisms against bias were weak, there was a stronger reliance on extra-organizational influences.

Citation: Ryu, K. (2010). State policies and gender earnings inequality: A multilevel analysis of 50 US states based on US Census 2000 data. *Sociological Quarterly, 51*(2), 226–254.

Data source: The 1 Percent Public Use Microdata Sample of the U.S. Census of 2000.

Population studied: Individuals 25–60 years of age who were working within the 50 contiguous United States in 1999.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X	X	X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X (dummy)		Public sector employment and English-speaking ability; state-level variables including Family and Medical Leave Act score, mean and median earnings, unemployment rate, unionization, public social service sector employment, per capita person income in 1998 and 1999.

Ryu (2010) used hierarchical models to analyze the association between state family policies and gender inequality in earnings. This allowed for nesting of individuals within states. The outcome of interest was the log of annual earnings of the individual and examined the gender earnings gap within each state, controlling for a series of personal characteristics.

Key findings: The study found a gender wage gap of 40.67 percent, in which the state-level effects accounted for only a little more than 2 percent of the total variance in wages. When the individual characteristics were included, the gender wage gap was 26.07 percent. Interestingly, when state government intervention on labor market inequality was included in the model, it accounted for an additional 5.33 percent of the gender wage gap. Therefore, it appears that progressive state institutional

environments supportive of norms of equality help female employees close the earnings gap with their male counterparts, while states that function as welfare providers and employers exacerbate the gender earnings gap.

RACE/ETHNICITY

Citation: Black, D. A., Haviland, A., Sanders, S. G., & Taylor, L. J. (2008). Gender wage disparities among the highly educated. *Journal of Human Resources, 43*, 630–659. doi: 10.3368/jhr.43.3.630

Data source: National Survey of College Graduates from 1993, which resurveyed 214,643 individuals who had a bachelor's degree or higher in the 1990 Census.

Population studied: 74,613 college graduates aged 25–60 years.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X		X	X	X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X		14 majors plus "other majors."

Black, Haviland, Sanders, and Taylor (2008) conducted an alternative decomposition procedure built on nonparametric matching of female racial and ethnic groups (non-Hispanic white, black, Hispanic, Asian) to similar white males in terms of age, education level, and fields of study. The subsequent nonparametric decomposition procedure estimated the gender wage gaps for different races and ethnicities in comparison to white, non-Hispanic males of similar underlying characteristics.

Key findings: The study found that across racial and ethnic groups examined, between 44 and 73 percent of gender wage gaps were accounted for by premarket/demographic factors like age, education level, and major. When focusing on women with "high labor force attachment" (those women with work experience similar to male counterparts), Black et al. accounted for between 54 and 99 percent of gender wage gaps. Furthermore, the findings indicated that the gender wage gaps were approximately zero for both Asian and Hispanic women.

Citation: Chapman, S. J., & Benis, N. (2017). Ceteris non paribus: The intersectionality of gender, race, and region in the gender wage gap. *Women's Studies International Forum*, *65*, 78–86. doi: 10.1016/j.wsif.2017.10.001

Data source: National Women's Law Center data from 2015, American Community Survey.

Population studied: Full-time, year-round workers from all 50 states.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X						X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
			X			State-level GDP, state-level unemployment rate, percent of state population living below poverty line, percent of state population living in a metropolitan area

Using regression models, Chapman and Benis (2017) used state-level data to examine the difference in the wage gaps between men and women, racial groups, and regions. To examine the differences in the wage gaps for gender, race, and region, analysis of variance (ANOVA) was also used. Annual median wages by state was the outcome of interest in all cases.

Key findings: This study found that even when controlling for economic and demographic characteristics of each state, region has an impact on the gender pay gap. The average overall state-level gender wage gap is 20.88 percent (range: 11–36 percent). The gender wage gap also varies across racial/ethnic groups: African-American and Latinx groups face significantly higher gender wage gaps than white, non-Hispanic groups.

Citation: Greenman, E., & Xie, Y. (2008). Double jeopardy? The interaction of gender and race on earnings in the United States. *Social Forces, 86*(3), 1217–1244. doi: 10.1353/sof.0.0008

Data source: Census 2000 Public Use Micro Sample (PUMS).

Population studied: 10 percent sample of monoracial whites from the 1 percent PUMS, all monoracial blacks from the 1 percent PUMS, and all other groups from the 5 percent PUMS. Sample is restricted to full-time, full-year workers ages 25–55.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X				X	X	X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X		

Earnings differences are studied for each racial and ethnic group by comparing the gender earnings gaps among minorities and whites. The paper specifically addresses role specialization theory by measuring the responsiveness of wives' employment to husbands' income in families with young children. The

models highlight whether the effects of alternative family income are weaker (i.e., less negative) for racial/ethnic minority groups compared to whites.

Key findings: In confirming the intersectionality of race and gender in determining earnings among U.S. workers, this study notes that "pure gender effect" or "pure race effect" has little meaning. For earnings-advantaged groups, women experience a greater advantage than men, and for earnings-disadvantaged groups, the race penalty is universally smaller among women than among men. For all minority groups, the gender penalty is smaller for minority women than for white women. Results of marital status revealed that among the married, the gender earnings gap was significantly smaller for almost every minority group than for whites; however, few racial differences in the gender earnings gap exist among the unmarried. These results strongly suggest that the explanation for the race/gender earnings interaction is linked with family factors.

Citation: Mandel, H., & Semyonov, M. (2016). Going back in time? Gender differences in trends and sources of the racial pay gap, 1970 to 2010. *American Sociological Review*, *81*(5), 1039–1068. DOI: 10.1177/0003122416662958

Data source: Integrated Public Use Microdata Series 1970, 1980, 1990, 2000; American Community Survey 2010.

Population studied: Black and white individuals.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X	X	X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X				X (hours per week)		Foreign born, sector (public/private), metropolitan area.

Mandel and Semyonov (2016) analyzed how the size, convergence pace, and source of the racial pay gap differ by gender. They used Oaxaca-Blinder decomposition to estimate separate wage regressions by race.

Key findings: The study found that the racial pay gap for men has declined by about 25 percent over the past four decades, from -0.44 log units in 1970 to -0.332 log units in 2010. Most of this decline occurred in the 1970s. The racial pay gap for women similarly decreased in the 1970s. For both genders, this trend reversed in the 2000s as the racial pay gap began to increase. The gross racial earnings gap is much larger among men than among women throughout the entire period studied. In 1980, the pay gap between black and white men was greater than 30 percent, while the pay gap between black and white women was less than 1 percent.

SEXUAL ORIENTATION

Citation: Sayers, R., Levendis, J., & Dicle, M. (2017). The sexual orientation wage gap in the USA. *International Journal of Social Economics, 44*(12), 1846–1855. doi: 10.1108/IJSE-08-2016-0215

Data source: General Social Survey 1988–2014.

Population studied: Sample of 24,748 observations in the dataset.

Country/Countries: United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X			X	X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X						Sexual orientation, prestige (continuous variable of prestige associated with occupation).

Sayers, Levendis, and Dicle (2017) used ordinary least squares regression to examine the relationship between sexual orientation on the gender wage gap. Specifically, the authors compare the wages of homosexual women and homosexual men to those of straight men.

Key findings: This study found that consistent across the different models, homosexuality affects wages differently by gender. Homosexual women earn 28 percent more than straight women, while homosexual men earn 22 percent less than straight men, controlling for education and occupation. Bisexual men earn the least amount compared to the other two groups of men. Homosexuality results in a wage decrease for men and a wage increase for women, but this premium is not large enough to compensate for the gender wage gap.

ANNOTATED BIBLIOGRAPHY (NON-US STUDIES)

Education and Human Capital Development

Citation: Amado, C. A. F., Santos, S. P., & São José, J. M. S. (2018). Measuring and decomposing the gender pay gap: A new frontier approach. *European Journal of Operational Research*, *271*(1), 357–373. doi: 10.1016/j.ejor.2018.05.023

Data sources: European Structure of Earnings Survey in 2010.

Population studied: 32,887 business and administration associate professionals aged 20–59 years who worked full-time/full-year as a permanent employee with at least 1 year of experience in the financial and insurance industry and in private companies with 50 or more employees in 20 European countries.

Country/Countries: 20 European Countries.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
		X	X				X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X			X	X	Country- specific dummy.

Amado, Santos and São José (2018) developed an enhanced method to measure and decompose the gender pay gap, based on Data Envelopment Analysis (DEA) and the Malmquist Index. With this method, they included multiple types of pay (such as wages and bonuses) and adjusted for multiple productive characteristics (such as level of education and experience/job tenure). Amado et al. used (1) the DEA to estimate a pay frontier representing the maximum pay that could be achieved for certain characteristics and (2) measured the gender pay gap with a Malmquist Index that compared male and female pay data.

Key findings: Findings suggest a substantial pay gap in the 20 European countries that were included in the study. In particular, when controlling for level of education and tenure, females received 19.51 percent lower pay than males. However, Amado et al. estimated wide differences between the pay gap and the values of its various components across the countries. They also found that in some countries, the realized wages of female workers are farther from their optimal pay frontiers[5] than those of male workers, and this distance results in a larger pay gap. However, in other countries, female workers' realized wages are closer to the pay frontier than males, resulting in a smaller pay gap. Finally, Amado et al. also identified a bias effect in terms of productive characteristics in some countries—predominately education (i.e., when compared to males, level of education had a greater influence on the ability to secure certain levels of pay than tenure had).

Citation: Asplund, R., & Napari, S. (2011). Intangibles and the gender wage gap: An analysis of gender wage gaps across occupations in the Finnish private sector. *Journal of Labor Research, 32*(4), 305–325. doi: 10.1007/s12122-011-9114-9

Data sources: Cross-sectional data from the Confederation of Finnish Industries' records (Finland's leading business organization).

Population studied: White-collar manufacturing workers (*n* = 322,402) and service sector workers (*n* = 387,180), ranging in age from 18–64 years old.

Country/Countries: Finland.

[5] An "optimal pay/wage frontier" is the best set of wages (and other characteristics and preferences) acceptable to a given worker. If women have a lower pay frontier or their realized wages are farther below the frontier, a gender wage gap is observed.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X					Cognitive, social, and physical skills; city size.

Asplund and Napari (2011) used unconditional quantile regression decomposition methods to identify causes of gender pay disparities across the income distribution. Specifically, the authors were interested in how intangible factors impact human capital formation in two occupational groups: innovation workers (i.e., management and marketing) and non-innovation workers.

Key findings: Overall, the comparison of innovation and non-innovation workers in relation to the levels, profiles, and trends of gender wage gaps strongly implied that the differences between these worker groups were more prominent than within sectors. The unifying factor between the gender wage gaps for innovation and non-innovation white-collar manufacturing workers was that women were rewarded less than men for similar characteristics of human labor. As non-innovation workers moved up through the wage distribution, the wage gap increased notably. The findings of this study suggest that sector-specific factors play a larger role in the observed differences in gender wage gap patterns between innovation workers in manufacturing and services than occupation-specific factors. Therefore, the role of occupation-specific factors should not be disregarded.

Citation: Baker, M., & Drolet, M. (2010). A new view of the male/female pay gap. *Canadian Public Policy-Analyse De Politiques*, *36*(4), 429–464. doi: 10.2307/25782105

Data sources: Survey of Work History 1981, Survey of Union Membership 1984, Labour Market Activity Survey 1986–1990, Survey of Labour and Income Dynamics 1993–1996, Labour Force Survey 1997–2008, Survey of Consumer Finances.

Population studied: All paid employees in their primary job (i.e., job with the greatest number of hours [not including compensation received from any secondary jobs]).

Country/Countries: Canada.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X	X		X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X		X		X	

Baker and Drolet (2010) compared the trends of gender pay ratio based on hourly wage and annual earnings data across several demographic, educational, and labor market characteristics. Further, they conducted an Oaxaca-Blinder decomposition of the gender wage gap to explore how differences in observable characteristics by gender may account for any corresponding differences in wages.

Key findings: Findings suggest that the female-male wage-based ratio was consistently 10 to 15 percentage points higher than the earnings-based ratio. More specifically, for 2006, the authors estimated a wage-based ratio for full-time workers of 0.85, while they estimated a full-year full-time earnings-based ratio of 0.72. The wage-based ratio showed steady, though relatively small, progress made on the gender wage gap over the prior 15 years, while the earnings-based ratio had remained stagnant. When controlling for gender differences in productive characteristics, Baker and Drolet found that females more often possess characteristics that imply higher pay across several dimensions. The authors noted that this "female edge" suggested that if females would receive the same returns on these characteristics as males, females would garner higher, not lower, wages than males.

Citation: Behr, A., & Theune, K. (2018). The gender pay gap at labour market entrance: Evidence from Germany. *International Labour Review, 157*(1), 83–100. doi: 10.1111/ilr.12037

Data source: 2001 German panel survey of graduates conducted by the Hochschul-Informations-System (HIS college information system).

Population studied: Sample size = 3,386 observations. Includes information on wages of the first job after graduation, grades, times to degree, fields, and course of study for 8,117 individuals. Excludes graduates not working at the time of the survey, self-employed, individuals working less than 10 hours per week, and observations for hourly wages below euro 2.5 and above euro 50.

Country/Countries: Germany.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X		Job search duration, grade point average, length of study, field of study, vocational training, parental academic degree status.

Beach and Theune (2018) used traditional decomposition methods, including Oaxaca-Blinder and quantile regression techniques, to estimate a series of Mincerian wage equations with log hourly wages as outcome.

Key findings: The authors found the gender pay gap in average hourly starting wages is 25 percent. In addition, estimates that include a comprehensive set of covariates explain only 42 percent of the total variation in hourly log wages for men and 35 percent of hourly log wages for women. Similar to most

previous studies, university performance and fields of study have a strong impact on entry wages of men and women, with field of study being more significant than all other characteristics. Male graduates tend to study engineering, economics, natural sciences, and informatics and math, while female graduates tend to choose other fields of study (except law), with the share of female graduates noticeably higher in teaching. The gender pay gap at labor market entry is about the same magnitude as the overall gender pay gap in Germany, with the choice of field of study having the strongest impact on this trend.

Citation: Bonhomme, S., & Hospido, L. (2013). Earnings inequality in Spain: New evidence using tax data. *Applied Economics, 45*(30), 4212–4225.

Data source: Spanish tax files matched to social security records from Continuous Sample of Working Histories (Muestra Continua de Vidas Laborales [MCVL]), 2004–2010

Population studied: 696,223 employees age 25 through 54 with positive taxable income.

Country/Countries: Spain.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X						

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X						Year dummy variables, immigrant/native dummy variable, sector dummy variable, dummy variable for type of contract.

Bonhomme and Hospido (2013) used Spanish tax and social security data to explore gender pay inequality between 2004 and 2010. The authors estimated a series of quantile regressions, where the outcome was log daily earnings.

Key findings: Overall, the raw gender earnings gap across the distribution decreased between 2004 and 2010, with a reduction from 57 percent to 47 percent at the 10th percentile and from 30 percent to 22 percent at the 90th percentile. After controlling for personal characteristics, for 2010, the authors found a pay gap of around 35 to 42 percent at the 10th percentile of the earnings distribution and a gap of around 25 to 27 percent at the 90th percentile. The gap is lowest at the median of the distribution.

Citation: Borland, J., & Coelli, M. (2016). Labour Market Inequality in Australia. *Economic Record*, *92*(299), 517–547. doi: 10.1111/1475-4932.12285

Data sources: Income Distribution Surveys/Surveys of Income and Housing; Labor Force Surveys; Employer Surveys; the HILDA Survey; the Australian Tax Office; and information from the Australian Bureau of Statistics for a subsample of data taken from the 5-year censuses (the authors used the latter

to calculate income and employment differences between various subgroups: education level, age, gender, immigrant status, and Indigenous status).

Population studied: Full-time non-self-employed workers.

Country/Countries: Australia.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X		X		X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X		X	X	X		Immigrant status, Indigenous status, country of birth, earnings, employment/population rates, labor market income, market income, and disposable income.

Borland and Coelli (2016) examined the potential causes and consequences of labor market inequality. Changes in inequality were decomposed into the effects of changes in the distribution of observable characteristics in the workforce, changes in the monetary return to observable characteristics, and changes in earnings inequality within groups of workers with the same observable characteristics.

Key findings: Findings indicated that among full-time workers, the growth in inequality has been particularly pronounced for employees at the top of earnings distribution since the mid-1990s. Estimates on trends in earnings inequality for females, the authors found that changes in observable characteristics of the workforce have added to earnings inequality (e.g., increases in the proportion of females with higher levels of education, as well as increases in participation rates of older females in the workforce).

Citation: Blundell, R., Gosling, A., Ichimura, H., & Meghir, C. (2007). Changes in the distribution of male and female wages accounting for employment composition using bounds. *Econometrica*, *75*(2), 323–363. doi: 10.1111/j.1468-0262.2006.00750.x

Data sources: Pooled repeated cross-section longitudinal data from the UK Family Expenditure Survey, 1978–2000.

Population studied: 187,467 British men and women between 23 and 59 years old who were not in full-time education and reported working (full-time, part-time, or self-employed) in the past week.

Country/Countries: United Kingdom.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X					

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Time.

Blundell, Gosling, Ichimura, and Meghir (2007) built upon the theoretical econometric literature on selection and bounds to develop a methodology for bounding the distribution of wages to account for the censoring introduced by nonparticipation in the labor market. The authors handled nonparticipation in the model by introducing restrictions that impose positive selection into the labor market. In addition to developing a theoretical model, the authors presented an empirical analysis on changes in the hourly wage distribution that account for changes in worker composition due to selection and labor market trends.

Key findings: The empirical estimates on gender wage differentials indicated that the male–female differential, among those with less than a college education at age 25, declined by at least 23 percentage points between 1978 and 1998. For all other groups, the estimates were not statistically significant.

Citation: Chzhen, Y. & Mumford, K. (2011). Gender gaps across the earnings distribution for full-time employees in Britain: Allowing for sample selection. *Labour Economics, 18*(6), 837–844. doi: 10.1016/j.labeco.2011.05.004.

Data sources: British Household Panel Survey, Wave 15.

Population studied: 4,223 full-time workers aged 25 to 55 years.

Country/Countries: United Kingdom.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X	X		X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X				Only include full-time male and female workers and part-time female workers. Exclude all non-workers and part-time/self-employed men).	X	Private sector/public sector; managerial/supervisory duties.

Chzhen and Mumford (2011) used a quantile regression decomposition method developed by Machado and Mata (2005) to examine the gender wage gap in log average hourly wages, allowing for possible non-random selection of females into full-time employment (Albrecht, van Vuuren, & Vroman, 2009).

Key findings: The study showed that the selection-corrected gender wage gap is almost twice the raw gap across the distribution of wages. This selection-corrected wage gap occurred due to the lower returns on women's characteristics than returns on those of men. The study showed that the gender

earnings gap in Britain would almost disappear if women's returns on characteristics were the same as the return on those for men.

Citation: Chzhen, Y., Mumford, K., & Nicodemo, C. (2013). The gender pay gap in the Australian private sector: Is selection relevant across the earnings distribution? *Economic Record, 89*(286), 367–381. doi: 10.1111/1475-4932.12060

Data sources: Household, Income and Labour Dynamics data, Wave 9, a nationally representative annual survey of private Australian households.

Population studied: 2,896 full-time employed individuals in the private sector aged 25–55 years and 584 non-working women.

Country/Countries: Australia.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X	X	X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X					X	Supervisory duties, migrant status.

Chzhen, Mumford, and Nicodemo (2013) employed the quantile regression decomposition method developed by Machado and Mata (2005) to analyze the gender pay gap and allow for the possible self-selection of women into full-time employment using Albrecht, van Vuuren, & Vroman (2009).

Key findings: Findings showed a substantial gender gap in average gross hourly earnings of 17 log points (or 20.5 percent) in the sample of Australian full-time private-sector employees studied. However, the authors did not find significant evidence of sample self-selection. These results imply that self-selection correction is unnecessary and could result in an imprecise estimate of the gender earnings gap. The study further showed that the observed gender gap is related to lower returns on women characteristics than men.

Citation: del Mar Salinas-Jimenez, M., Rahona-Lopez, M., & Murillo-Huertas, I. P. (2013). Gender wage differentials and educational mismatch: An application to the Spanish case. *Applied Economics, 45*(30), 4226–4235. doi 10.1080/00036846.2013.781260

Data source: 2006 Spanish Wage Structure Survey.

Population studied: 118,996 male workers and 69,519 female workers ages 16 through 65.

Country/Countries: Spain.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X				X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X			X		Type of contract, supervisory tasks, firm size, public v. private ownership, modal measure of over- or under-schooling.

Del Mar Salinas-Jimenez, Rahona-Lopez, and Murillo-Huertas (2013) estimated the gap in gross hourly earnings using standard Oaxaca-Blinder decomposition and regression analysis. Aside from various typical controls for human capital characteristics, the authors control for potential educational mismatch (i.e., over- or under-schooling).

Key findings: Overall, the authors found evidence that women's productive characteristics (i.e., education and experience) are better than those of men and that the gender wage gap between men and women would be even greater if women had characteristics more similar to those of men. The authors estimated that women's earnings are around 80 to 82 percent of men's earnings. However, this gap is larger for undereducated workers; for this group, women's earnings are around 70 percent of men's earnings.

Citation: del Rio, C., Gradin, C., & Canto, O. (2011). The measurement of gender wage discrimination: the distributional approach revisited. *Journal of Economic Inequality*, *9*(1), 57–86. doi: 10.1007/s10888-010-9130-7

Data source: Encuesta de Estructura Salarial (Survey of Wage Structure) undertaken by the Instituto Nacional de Estadística (INE) in 1995.

Population studied: 27,085 female and 100,208 male full-time employees in firms with 10 or more workers who do not work in agriculture, public administration, health services, or education.

Country/Countries: Spain.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X				X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X					X	Type of contract; type of collective agreement; firm ownership; type of reference market (international, national, or local).

del Rio, Gradin, and Canto (2011) estimated the gender wage gap using ordinary least squares and quantile regressions.

Key findings: In both ordinary least squares and quantile regression estimations, the average absolute wage gap represents approximately 27 percent of the average female wage. In addition, absolute discrimination increases with wage in both estimation types. The study found a sticky floor effect for women with low levels of education, as well as a glass ceiling for highly educated women. It also revealed that relative discrimination is smaller at the top of the female wage distribution than the bottom. When comparing the estimation techniques, quantile regression indicated significantly more aggregate discrimination than classical estimation techniques. The authors concluded that this result was due to the better fit of the wage estimations using quantile regression.

Citation: Fortin, N. M., Bell, B., & Bohm, M. (2017). Top earnings inequality and the gender pay gap: Canada, Sweden, and the United Kingdom. *Labour Economics*, *47,* 107–123. IZA Discussion Paper #10829.

Data source: Canadian Longitudinal Worker Files 1983–2010; British Annual Surveys of Hours and Earnings 1999–2015; Swedish Longitudinal Integration Database for Health Insurance and Labour Market Studies 1990–2013; public use files of the Canadian and British Labour Force Surveys.

Population studied: Workers aged 25–64.

Country/Countries: Canada, Britain, and Sweden.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X				X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X		X	X (dummy)		Percentile groupings (the bottom 90 percent, the next 9 percent, the next 0.9 percent, and the top 0.1 percent).

Fortin, Bell, and Bohm (2017) examined the impact of the underrepresentation of women in top occupations on the overall gender gap in annual earnings. The authors constructed counterfactual female earnings to estimate what the average gender earnings ratio would be if the representation of women among the four percentile groupings were the same as men.

Key findings: The study found that underrepresentation of women in top occupations accounts for a substantial, and often majority, portion of the gender earnings gap in Sweden, Canada, and the UK. The authors showed that women's increases in educational attainment have not been accompanied by commensurate increases in pay. The highest glass ceiling was found in the top 0.1 percent, where there are few women and women do not receive earnings in top ranges similar to those of men. In the three countries studied, the gender earnings ratio for the top 0.1 percent fell during the 5 years before the decline associated with the financial crisis.

Citation: Francesconi, M., & Parey, M. (2018). Early gender gaps among university graduates. *European Economic Review, 109*, 63–82. doi: 10.1016/j.euroecorev.2018.02.004

Data sources: Nationally representative survey sample of college graduates collected by the German Centre for Higher Education Research and Science Studies, cohorts 1988–1989, 1996–1997, 2000–2001, 2004–2005, and 2008–2009.

Population studied: 54,108 (26,153 females and 27,955 males) recent graduates (12–18 months after graduation) who work full-time.

Country/Countries: Germany.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X		X		X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X	X		X (Dummy variable).		PhD studies; family background; high school and university grades.

Francesconi and Parey (2018) used cross-sectional regression and Oaxaca-Blinder decomposition to analyze human capital accumulation as a source of gender gaps in monthly earnings for recent graduates using ordinary least squares regressions that include controls for family background, fields of study, performance in university coursework, and hours worked.

Key findings: Francesconi and Parey found that the most important contribution to the gender earnings gap is field of study, accounting for 9.4 log points of explained gender differences. After 12 to 18 months of graduating college, the gender gap in monthly earnings is nearly 20 points, excluding those in training and PhD programs. It is notable that after controlling for all covariates, the gender wage gap is similar across all quartiles at around 8 log points.

Citation: Frolich, M. (2007). Propensity score matching without conditional independence assumption-with an application to the gender wage gap in the United Kingdom. *Econometrics Journal, 10*(2) 359–407. doi: 10.1111/j.1368-423X.2007.00212.x

Data sources: The United Kingdom Labour Force Survey from 1996.

Population studied: The total sample size consisted of 2,983 male and 2,183 female college graduates.

Country/Countries: United Kingdom.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X			X		X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X			X (Dummy variable).		Employed in private sector; 11 broad degree subjects (medicine, agricultural science, language studies, etc.).

Frolich (2007) followed the Oaxaca-Blinder decompositions conducted by Machin and Puhani (2003) to find that the subject of degree explains a significant fraction of the gender wage gap. He conducted decompositions both with and without subject of degree using both parametric and nonparametric propensity score matching (PSM) estimates.

Key findings: Frolich found that the percentage of the wage gap explained by the PSM approach is larger than in the parametric decomposition method chosen by Machin and Puhani (2003) and is thus more robust in explaining the gap. The subject of degree contribution to the explaining wage differences is not uniform across wage distribution and showed little explanatory power at the lower end; at the high end, the large wage differential between high-earning men and women is largely the result of men and women choosing different subjects in university.

Citation: Garcia-Aracil, A. (2008). College major and the gender earnings gap: A multi-country examination of postgraduate labour market outcomes. *Research in Higher Education, 49*(8), 733–757. doi: 10.1007/s11162-008-9102-y

Data sources: A study from Careers after Higher Education – A European Research Survey.

Population studied: 36,000 graduates who held first higher education degrees and were surveyed again 4 years after post-graduation. The sample only included young employed graduates between the ages of 26–35 removing cases with missing values for income; the final sample contained 15,510 records.

Country/Countries: Nine European countries.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X			X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X				X (Dummy variable).		Mother's educational background; presence of partner; self-reported level of competencies (foreign language, computer skills, planning/coordinating/organizing, problem-solving ability, negotiating, taking responsibilities and decisions); working hours; public sector; permanent; and field of study.

Garcia-Aracil (2008) analyzed the determinants of the field of study choice through a multinomial regression model, which included explanatory variables of the graduates' family and educational background. Then, estimates were made of field of study as both endogenous and exogenous variables on observable distribution of earnings. Finally, the author estimated the gender wage gap using the Oaxaca-Ransom decomposition method, adjusting for selection bias and a weighting procedure to produce estimates of conditional gross log-earning differentials and unexplained components. These measures were calculated in aggregate for all countries as well as for individual countries.

Key findings: Garcia-Aracil found that field of study influences the income level, after controlling for individual and job-specific characteristics. These results, however, do not change even if the model in which the choice of a given field is included as an endogenous determinant. The gender differences, even in a very homogenous group of highly skilled European graduates, is prominent. They are smaller for graduates in education, humanities, and mathematics.

Citation: Grönlund, A., & Magnusson, C. (2016). Family-friendly policies and women's wages – is there a trade-off? Skill investments, occupational segregation and the gender pay gap in Germany, Sweden and the UK. *European Societies*, *18*(1), 91–113. doi: 10.1080/14616696.2015.1124904

Data source: European Social Survey 2004 and 2010.

Population studied: Employees aged 20–65 working at least 10 hours a week, resulting in 1,288 respondents for Germany, 1,447 for Sweden, and 1,156 for the United Kingdom.

Country/Countries: Germany, Sweden, and the United Kingdom.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
		X				Tenure, on-the-job training, percentage female, welfare sector.

Grönlund and Magnusson (2016) examined the mechanisms behind the gender wage gap in Germany, Sweden, and the United Kingdom. In comparing high- and low-skilled employees in these countries, the authors found the mechanisms behind the gender wage gap differ. The authors estimated separate ordinary least squares regressions for Germany, Sweden, and the UK that include control variables that capture gender segregation in the labor market.

Key findings: In particular, the importance of occupational segregation may be overrated, at least for high-skilled employees in Sweden and Germany. Study evidence indicates occupational segregation is weakening in prestigious occupations, yet such segregation is presented in the trade-off hypothesis as an obstacle for highly educated, career-minded women.

Citation: Gonzalez, P., Santos, L. D., & Santos, M. C. (2008). Gender pay differentials in Portugal: Contributions to the employment policy debate in the European Union. *Social Policy & Administration, 42*(2), 125–142. doi: 10.1111/j.1467-9515.2007.00599.x

Data sources: Personnel Records database (Quadros de Pessoal), an administrative dataset collected by the Portuguese Ministry of Employment.

Population studied: Private-sector employees in Portugal from 1986 through 2005.

Country/Countries: Portugal.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X				X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X			X	X	Tenure and plant size.

Gonzalez, Santos, and Santos (2008) analyzed yearly wage gaps at different time periods between 1985 and 2005 and decomposed it into an explained (endowment differential) and unexplained (discrimination differential) part.

Key findings: Gonzalez et al. found that only differences in job characteristics are responsible for the increasing gender pay gap in 2005. The characteristics of male and female workers are becoming increasingly similar and are now clearly more favorable to women, especially regarding education. This has contributed to the reduction of the pay gap. The study finds that discrimination remains the major explanation of the pay gap.

Citation: Guner, N., Kaya, E., & Sanchez-Marcos, V. (2014). Gender gaps in Spain: Policies and outcomes over the last three decades. *Series-Journal of the Spanish Economic Association, 5*(1), 61–103. doi: 10.1007/s13209-014-0104-z

Data source: European Community Household Panel for 1994; European Union Statistics on Income and Living Conditions for 2004 and 2010.

Population studied: Individuals of working age, aged 25–54, excluding students, apprentices, and self-employed persons.

Country/Countries: Spain.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X			X (dummy)		Immigration status.

Guner, Kaya, and Sanchez-Marcos (2014) estimated Mincerian wage regressions and use standard decomposition methods to examine the gender pay gap in Spain, where the outcome of interest was the natural log of gross hourly wages.

Key findings: The authors found that the gender employment gap has substantially declined over the past few decades. However, women are more likely to be employed part-time and in lower paid jobs, potentially contributing to the gender wage gap. The gender wage gap in 2010 was around 20 percent, not significantly different from the 1994 level.

Citation: Kumlin, J. (2007). The sex wage gap in Japan and Sweden: The role of human capital, workplace sex composition, and family responsibility. *European Sociological Review, 23*(2), 203–221. doi: 10.1093/esr/jcl029

Data source: Japanese General Social Survey 2001 and the Swedish Level of Living Survey 2000.

Population studied: Random sample of 4,822 persons aged 20–89; 5,142 interviewees aged 20–65.

Country/Countries: Japan/Sweden.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X (proxy for experience)	X		X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
		X				On-the-job training.

Kumlin (2007) examined the different sources of the gender wage gap in Japan and Sweden. Specifically, the author estimated wage regressions and used Oaxaca-Blinder decomposition to understand the portion of the gap that is due to return on observable characteristics.

Key findings: The author found that the Japanese economy is more focused around traditional gender roles than the Swedish economy. Overall, the results indicate an unexplained gender wage gap of 31 percent in Japan and 10 percent in Sweden.

Citation: Ñopo, H. (2008). Matching as a tool to decompose wage gaps. *Review of Economics and Statistics, 90*(2), 290–299. IZA Discussion Paper #981.

Data source: Peruvian National Household Surveys (Encuestas Nacionales de Hogares) 1986–1995 excluding 1988; Specialized Employment Survey (Encuesta Especializada de Empleo) 1995–1999.

Population studied: Peruvian workers over the age of 14 in metropolitan Lima.

Country/Countries: Peru.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X		X			

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Migratory status.

Ñopo (2008) developed a decomposition method that uses matching comparisons to account for differences in the distribution of individual characteristics when studying the gender wage gap. The author compared this decomposition method to the Oaxaca-Blinder decomposition technique. Ñopo applied his decomposition to the Peruvian gender wage gap, decomposing the gap into explanatory factors including the gender differences in the distribution of individual characteristics on the common support.

Key findings: Ñopo found that males receive on average 45 percent more than females in Lima. Using the proposed matching decomposition model, results showed that gender differences in the distributions of individual characteristics accounts for about 11 percent of the gender wage gap. In addition, differences in the distributions of individual characteristics explain about 6 percent of average female wages. The results showed that the unexplained component of the gap is about 28 percent.

Citation: Ñopo, H., Daza, N., & Ramos, J. (2012). Gender earning gaps around the world: A study of 64 countries. *International Journal of Manpower 33*(5), 464–513. doi: 10.1108/01437721211253164

Data source: Nationally representative surveys of household earnings and individual characteristics.

Population studied: Working individuals aged 18–65 who report positive earnings at their main activity and with no missing information on their demographic characteristics.

Country/Countries: 64 countries across Asia, Europe, and Africa.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X		X	X		X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X					Presence of elderly (older than 65 years old) in the household, presence of other household members who generate labor income, hours of work per week, employment status; formality (social security coverage).

Ñopo, Daza, and Ramos (2012) presented estimates of the gender gap in hourly earnings across a variety of countries in Asia, Europe, and Africa. The authors' decomposition analysis included controls for sector and formality.

Key findings

The gender earnings gap is highest in South Asia, with males earning 48 percent more than females, and lowest in Middle East and North Africa, with males earning 8 percent more than females. Throughout the countries studied, gender pay disparities can be partially accounted for by gender differences in observable sociodemographic and job characteristics. The unexplained component of the gender earnings gaps tended to be more pronounced among part-time workers and those with lower education levels.

Citation: Pena-Boquete, Y., De Stefanis, S., & Fernandez-Grela, M. (2010). The distribution of gender wage discrimination in Italy and Spain: A comparison using the ECHP. *International Journal of Manpower, 31*(2), 109–137. doi: 10.1108/01437721011042232

Data source: European Community Household Panel from 1997 to 2001.

Population studied: 7,488 Italian women and 11,441 Italian men; 7,206 Spanish women and 12,506 Spanish men.

Country/Countries: Italy and Spain.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X			

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X			X	X	Tenure, type of contract, year.

Pena-Boquete, De Stefanis, and Fernandez-Grela (2010) aimed to estimate the degree of individual discrimination for each female employee and the extent of individual discrimination across several socioeconomic groupings. They first used Oaxaca-Blinder decomposition of Mincerian wage equations (by country and gender) to compute aggregate measures of the degree of wage discrimination.

To estimate the degree of individual discrimination, they then calculated for each female employee the difference between her estimated wage if her individual characteristics were rewarded the same as average male rewards and her estimated wage if her individual characteristics were rewarded the same as average female rewards.

Key findings

The study found significant differences in the distribution of individual measures of discrimination between Spain and Italy. They found a glass ceiling effect in Italy, which inhibits the access of highly educated women to high-paying occupations. However, they did not find this effect in Spain.

Citation: Perales, F. (2013). Occupational sex-segregation, specialized human capital and wages: evidence from Britain. *Work, Employment and Society, 27*(4), 600–620. doi: 10.1177/0950017012460305

Data source: British Household Panel Survey, UK Labour Force Survey, and Skills Surveys.

Population studied: Sample size = 3,968 men (26,365 observations) and 4,359 women (29,446 observations). Data are based on a sample of employees within statutory working age and not in full-time education.

Country/Countries: Britain.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X					X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X	X			X	Year, contract type, hours of work, job tenure.

Perales (2013) examined two potential, yet competing, explanations for the gender pay gap: (1) that "women's" work is undervalued and (2) that women select into low-skilled occupations. The author estimated ordinary least squares regression models to estimate the gender gap in hourly wages.

Key findings: After controlling for several labor supply and demand factors—SHC (specialized human capital), domestic labor supply, socialization, workplace authority, and compensating differentials—a strong negative relationship between occupational feminization and wages is found. The preferred models estimate the occupational wage penalty is 9–15 percent for women and 7–13 percent for men. Additional findings indicate that women receive wages approximately 15 percent lower than those of "equivalent" men, that sex-segregation of occupations accounts for at least 14 percent of the gender wage gap, that unobserved individual traits play an important part in allocating workers to occupations with different gender-compositions, and that the relationship between occupational feminization and wages is linear. Further, there is support for both devaluation theory (i.e., the hypothesis that deep-rooted social mechanisms contribute to undervaluation of "women's work" cannot be rejected) and for the SHC hypothesis (i.e., skill specialization raises wages net of education, age, job tenure, and other important drivers of pay while also reducing the effect of occupational feminization on wages).

Citation: Piazzalunga, D. (2018). The gender wage gap among college graduates in Italy. *Italian Economic Journal, 4*(1), 33–90. *IZA working paper version

Data source: ISTAT 2011 University graduates' vocational integration dataset.

Population studied: 62,000 individuals who graduated from Italian universities in 2007.

Country/Countries: Italy.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X	X		X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X (profession)	X (sector)					High school grades; working in college tenure; type of contract; dummy indicating whether individual moved to work; parents' education; other degree attainment (e.g., masters or PhD); internship after graduation.

Piazzalunga (2018) studied the role college major and field of study play in hourly wage disparities for recent Italian college graduates. The author used Oaxaca-Blinder decomposition and quantile regression, controlling for field of study and job characteristics, to estimate gender differences in log hourly wages.

Key findings: The author found a gender wage gap of 5.6 percent, with the largest gaps in law (16.3 percent), political-social sciences (12.3 percent), and economics-statistics (10.8 percent); for most majors there was a significant unexplained gap. Quantile regression estimates indicated that the total gap increases along the wage distribution and declines at the 90th percentile.

Citation: Razzolini, T., Leombruni, R., Mastrobuoni, G., & Pagliero, M. (2014). Beneath the surface: The decline in gender injury gap. *Labour Economics, 30*, 282–288. doi: 10.1016/j.labeco.2014.04.007

Data sources: (1) Administrative data from a 1:90 random sample of Italian workers (the Work Histories Italian Panel), and (2) administrative records from the Italian Workers' Compensation Authority, spanning 1994–2002.

Population studied: Samples from approximately 120,000 individual records for each of the 9 years in the sample.

Country/Countries: Italy.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X					

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X			X (dummy)	X	Place of birth, weeks worked in a year, number of work-related injuries, days of work lost due to accidents.

Razzolini, Leombruni, Mastrobuoni, and Pagliero (2014) were interested in two main outcomes: the gender wage gap and workplace injuries. For the purpose of this *Annotated Bibliography*, we have included only information about the gender wage gap, though much of the focus is on workplace injuries. Razzolini et al. used the log of full time-equivalent weekly earnings in 1994 and 2002 to explore changes in the gender wage gap from 1994 to 2002. Razzolini et al. used DiNardo et al.'s (1996) reweighting approach to examine the relative importance of observable and unobservable characteristics of workers and firms and their impact on the gender gap. Furthermore, Razzolini applies this approach to construct counterfactual density and counterfactual population measures of wages.

Key findings: Descriptive analysis (not accounting for covariates) revealed that the gender wage gap dropped 21 percentage points from 1994 to 2002. Interestingly, when examining changes in the workforce over time and their potential to explain changes in the gender wage gap, Razzolini et al. found that the nearly-30 percent reduction in the gender wage gap was almost fully explained by changes in the observable characteristics of men in the workforce.

Citation: Russell, H. S., E., & O'Connell, P. J. (2010). Gender differences in pay among recent graduates: Private sector employees in Ireland. *Journal of Youth Studies, 13*(2), 213–233. DOI: 10.1080/13676260903295083

Data source: Higher Education Authority Survey of Recent Graduates.

Population studied: All individuals who received degrees from Irish public tertiary educational institutions in 2001 and were in the labor force in spring 2002.

Country/Countries: Ireland.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X				X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X	X	X	X	X	Measures of job fit, characteristics of educational institution, work commitment and values, factors impacting decision to take current job.

The authors examined factors that account for differences in earnings for recent college graduates in Ireland. To estimate the gender wage gap in the natural log of hourly wage, the authors used ordinary least squares regressions. First, they ran regressions for each domain (education, labor market, job/education match, institutional factors, and preferences/values) and then across all domains.

Key findings: The authors found that variables across all domains significantly impacted earnings, but only education, labor market human capital, and gender composition of the workplace impacted female wage coefficients. Additional analysis indicated men receive higher returns to post-graduate education, with a wage increase of 34.5 percent, compared to 17.6 percent for women.

Citation: Smith, M. R., Waite, S., & Durand, C. (2017). Gender differences in the earnings produced by a middle range education: The case of Canadian 'colleges.' *Social Science Research, 66*, 140–153. doi: 10.1016/j.ssresearch.2017.03.003

Data source: Statistics Canada's National Graduates Survey.

Population studied: Recent graduates from community colleges or community college-like institutions from cohorts in 1986, 1990, 1995, 2000, 2005, and 2010.

Country/Countries: Canada.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X			X	X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X (hours worked)		Field of study, tenure.

Smith, Waite, and Durand (2017) conducted both cross-sectional and panel data analyses of the gender earnings gap. In the cross-sectional analyses, they used Oaxaca-Blinder decompositions with the male coefficient being treated as the non-discriminatory referent. For the panel analyses, they used a hybrid random-effects model including terms that summarized the effect of the independent variables over the two data points, as well selected variables that were introduced as change scores.

Key findings: The study found a decline in the gender earnings gap between the first two cohorts (1988 and 1992) from 16 percent to 13 percent. The gap rose significantly to 27 percent in 1997 but declined to 19 percent in 2002. Authors also found that the decline in the gender earnings gap was partly due to narrowing human capital differences.

Citation: Sten, A. (2015). Non-parametric decomposition and the choice of reference group: A study of the gender wage gap in 15 OECD countries. *International Journal of Manpower, 36*(8), 1266–1280. doi: 10.1108/IJM-03-2015-0047

Data source: Organization for Economic Cooperation and Development's (OECD) Program for the International Assessment of Adult Competencies collected between August 2011 and March 2012.

Population studied: Full-time (working at least 35 hours per week) wage and salary (not self-employed) workers.

Country/Countries: Belgium (specifically, Flanders), Cyprus, the Czech Republic, Estonia, Finland, France, Ireland, Italy, Japan, Korea, Norway, Poland, the Slovak Republic, Spain, and the UK (England and Northern Ireland).

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X					Labor market status (employed, unemployed inactive); immigration status; type of employment contract (fixed-term, indefinite-term, apprenticeship or training scheme, no contract, other); management or supervision of other employees; skills (measured by performance on a numeracy test).

Sten (2015) examined the gender pay gap across 15 European countries using decomposition methods similar to those in Neumark (1998) and Oaxaca and Ransom (1994). However, one notable difference from previous studies is that the author decomposes male and female differences from mean wage.

Key findings: Overall, the author found that adding numeracy test scores as a measure of skill had a negligible effect on unexplained gap in wages. The asymmetry of the unexplained wage gaps varies across the countries of interest.

Citation: Sulis, G. (2012). Gender wage differentials in Italy: A structural estimation approach. *Journal of Population Economics, 25*(1), 53–87.

Data source: Italian Social Security Institute.

Population studied: INPS 1:90 random sample, representative of employed, private-sector workers from 1985 to 1996.

Country/Countries: Italy.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X						X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X				X	Job duration.

Sulis (2012) examined gender pay differentials by estimating the parameters of a Burdett-Mortensen-style equilibrium job search model. The parameters of interest, job transition, and firm productivity are estimated using maximum likelihood and method of moments.

Key findings: The author found a raw earnings gap of approximately 20 percent between men and women. Maximum likelihood estimation predicted a gender earnings differential of nearly 37 percent,

while method of moments predicted a wage differential of 25 percent which is close to the raw gap. Further analysis indicated that productivity and differences in job search are the most important components in explaining the gender pay differential.

Citation: Van Kerm, P. (2013). Generalized measures of wage differentials. *Empirical Economics, 45*(1), 465–482. doi: 10.1007/s00181-012-0608-y

Data sources: Pooled 2003–2007 data from the Panel Socio-Economique Liewen zu Lëtzebuerg (PSELL-3/EU-SILC).

Population studied: Full-time workers from Luxembourg between the ages of 25 and 55 years, excluding those who were self-employed, were international civil servants, or had hourly wages < 3 euros or > 60 euros. The final sample included 9,168 observations for men (7,919 which were full-time workers) and 10,015 observations for women (3,543 which were full-time workers).

Country/Countries: Luxembourg.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X (three age groups: 25-34, 35-44, 45-55).	X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Nationality (dummies for Luxembourg nationals, Portuguese, other Europeans, non-Europeans).

Van Kerm (2013) examined higher order differences in conditional wage distributions rather than just mean differences using a simple expected utility framework. The author developed a fully parametric approach to estimate conditional wage distribution of gross hourly wages under endogenous labor force participation, by gender, for several combinations of human capital characteristics (i.e., age, educational attainment, nationality, work experience). The model allows for varying degrees of skewness and kurtosis that helps to explain the tails typical in income and earnings distributions.

Key findings: Van Kerm computed summary measures of the wage distribution differences between men and women and found that male distributions are “more densely concentrated toward higher wages than female distributions.” In addition, “female distributions tend to be more right-skewed,” in which the mean hourly wage is greater than the median.

Citation: Villadoniga, M. J. P., & Rodriguez-Alvarez, A. (2017). Analysing wage differentials when workers maximize the return to human capital investment. *Applied Economics, 49*(42), 4196–4208. doi 10.1080/00036846.2017.1279267

Data source: 2010 Spanish Structure of Earnings Survey.

Population studied: 19,308 firms and 147,616 workers who had a job contract and were paid during the survey reference month.

Country/Countries: Spain.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X	X	Tenure, schooling-tenure interaction, temporary contract, job responsibility.

Villadoniga and Rodriguez-Alvarez (2017) presented a theoretical model in which workers maximize earnings, given the costs of acquiring human capital. The transformation of human capital into marginal productivity is estimated using an input distance function. These assumptions allowed the authors to provide consistent estimates of the wage frontiers for male and female workers.

Key findings: The authors found that workers with longer labor market spells were closer to their wage frontiers. However, women's realized wage frontiers tend to lie farther below their potential wage frontiers compared to men.

Citation: Waite, S. (2017). Postgraduate wage premiums and the gender wage gap in Canada. *Canadian Journal of Higher Education, 47*(2), 156–187.

Data source: National Household Survey 2011.

Population studied: Canadian full-time employees older than age 25 with a bachelor's degree or above—excluding doctors and lawyers; non-permanent residents; and residents of Nunavut, Yukon, or the Northwest Territories.

Country/Countries: Canada.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X				X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X					Hours worked.

Waite (2017) used descriptive statistics and ordinary least squares regressions to examine whether a postgraduate wage advantage exists and how the gender wage gap of individuals who have only undergraduate education compares to the gender wage gap of individuals who have postgraduate education. To determine the extent to which the wage effects of having a postgraduate degree vary by

field of study and sex, the author used Oaxaca-Blinder decomposition to estimate the gender wage gaps, separating the portions explained by differences in characteristics and differences in returns to those educational characteristics.

Key findings

The author found large wage premiums for postgraduate degrees in both genders and found that the gender wage gap is smaller for women with master's degrees than for women with bachelor's or doctoral degrees. Occupational differences explain more of this gender wage gap than field of study, suggesting that women sort into lower paid occupations after graduation compared to their male counterparts. Post-graduation occupational sorting plays a larger role in the gender wage gap than women's choices of fields of study during school.

Personality Traits, Cognitive, and Non-Cognitive Skills

Citation: Garcia-Aracil, A. (2007). Gender earnings gap among young European higher education graduates. *Higher Education*, *53*(4), 431–455. doi: 10.1007/s10734-005-3864-3

Data sources: Careers after Higher Education — A European Research Survey.

Population studied: 36,000 graduates who held first higher education degrees and were surveyed again 4 years after post-graduation. The sample only included employed graduates between the ages of 26–35 years.

Country/Countries: 11 European countries.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X			X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X				X (Dummy variable).	X	Mother's educational background; presence of partner; self-reported level of competencies (foreign language, computer skills, planning/coordinating/organizing, problem-solving ability, negotiating, taking responsibilities and decisions); working hours; public sector; permanent; and field of study.

Garcia-Aracil (2007) estimated gender wage gap using the Oaxaca-Ransom (1994) decomposition method, adjusting for selection bias and a weighting procedure to produce estimates of conditional gross log-earning differentials and unexplained components. These measures were calculated in aggregate for all countries as well as for individual countries.

Key findings: Garcia-Aracil found that job characteristics explain an advantage that occurs for female workers. Among competencies, foreign language and computer skills play a significant role in explaining

female workers' earnings advantage. This study found significant variation in both size and composition of gender earnings gaps across countries.

Citation: Le, A. T., Miller, P. W., Slutske, W. S., & Martin, N. G. (2011). Attitudes toward economic risk and the gender pay gap. *Labour Economics, 18*(4), 555–561. doi: 10.1016/j.labeco.2010.12.007

Data sources: Australian Twin Study of Gambling from members of the Australian Twin Registry Younger Twin Cohort, 2004–2007

Population studied: 2,288 members of complete twin pairs born between 1964 and 1971 where each member was employed, had positive gambling earnings, and had valid data variables analyzed. Of these pairs, 592 are identical twins, and 552 are non-identical.

Country/Countries: Australia.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X					

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X		Attitudes toward risk.

Le, Miller, Slutske, and Martin (2011) used models of behavioral genetics and human capital to examine the role that risk preferences play in wage determination. Data on both identical and non-identical twins were used to identify variation in the variables (economic risk-taking and earnings) that are attributed to genetic effects, shared environmental effects, or unshared environmental effects. The authors estimated wage equations that control for risk preferences and human capital characteristics using multiple regression.

Key findings: More positive attitudes toward economic risk-taking were found to be associated with higher earnings. Specifically, the authors found that a one-point increase in the measure of attitudes toward risk was associated with increases in men's and women's earnings of 3.4 percent and 2.4 percent, respectively. However, the differences between estimates of the risk coefficient for men and women were statistically insignificant. Overall, the authors found a gender pay gap of just over 20 percent, which is in line with previous estimates for Australia. The analysis showed that attitudes toward economic risk are moderately heritable, but there is no evidence that this heritability differs between males and females. Finally, only a small part of the gender wage gap can be accounted for by attitudes toward risk.

Citation: Nyhus, E. K., & Pons, E. (2012). Personality and the gender wage gap. *Applied Economics, 44*(1), 105–118. doi: 10.1080/00036846.2010.500272

Data source: DNB Household Survey.

Population studied: 622 Danish employees (370 men and 252 women) ages 16–64 who only have one employer and are not retired and are not students.

Country/Countries: Denmark.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X	X		X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X (dummy)		Personality factors (personal self-efficacy, time preference, extraversion, emotional stability, agreeableness, conscientiousness, openness to experiences); public sector; tenure; permanent/temporary status.

Nyhus and Pons (2012) estimated separate ordinary least squares regression for males and females to analyze the relationship between personality traits and hourly wage, controlling for other relevant factors. They then used Oaxaca-Blinder decomposition to determine the extent to which differences in personality traits explain the gender wage gap in Denmark.

Key findings: Findings showed that differences in personality traits, primarily agreeableness and intellect, account for 11.5 percent of the observed gender wage gap. Differences in the returns to personality traits only account for 0.5 percent of the observed gap. Adding personality traits to the model reduced the unexplained part of the gender wage gap from 75.2 percent to 62.7 percent.

Citation: Risse, L., Farrell, L., & Fry, T. R. L. (2018). Personality and pay: Do gender gaps in confidence explain gender gaps in wages? *Oxford Economic Papers (New Series), 70*(4), 919–949. doi: 10.1093/oep/gpy021

Data sources: The Household, Income and Labour Dynamics in Australia Survey data; analysis was based on the wage data collected in 2013.

Population studied: Individuals aged 18–64 years.

Country/Countries: Australia.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X	X		X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X		X		X	Achievement motivation, Big Five personality traits, locus of control, cognitive test scores, English-speaking proficiency, public sector, caretaker responsibilities, disability/health condition, and renting.

Risse, Farrell, and Fry (2018) used an Oaxaca-Blinder decomposition model to measure the impact of select personality traits on the gender pay gap.

Key findings: Risse et al. found a gender pay gap in which men earned about 19.6 percent more than women. In addition, men generally had more confidence in their capabilities and a stronger focus on their own agendas (higher hopes for success, weaker fears of failure, and lower agreeableness) compared to women, which accounts for a substantial portion of the pay gap; however, some of the wage gap was still unexplained.

Citation: Roszkowski, M. J., & Grable, J. E. (2010). Gender differences in personal income and financial risk tolerance: How much of a connection? *Career Development Quarterly, 58*(3), 270–275.

Data source: The Survey of Financial Risk Tolerance (SOFRT) consists of 51 items and uses a comprehensive set of questions to measure risk tolerance.

Population studied: 451 male and 266 female clients of financial planners who had used the SOFRT between 1992 and 1998.

Country/Countries: Not specified.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X		X			

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X					Financial risk tolerance and self-employment, household income.

Roszkowski and Grable (2010) conducted correlations and then a multiple hierarchical regression analysis to assess the assess the effects of gender and financial risk tolerance on income.

Key findings: The study found that the gender differences in earnings were larger than the gender differences in financial risk tolerance. While women's lower risk tolerance explains a slight portion of the gender pay gap, this analysis shows that gender is more closely related to pay than to risk tolerance.

Citation: Sakellariou, C. (2013). Are cognitive skills relevant in gender earnings decompositions? *Bulletin of Economic Research, 65*(2), 134–153. doi: 10.1111/j.1467-8586.2011.00430.x

Data source: The International Adult Literacy Survey data from 1994 to 1998.

Population studied: Adult population ages 18—65 who are employed for wages.

Country/Countries: Not specified

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X				X		Schooling cognitive skills, non-schooling cognitive skills, urban residence, firm with less than 20 employees, more than one employer in the past year, received training in the past year.

Sakellariou (2013) used two approaches to estimate the potential effect of cognitive skills on the size and pattern of the gender wage gap across the wage distribution. In the first approach, the author includes an overall measure of cognitive skills (total cognitive score) in the earnings equation. In the second approach, the author replaces the full measure with "schooling cognitive and non-schooling cognitive skills," thereby accounting for the origin of cognitive skills. The earnings gap was estimated using the standard Oaxaca-Blinder decomposition procedure and a quantile regression approach.

Key findings: The author found that using the overall measure of cognitive skills does not result in any significantly different estimates of the unexplained component of the gender wage gap compared to when cognitive skills are not controlled for in the earnings regression. However, once cognitive skills are distinguished by source (schooling cognitive and non-schooling cognitive skills), the estimates change substantially for the three of the five countries examined.

Citation: Selezneva, E., & Van Kerm, P. (2016). A distribution-sensitive examination of the gender wage gap in Germany. *The Journal of Economic Inequality,* 14(1), 21–40. doi: 10.1007/s10888-016-9320-z

Data source: German Socio-Economic Panel (SOEP) 1999–2008

Population studied: Respondents aged between 25 and 55, include wages of individuals working in the private or public sector at least 15 hours per week in a regular (full-time or part-time) job. Excludes workers on vocational training, in sheltered workshops, or reporting marginal or irregular part-time employment; self-employed workers; workers in the agricultural sector; individuals with hourly wage below 4 euros. Final samples consist of 24,029 males and 17,330 females for Western Germany and 7,047 males and 6,831 females for Eastern Germany.

Country/Countries: Germany.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X			X		X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Foreign born.

Selezneva and Van Kerm (2016) expand on previous gender wage gap studies by adopting a distribution-sensitive method that takes into consideration the impact of independent variables across the earnings distribution. The authors also included controls for risk aversion. Furthermore, the authors utilized a parametric approach to estimate the gender wage gap.

Key findings: Estimates are produced on the sensitivity of standard indicators of the wage gap to inequality differences, providing both lower and upper bounds for risk-aversion parameters of individual workers. Women's wage gaps in Germany appears to be worse than suggested by classic indicators, with women tending to be penalized both by lower mean wages and by unfavorable configurations of higher moments of the percentile wage distributions.

Compensation and Benefits

Citation: Artz, B., Goodhall, A. H., & Oswald, A. J. (2018). Do women ask? *Industrial Relations*, *57*(4) 611–636. doi: 10.1111/irel.12214

Data sources: Quantitative data from the Australian Workplace Relations Survey (AWRS), 2013–2014.

Population studied*:* 4,582 Australian employees across 840 employers.

Country/Countries: Australia.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X		X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X		Demographic controls, job controls, employer tenure (males and females): age squared, secondary, certificate, diploma, bachelor degree, graduate, post-graduate, weekly hours worked, "pay is negotiated," "successful since joining," "I have asked for pay raise," "I have asked for promotion," "satisfied with wage," "no process," "concerned about relationships," "role not worthy," "satisfied in role."

Artz, Goodall, and Oswald (2018) used regression analysis. Dependent variables included dichotomous answers to a series of questions on negotiation behavior. Artz et al. used demographic and workplace variables such as gender, age, marriage status, education level, tenure, and weekly hours worked as their independent variables.

Key findings: The study found that 39 percent of women and men reported being employed in a job that has a wage that could be negotiated with the company. Artz et al. found no statistical difference between men and women in the probability of asking for a pay raise; however, the study found that women were 25 percent less likely than men to obtain a pay raise. The study found no statistical evidence that women were more cautious than men when asking for a pay raise due to a concern for their workplace relationships. Employees, both men and women, working longer hours are more likely to ask for a pay raise than those who work shorter hours. Artz et al. found that men and women with higher levels of education and who worked longer hours were both more likely to be in a job with salary negotiation and to have been successful in negotiating a pay raise.

Citation: Bailey, J., David, P., D., Strachan, G., Whitehouse, G., & Broadbent, K. (2016). Academic pay loadings and gender in Australian universities. *Journal of Industrial Relations*, 58(5) 647–668. doi: 10.1177/0022185616639308

Data source: 2011 Work and Careers in Australia Universities study.

Population studied: 8,391 Australian academic staff.

Country/Countries: Australia.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X					

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Academic level of position; academic discipline; employment status.

Bailey, Strachan, Whitehouse, and Broadbent argue that in a highly regulated industrial relations system, in which most academic salaries are determined by collective bargaining, the unregulated determination of loadings allows for gender wage discrimination. After descriptive analysis, the study estimated ordinary least squares regression to analyze the extent and causes of gender differences in performance loading values.

Key findings: The study found that male academics are much more likely to receive allowances than their female counterparts. Classification factor, position in business faculty, and university grouping all contributed to the gender differences in market loadings. Gender was less significant than these factors but still significantly contributed to the loadings gap. The study also indicated that high regulation distance variable pay components through discretionary loadings leads to gender pay disparities.

Citation: Boye, K., & Grönlund, A. (2018). Workplace skill investments—an early career glass ceiling? Job complexity and wages among young professionals in Sweden. *Work, Employment and Society, 32*(2), 368–386. doi: 10.1177/0950017017744514

Data source: National Register of Higher Education; Swedish Register of Education 2013—a 2013 survey on Swedish men and women who recently graduated between 2007–2010 from five higher education programs.

Population studied: 2,300 employed Swedish individuals who graduated between 2007–2010 from five higher education programs and who work more than 15 hours a week in the occupation in which they were trained.

Country/Countries: Sweden.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X			X		X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X						Seniority, complex jobs (having a job that requires at least 1 year of initial on-the-job training), work hours.

Boye and Grönlund (2018) aimed to analyze gender differences in the likelihood of acquiring complex jobs that require on-the-job training and whether these gender differences lead to gender differences in wages or bargaining position. To accomplish this analysis, the authors first estimated a linear probability model to analyze the likelihood of having a complex job for each gender and replaceability (a proxy for bargaining power). Furthermore, the authors estimated ordinary least squares regressions to examine whether gender differences in access to complex jobs impact gender differences in monthly wages in the early career.

Key findings

The study found that men more often had complex jobs that required at least 1 year of on-the-job training compared to women working in the same occupations. A few years after graduation, men receive higher wages and occupy better bargaining positions with their employers compared to women. These gender disparities in wage and bargaining power are at least partly accounted for by men's better access to on-the-job training at the beginning of their careers.

Citation: Bryan, M., & Bryson, A. (2016). Has performance pay increased wage inequality in Britain? *Labour Economics, 41*, 149–161.

Data source: British Household Panel Survey, from 1998 (wave 8) to 2008 (wave 18)

Population studied: 3,918 male and 4,222 female employees aged 18–64 years who reported working between 5 and 100 hours a week and provided valid observations for all included variables.

Country/Countries: Britain.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X		X			

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X		**X**	X (part-time if less than 30 hours total)		

Bryan and Bryson (2016) examined changes in the dispersion of log hourly wages 1998 and 2008 for all men, all women, and full-time women in two different pay systems: performance-pay (PP) and fixed-rate-pay (FP) jobs. The authors examined the mean and standard deviation in log hourly earnings for PP jobs and FP jobs to estimate the premium associated with PP jobs and how it changed over time. Then, the authors compared the actual wage distribution with a counterfactual wage distribution to understand the effect of PP on wages at different parts of the wage distribution.

Key findings

The study found that PP jobs were associated with increased earnings dispersion among men and women, including the subgroup of full-time working women. In addition, PP contributed to less wage dispersion for women at the bottom of the earnings distribution.

Citation: Card, D., Cardoso, A. R., & Kline, P. (2015). *Bargaining, sorting, and the gender wage gap: Quantifying the impact of firms on the relative pay of women*. National Bureau of Economic Research Working Paper 21403.

Data sources: Quadros de Pessoal, a census of private sector employees, which spans from 2002–2009; and Sistema de Analisis de Balances Ibericos database, which includes general descriptive information about each business in Portugal.

Population studied: Individuals between 19 and 65 years of age with more than 1 year of potential labor market experience who have worked as a paid employee in the QP reference week. The sample excludes government employees and independent contractors. The sample includes annual wage observations for 2.1 million men and 1.7 million women in Portugal.

Country/Countries: Portugal.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X					X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X					Hours of work, founding date of the firm, gross sales of firm in preceding year.

Card, Cardoso, & Kline (2015) built on a simple rent-sharing model to develop an approach to measuring the sorting and bargaining channels via an Oaxaca-Blinder decomposition of gender-specific firm wage effects. Their model included fixed effects for individual workers and fixed effects for employers that measure the wage premium paid by each firm relative to some reference firm or group of firms.

Key findings: Card et al. found that the wages of both men and women contained firm-specific premiums strongly correlated with simple measures of potential bargaining surplus at each firm. Card et al. (2015) also found that women were disproportionately likely to work at low-surplus firms paying small premiums to both genders, and that women received only 90 percent of the firm-specific pay premiums earned by men. The combination of sorting and bargaining effects explained about one-fifth of the cross-sectional gender wage gap in Portugal. Of this 20 percent, roughly two-thirds was explained by sorting, and one-third was explained by the shortfall in relative bargaining power.

Citation: Grund, C. (2014). Gender pay gaps among highly educated professionals – Compensation components do matter. *Labour Economics, 34*, 118–126. doi: 10.1016/j.labeco.2015.03.010

Data sources: A yearly salary survey from 2008–2012, conducted by the German Association of Employed Academics and Executives in the Chemical Industry.

Population studied: An unbalanced panel of 16,029 observations with 7,021 individuals across 5 years (14,292 observations of males and 1,737 observations of females) who were full-time professionals and managers in the German chemical sector (excluding "top" managers).

Country/Countries: Germany.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X			X		X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X			X (all full-time).	X	Field of study; level of hierarchy (levels 2–4), functional area (nine areas), and year.

Grund (2014) analyzed the pay gaps using Mincer-type wage regressions of log total compensation and fixed salary with random effects. Additional models were run on bonus payments as dependent variable using Tobit regressions and generalized least squares methodology.

Key findings: Grund found that the gender pay gap exists, even for quite homogenous and well-educated workers in the same job in the chemical sector. The study found these gaps to be more relevant for experienced employees, employees with children, and employees who were at higher levels in the firm. Additionally, the study found these gaps to differ widely by compensation components and to be much higher for bonus pay than fixed salaries.

Citation: Gnesi, C., De Santis, S., & Cardinaleschi, S. (2016). The gender pay gap in Italy: Some evidence on the role of decentralized collective bargaining. *Estudios de Economía Aplicada, 34*(1).

Data source: Structural Earnings Survey for 2002, 2006, and 2010 from the Italian National Institute of Statistics.

Population studied: 87,753 employees from 9,771 enterprises (2002); 137,219 employees from 6,015 enterprises (2006); 228,688 employees from 8,297 enterprises (2010).

Country/Countries: Italy.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X					X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X			X (dummy)	X	Tenure (in years); management position; performance pay; decentralized collective bargaining.

Gnesi, De Santis, and Cardinaleschi (2016) estimated wage regressions for each of the 3 years studied, analyzing the impact of individual, job, and firm characteristics on average hourly earnings. They examined the extent to which performance pay (PP) influences the gender pay gap and analyzed how individual, job, and firm characteristics impact the likelihood of receiving PP.

Key findings

The authors found that PP positively influences equality of the wage distribution because it gives higher returns to employee characteristics than job or firm characteristics. In Italy in 2010, PP salaries were more attached to the employee and non-PP salaries were more attached to the job. This reduces the gender pay gap because women's education and skills receive a higher market reward. When pay relates to performance, the return to human capital is more equal.

Citation: Kangasniemi, M. K., & Kauhanen, A. (2013). Performance-related pay and gender wage differences. *Applied Economics*, *45*(36), 5131–5143. doi: 10.1080/00036846.2013.824546

Data sources: Elinkeinoelämän Keskusliitto, 1998–2007.

Population studied: 590,809 Finnish employees (414,601 men and 176,208 women) from 3,768 (mostly manufacturing) firms.

Country/Countries: Finland.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X				X	Job title dummies, year dummies, bonus plan, piece or reward rate, field of education.

In addition to descriptive statistics, Kangasniemi and Kauhanen (2013) used ordinary least squares regression and fixed-effects estimations to analyze the impact of two types of performance reward pay plans (piece rates and reward rates, bonuses) on the gender wage gap.

Key findings: Findings indicate that for both blue-collar and white-collar workers, the gender wage gap is about 12 percent. The raw gender wage gap (i.e., when other factors are not taken into account) among white-collar workers is considerably larger than the raw gender wage gap among blue-collar workers. Additionally**,** Kangasniemi and Kauhanen found, after controlling for unobserved person and firm effects, that bonus pay has little impact on the gender wage gap, as bonuses increased earnings similarly for both genders (increased by 6 and 4 percent for men and women, respectively). However, piece rates and reward rates increased the overall gender wage gap.

Citation: Konietzko, T. (2015). Self-employed individuals, time use, and earnings. *Journal of Family and Economic Issues, 36*(1), 64–83. doi: 10.1007/s10834-014-9411-6

Data sources: German Socio-Economic Panel (GSOEP, version SOEP v26, Socio-Economic Panel 2010) with waves 2000–2009 and the German Time Use Survey from 2001 and 2002.

Population studied: Individuals 20–60 years old who reported working full or part time in either paid or self-employment, excluding family workers, apprentices, or military or civilian national service.

Country/Countries: Germany.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X			**X**	**X**	**X**		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
					X	Self-employment, time use, housework, residence ownership.

Konietzko (2010) performed several regression analyses to examine whether time spent on housework differentially impacted earnings by self-employment status and gender. The outcome of interests were hourly and monthly gross earnings.

Key findings: Findings revealed a smaller wage gap among self-employed individuals versus paid-work individuals (gender wage gap of 18.99 percent versus 22.45 percent, respectively). The study found that self-employed individuals had a different time allocation than wage and salary workers, which varied by gender. Konietzko found that self-employed men performed more market work and less housework than self-employed women or wage and salary workers. The study found an inverse association between the time spent on housework activities and earnings; however, after controlling for person-fixed effects, Konietzko found a significant negative impact of housework hours on monthly earnings of self-employed men. In addition, after controlling for potential endogeneity via fixed-effects instrumental variables techniques, Konietzko found no impact. As such, this study found no evidence that differences in time use between men and women contribute to the gender wage gap.

Citation: Lott, Y., & Chung, H. (2016). Gender discrepancies in the outcomes of schedule control on overtime hours and income in Germany. *European Sociological Review, 32*(6), 752–765. doi: 10.1093/esr/jcw032

Data sources: German Socio-Economic Panel, years 2003, 2005, 2007, 2009, and 2011.

Population studied: 20,938 person-years for men and 19,689 person-years for women. Respondents were employed with contracted working hours at the time of interviews; respondents were excluded if they were self-employed or over the age of 65.

Country/Countries: Germany.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X		X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X			X		Status (employee, professional, civil servant, and manual worker); job authority (no job authority, management tasks, and extensive leadership); presence of bonus pay/overtime/holiday pay; second job; permanent contract; public or private sector; year; primary breadwinner; job change.

Lott and Chung (2016) used a hybrid panel regression that allowed for group differences as well as changes in individuals over time. They measured these group differences with between-unit estimates and measured changes in individuals with within-unit estimates.

Key findings: This study found that for men, schedule control was associated with increased overtime and income. For women, schedule control was associated with increased overtime hours but not income even when controlling for the sex segregation of the labor market, and self-selection of time-invariant characteristics in jobs.

Citation: Sandberg, P. K., Törnroos, M., & Kohvakka, R. (2018). The institutionalised undervaluation of women's work: The case of local government sector collective agreements. *Work Employment and Society, 32*(4), 707–725. doi: 10.1177/0950017017711100

Data sources: The *Gender Equality into Pay Systems Project*, which worked on pay systems of 18 Finnish organizations to promote equal pay.

Population studied: The sample is composed of two case organizations: Organization 1 with 318 participants and Organization 2 with 365 participants.

Country/Countries: Finland.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X			

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
			X			Collective agreement (general or technical).

Sandberg, Törnroos, and Kohvakka (2018) conducted ordinary least squares regression analyses and an Oaxaca-Blinder decomposition in order to analyze the determinants of wages and how much of the gender wage gap in the local government sector can be attributed to the collective agreements.

Key findings: Sandberg et al. found that women were at a disadvantage in base and total wages in both organizations, regardless of collective agreement and human capital variables. However, in Organization 1, collective agreement explained 61.9 percent of the wage gap in base wages and 47.1 percent of the gap in total wages between women and men.

Citation: Schafer, A., & Gottschall, K. (2015). From wage regulation to wage gap: How wage-setting institutions and structures shape the gender wage gap across three industries in 24 European countries and Germany. *Cambridge Journal of Economics, 39*(2), 467–496. doi: 10.1093/cje/bev005

Data source: European Union Statistics on Income and Living Conditions; Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts Database; OECD data.

Population studied: Full-time employees between the ages of 25 and 64.

Country/Countries: Central and Western Europe.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X							

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X		X			

Schafer and Gottschall (2015) used multilevel mixed-effects linear regression to analyze the impact of individual and institutional factors on gross hourly earnings across several Western European and Central European countries. The analysis used random effects for the intercept and the female indicator variable.

Key findings

The study found a substantial gender wage gap within each sector studied. In addition, the authors found that full-time employees in the female-dominated health sector experienced a wage penalty compared to employees in the manufacturing and finance sectors. When compared with local unions, findings showed that sectoral bargaining and strong unions are less favorable for female earnings.

Citation: Winder, K. L. (2009). Flexible scheduling and the gender wage gap. *The B. E. Journal of Economic Analysis & Policy, 9*(1), 26.

Data source: 2004 Workplace Employment Relations Survey.

Population studied: Approximately 2,500 firms matched to about 22,000 employees.

Country/Countries: United Kingdom.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X		X	X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X			X	X (dummy for working less than 30 hours/week).		Test scores (A-levels), caretaking responsibilities, job training, control over job, job stress, control over start and end time of job (flexibility).

Winder (2009) examined the extent to which work flexibility and wages vary by gender using an ordinary least squares regression.

Key findings: Overall, the author found that returns to work flexibility can explain nearly 10 percent of the wage gap between men and women and that men have more than twice the wage return to flexibility as women.

Firm- and Industry-Specific Employment Characteristics

Citation: Abendroth, A. K., Melzer, S., Kalev, A., & Tomaskovic-Devey, D. (2017). Women at work: Women's access to power and the gender earnings gap. *ILR Review, 70*(1), 190–222. doi: 10.1177/0019793916668530

Data sources: The first wave of a linked employer-employee panel in project B3 (LEEP-B3) data, German administrative Social Security records, German Federal Employment Agency, and worker surveys from each of the workplaces.

Population studied: 5,022 German workers from 94 organizations with more than 500 employees.

Country/Countries: Germany.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X		X (proportion of women in management positions)				Worker–supervisor dyads, supervisory responsibility, the formal hiring process, formal career planning, and written performance evaluations.

Using a multilevel fixed-effects regression model (to control for the nested nature of employees within organizations), Abendroth, Melzer, Kalev, and Tomaskovic-Devey (2017) examined the effect of gender on the log monthly gross earnings, controlling for organizational characteristics (access to power and earning inequality, the gender composition of supervisory and worker positions, the gender pay gap across job levels, and human resources practices and inequality), with the following equation:

$$\ln(earnings_{ij}) = \alpha_1 female_{ij} + \gamma_1 O_j * female_{ij} + \delta_1 Z_{ij} + u_i + \varepsilon_{ij}$$

Key findings: Abendroth et al. found that higher numbers of women in management positions decreases the gender pay gap for low-qualification jobs but not for high-qualification jobs; female wages were not positively impacted by having a female supervisor, although male wages were positively affected by having a male supervisor; and human resources practices and job-level qualifications can influence the relationship between gender power and gender earnings inequalities.

Citation: Albaek, K., Larsen, M., & Stage Thomsen, L. (2017). Segregation and gender wage gaps in the private and the public sectors: an analysis of Danish linked employer–employee data, 2002–2012. *Empirical Economics, 53*(2), 779–802.

Data source: Matched employer–employee data from Statistics Denmark, 2002–2012.

Population studied: Non-disabled workers aged 16 to 64 employed in firms with at least 10 employees.

Country/Countries: Denmark.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X	X				

Albaek, Larsen, and Stage Thomsen (2017) used linear regression and traditional wage decomposition methods to estimate the relationship between occupational gender segregation and gender pay gaps among Danish workers, where the outcome of interest is the log wage.

Key findings: The authors found a raw gender wage gap of 13.7 percent which was reduced by 3.2 percentage points after controlling for various human capital characteristics. However, the inclusion of additional control variables increases the gender wage gap. Furthermore, the authors showed that gender segregation accounted for 46 percent of the raw wage gap in the private sector and 63 percent in the public sector.

Citation: Amilon, A., Persson, I., & Rooth, D. O. (2013). Scientific (wo)manpower – gender and the composition and earnings of PhDs in Sweden. *International Journal of Manpower, 34*(6), 658–673.

Data source: Swedish cross-sectional register data.

Population studied: Individuals under age 68, residing in Sweden, who obtained a PhD between 1970 and 2004.

Country/Countries: Sweden.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other

Amilon, Persson, and Rooth (2013) estimated the gender pay gap of Swedish PhDs inside and outside of academia using ordinary least squares regressions, where the outcome of interest was the log of 2004 annual earnings.

Key findings: Overall, the authors found a gender gap in wages for PhDs inside and outside of academia, with the gap slightly larger within academia. Specifically, within academia, the largest gap was for humanists and natural scientists, while the gap was largest for social scientists and medical PhDs outside academia. The largest observed gap was 36.7 percent for PhDs in medicine working outside academia.

Citation: Anspal, S. (2015). Non-parametric decomposition and the choice of reference group: A study of the gender wage gap in 15 OECD countries. *International Journal of Manpower, 36*(8), 1266–1280. doi: 10.1108/IJM-03-2015-0047

Data source: OECD Program for the International Assessment of Adult Competencies collected between August 2011 and March 2012.

Population studied: Countries' sample sizes range from 1,504 observations in Italy to 3,519 in Estonia; includes only wage and salary workers, excludes respondents self-identified as entrepreneurs.

Country/Countries: Belgium (Flanders), Cyprus, Czech Republic, Estonia, Finland, France, Ireland, Italy, Japan, Korea, Norway, Poland, the Slovak Republic, Spain, the United Kingdom (England and Northern Ireland).

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X		X			

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X			X		Personal Characteristics: labor market status of partner (employed, unemployed, inactive); immigrant status. Job Characteristics: type of employment contract (fixed, indefinite, apprenticeship or training scheme, no contract, other); management supervision of other employees. Skills: level of the numeracy score (four levels: 225, 226–275, 276–325, 326 and over).

Using an algorithm based on matching, the wage gap is decomposed analogously to Oaxaca (1973). The research posits the decomposition method by Ñopo (2008) and accounts for the possibility that distributions of characteristics will not completely overlap among men and women. Therefore, the components are calculated based on subsamples in which there is common support in the distributions of men's and women's characteristics.

Key findings: The Ñopo decomposition can be considered analogous to parametric approaches of Cotton and Neumark (1988) and Oaxaca and Ransom (1994). The method, illustrated with data from 15 OECD countries, also demonstrated that there are widely varying asymmetries in unexplained gaps within countries, some of them significantly so. While not surprising, the extent of the asymmetry is highly influenced by the specifications used, thus confirming the relevance of this proposed method for empirical application.

Citation: Barón, J. D., & Cobb-Clark, D. A. (2010). Occupational segregation and the gender wage gap in private- and public-sector employment: A distributional analysis. *Economic Record*, *86*(273), 227–246. doi: 10.1111/j.1475-4932.2009.00600.x

Data sources: Repeated cross sections of the Household, Income and Labour Dynamics from 2001 to 2006.

Population studied: Australian private and public sector employees between 22–60 years old.

Country/Countries: Australia.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X			X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X		X	X	X	Employer tenure, occupation tenure, labor market experience.

The study utilized semiparametric methodology proposed by DiNardo, Fortin, and Lemieux (1996) to decompose the gender wage gap distribution.

Key findings: The study found that the gender wage gap among low-wage workers was explained by differences in wage-related characteristics, such as labor market position. However, the gender wage gap among high-wage workers was largely unexplained in both public and private sectors. This suggests that glass ceilings, rather than sticky floors, may be prevalent. The study concludes that disparity in educational qualifications and demographic characteristics explains little of the gender wage gap. Throughout the distribution, education had an insignificant effect on the gender wage gap. Demographic characteristics contributed significantly to the gender wage gap, although only in the top quarter of the distribution. These results indicate that the relative labor market position of low-wage workers, rather than wage-related characteristics of high-wage workers, largely explained the distribution of relative wages in the public sector.

Citation: Bartolucci, C. (2013). Gender wage gaps reconsidered: A structural approach using matched employer-employee data. *The Journal of Human Resources, 48*(4), 998–1034. doi: 10.3368/jhr.48.4.998

Data sources: German Labor Agency 1996–2006 dataset (called LIAB) and German Socio-Economic Panel (G-SOEP) 1996–2005 dataset.

Population studied: 5,760,110 workers from 15,174 West German firms in manufacturing, construction, trade, or services with 10 or more employees.

Country/Countries: West Germany.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X					Tenure (years), low qualification, high qualification.

Group-specific productivity for each firm was first estimated, relying on the production function estimation at the firm level and using LIAB. Then job-retention and job-locating rates were computed using the G-SOEP employee-level data. Lastly, the wage-setting parameters (i.e., bargaining power) were estimated using individual wage records in LIAB and transition parameters and productivity measures specific to each group.

Key findings: The study found that the unconditional gender pay gap is 42 percent; differences in productivity accounted for 65 percent of this gap; differences in destruction rate explained 9 percent; and segregation was responsible for 17 percent. The study found that women were 33 percent less productive than men in similar jobs; however, after controlling for differences in hours, this number was reduced to 17.5 percent. The contributing factors to this difference were that women were generally

more mobile than men in terms of job-to-job transitions, and they had higher job-destruction rates. Although they have large wage differentials, women had only slightly lower rent-splitting parameters than men in the construction sector. After accounting for differences in offer-arrival rates, the gap increased by 13 percent. Differences in the rent-splitting parameter generated 21 percent of the wage gap, which implies that female workers received wages 9 percent lower than their male counterparts.

Citation: Black, S. E., & Spitz-Oener, A. (2010). Explaining women's success: Technological change and the skill content of women's work. *The Review of Economics and Statistics, 92*(1), 187–194. doi: 10.1162/rest.2009.11761

Data sources: Qualification and Career Survey – an employee survey from the German Federal Institute for Vocational Training and the Research Institute of the Federal Employment Service, 1979 and 1999 matched to a 2 percent representative sample of the Administrative Social Security Records in Germany (also known as the "IAB employment sample"), covering years 1975–2001.

Population studied: About 30,000 survey participants aged 25–55 years, living in West Germany, working at least 38 hours per week (but not required to work year-round).

Country/Countries: West Germany.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X					

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X			X		Six assignments of activities: nonroutine analytic, nonroutine interactive, routine cognitive, routine manual, nonroutine manual, PC use.

Black and Spitz-Oener (2010) were interested in examining the role of demand-side explanations (i.e., relative change in demand for certain skills) in the closing of the gender pay gap. The authors estimated wage regressions and utilized decomposition methods to examine job task changes with respect to technological advancements. The wage analysis was restricted to employees with low (those individuals with no occupational training) and medium (those individuals with a vocational qualification who might have either completed an apprenticeship or graduated from a vocational college) levels of education.

Key findings: Findings suggest that relative task changes attributed to technological progress are an important factor in explaining the closing (or narrowing) of the gender wage gap. In particular, Black and Spitz-Oener found that women typically have experienced a large relative increase in nonroutine interactive and analytic tasks. Black and Spitz-Oener found a significant decline in routine tasks performed by women compared to men.

Citation: Braakmann, N. (2010). Fields of training, plant characteristics and the gender wage gap in entry wages among skilled workers: Evidence from German administrative data. *Jahrbucher Fur Nationalokonomie Und Statistik*, *230*(1), 27–41.

Data sources: Employment panel data comprising Social Security records from the German Employment Agency, from 1998 through 2003.

Population studied: 15,994 men and 15,189 women who completed vocational training between 1998 and 2003 (sample included 75–80 percent of the German workforce).

Country/Countries: Germany.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X					X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X	X		X	X	Occupation sites (training and current), work force structure (crosstabs of blue/white collar and skilled/unskilled), occupation site concentration of German nationals.

Braakmann (2010) used Oaxaca-Blinder decompositions weighted by gender coefficients and ordinary least squares regression.

Key findings: The study found that between 81 and 92 percent of the differences found in starting wages were explained by occupational field and training plant characteristics. Additionally, characteristics of the respondent's current employer, specifically the concentration of females, influenced entry-level pay differences between men and women. Findings suggest that men and women not only choose different training occupations but also work in extremely different plants.

Citation: Bredtmann, J., & Otten, S. (2014). Getting what (employers think) you're worth: Evidence on the gender gap in entry wages among university graduates. *International Journal of Manpower, 35*(3), 291–305. doi: 10.1108/IJM-01-2012-0013

Data sources: Quantitative data on business and economics graduates from Ruhr University Bochum in Germany.

Population studied: 576 business and economics graduates; 408 were men, and 168 were women.

Country/Countries: Germany.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X					

Bredtmann and Otten (2014) used a mincer-type wage regression to analyze the log of annual real gross income in the first job upon labor market entry. By focusing analysis on a homogeneous group of entrants into the German labor market, this study expands on existing literature on this topic by applying Oaxaca-Blinder decompositions that separate the gender wage gap into an explained portion and an unexplained portion.

Key findings: This research finds that, even for a homogenous group of graduates in similar fields of study, women's entry earnings are almost 7 percent lower than those of their male counterparts. The resulting unexplained gender pay differential ranged between 6.3 percent and 7.3 percent. Because this paper concentrates its analysis on a highly homogeneous group, there are limited unobserved factors. Therefore, the study concludes that the results strongly indicate the presence of gender discrimination among high-skilled workers in the German labor market.

Citation: Bunel, M., & Guironnet, J. P. (2017). Income inequalities for recently graduated French workers: A multilevel modeling approach. *Empirical Economics, 53*(2), 755–778. doi: 10.1007/s00181-016-1130-4

Data sources: Individual-level data were obtained from Generation 2004 survey (conducted by the Centre for Studies and Research on Qualifications in 2007), a nationally representative sample of young graduates that collects data from education to work transition and integration into the workforce; aggregate occupation data were obtained from DADS (Déclarations Annuelles de Données Sociales—Annual Declarations of Social Data) from 2007; and spatial data were obtained from the 2006 census collected by the French Office of Statistics.

Population studied: 9,805 French adults who graduated college in 2004, who held a bachelor's degree, and who were working full-time, representing a weighted population of 224,521 private-sector workers. Individuals included those who obtained a graduate degree and trained in a health facility or at a hospital. Lastly, individuals who did not give their facility of education/training or their location of work and those who work as civil servants were excluded from the study.

Country/Countries: France.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	**X**	**X**	**X**		**X**		**X**

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	**X**	**X**		**X**		Working time intensive dummy.

This study is estimated using a nested model of individuals in occupational groups (OG) or employment areas (EA). The multilevel model uses the Heckman two-step procedure to account for the employment selection process. In the first step, the probability of an individual working full-time is estimated using a probit model. The second step estimates the two-level nested model.

Key findings: Bunel and Guironnet (2017) reported results in three areas: between-group and within-group effects on earnings, gender gap decomposition, and employment area nests. OGs explained around 40 percent of overall wage heterogeneity, while EA captured less than 10 percent. In OGs dominated by seniors and men, women faced a higher wage penalty.

Citation: Card, D., Cardoso, A. R., & Kline, P. (2015). Bargaining, sorting, and the gender wage gap: Quantifying the impact of firms on the relative pay of women. *The Quarterly Journal of Economics*, 131(2), 633–686.

Data source: Quadros de Pessoal between 2002 and 2009; Sistema de Analisis de Balances Ibericos database.

Population studied: 2.1 million male and 1.7 million female Portuguese employees.

Country/Countries: Portugal.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X					X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X					Year of firm creation; shareholder capital; annual sales.

Card, Cardoso, and Kline (2015) analyzed the impact of bargaining (i.e., salary negotiations) and sorting (i.e., employment in higher paid jobs) on the gender wage gap. The authors employ a rent-sharing model and use an Oaxaca-Blinder decomposition to separate the impacts of bargaining and sorting on the gender wage gap.

Key findings: Findings indicated that at more profitable firms, female employees receive about 90 percent of the wage premiums that men receive. Women are also disproportionately likely to work at less productive firms that pay lower premiums to both men and women. The study concluded that 20 percent of Portugal's gender wage gap is explained by sorting and bargaining channels. Sorting accounts for approximately two-thirds of this 20 percent, and women's shortfall in relative bargaining power accounts for the other third.

Citation: Chatterji, M., Mumford, K., & Smith, P. N. (2011). The public–private sector gender wage differential in Britain: Evidence from matched employee-workplace data. *Applied Economics, 43*(26), 3819–3833. doi: 10.1080/00036841003724452

Data sources: British Workplace Employee Relations Survey 2004, a nationally representative sample of workplaces and employees.

Population studied: 10,600 full-time employees (2,903 public-sector and 7,697 private-sector employees).

Country/Countries: United Kingdom.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X	X	X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X		X	X (dummy)	X	Other workplace and performance characteristics.

Chatterji, Mumford, and Smith (2011) estimated separate log average hourly wage equations for four groups of employees—public-sector males, public-sector females, private-sector males, and private-sector females—and subsequently examined several earnings gaps based on the decomposition method used by Oaxaca and Ransom (1994).

Key findings: The study found that the gender earnings gap is three times larger in the private sector than it is in the public sector. The public–private earnings gap for males is less than half of the public–private earnings gap for females. While much of the public–private earnings gap for males can be explained by observable characteristics, a substantial proportion of this gap remains unexplained for females.

Citation: Duong, L. & Evans, J. (2016). Gender differences in compensation and earning management: Evidence from Australian CFOs. *Pacific-Basin Finance Journal*, 40(PA), 17–35. doi: 10.1016/j.pacfin.2016.07.004

Data source: Australian Securities Exchange between 2006 and 2010; S&P Capital IQ database; Aspect FinAnalysis database.

Population studied: 556 firm-year observations.

Country/Countries: Australia.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X					

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
		X				Female CFO; CFO on the board; percentage of company shares owned by CFO; CFO tenure; board size; percentage of executive directors on the board; gross sales figure after credit and returns in prior year; firm financial leverage; market value of equity/book value of equity ratio; return on assets; stock returns.

Duong used Tobit and ordinary least squares regression models to analyze the extent to which the gender of the chief financial officer (CFO) impacts CFO compensation and earnings management.

Key findings

The study found a significant gender pay disparity in CFO compensation: Female CFOs are paid less than half of the average total compensation of male CFOs. The average total compensation of female CFOs is $566,428, while the average total compensation for male CFOs is $1.2 million. Female CFOs receive significantly less than male CFOs in all types of compensation from 2006–2010. In terms of salary, female CFOs, on average, earn about 34 percent less than male CFOs.

The presence of female directors on the company board or compensation committee does not reduce the gap. However, the gender pay gap disappears when the authors replicate the analysis with a matched sample using a propensity score matching method.

Citation: Figueiredo, H., Rocha, V., Biscaia, R., & Teixeira, P. (2015). Gender pay gaps and the restructuring of graduate labour markets in Southern Europe. *Cambridge Journal of Economics*, *39*(2), 565–598. doi: 10.1093/cje/bev008

Data source: REFLEX survey 1999–2000; European Labour Force Survey 2001–2007.

Population studied: 3,203 young university graduates.

Country/Countries: Portugal, Spain, and Italy.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X		X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X						Country; parents' highest education; degree subject area; higher than average grade; fixed-term or long-term contract; tenure; education and skill mismatches in current job and first job (over-educated, under-educated, over-skilled, under-skilled); type of current job and first job; previous unemployment experience.

Figueiredo, Rocha, Biscaia, and Teixiera (2015) examined the extent to which gender patterns in labor market integration, particularly the emergence of new graduate jobs and their relative degrees of feminization, explain the gender pay gap. To capture the restructuring of the graduate labor market, the authors first applied hierarchical cluster analysis to construct a typology of jobs based on graduate skill intensity, ratio of younger to older workers, and presence of female workers. Using a within-group clustering method, they identified three distinct clusters of occupations in each country. This method allowed them to isolate jobs with significant intergenerational differences in skill level needed and jobs for which women are the minority. They then used this typology of graduate labor market restructuring, along with other demand-side factors, to examine the gender pay gap with ordinary least squares regressions and Oaxaca-Blinder decomposition.

Key findings

The study found that while more graduates overall have moved away from traditional jobs requiring a degree, young females are much more likely than young males to be over-educated for their jobs. The transition process into employment led to greater gender segregation in labor markets that require a degree, with women who occupy new types of jobs requiring a degree mainly moving to jobs that are already female-dominated. The study found that field of study, type of occupation, level of gender segregation in the occupation, and the match of qualifications and skills to the job all contribute to the gender pay gap. In addition to these individual and labor market integration variables, firm-level characteristics such as firm size and ownership help explain gender pay gap.

Citation: Flabbi, L., Macis, M., Moro, A., & Schivardi, F. (2016). *Do female executives make a difference? The impact of female leadership on gender gaps and firm performance.* National Bureau of Economic Research Working Paper 22877.

Data sources: The Bank of Italy's annual survey of manufacturing firms (INVIND), the National Social Security Institute's data on work histories of all employees ever employed at an INVIND firm from 1980–1997, and Company Accounts Data Service that includes balance sheet information for a sample of 40,000 firms between 1982–1997, including almost all INVIND firms.

Population studied: Workers age 15 years and older who worked more than 4 weeks in a given year.

Country/Countries: Italy.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X		X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X		X			X	Dummy variable for the presence of a female CEO.

Flabbi, Macis, Moro, and Schivardi (2016) examined the impact of female executives on a broad range of firm-specific outcomes, including wage distribution by gender. The authors estimated a fixed-effects regression of the relationship between the presence of a female CEO and wages at various quantiles of the wage distribution, controlling for firm characteristics, workforce characteristics, and worker fixed effects.

Key findings: Flabbi et al. found that female leadership increased the variance of women's wages due to an increase in women's earnings at the top of the wage distribution and a reduction in women's earnings at the bottom of the wage distribution. Specifically, in firms with female CEOs, the standard deviation of the women's wages was nearly 50 percent larger than in firms with male CEOs. In addition, results indicated that the effect of female CEOs was a 10 percentage point increase in wages for women in the top 25 percent of the female wage distribution; for women in the bottom 25 percent of the wage distribution, the effect of a female CEO is a reduction in wages of around 3 percentage points. The impact of female CEOs on the male wage distribution had opposite signs.

Citation: Geiler, P., & Renneboog, L. (2015). Are female top managers really paid less? *Journal of Corporate Finance, 25*, 345–369. doi: 10.1016/j.jcorpfin.2015.08.010

Data source: Manifest database, BoardEx database, and Datastream.

Population studied: Virtually all listed United Kingdom firms, 1997–2007. Sample = 35,307 director years (executives excluding CEOs); sample = 15,167 (all CEOs only).

Country/Countries: United Kingdom.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X				X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X		X			X	Female presence, positions, remuneration, director characteristics, governance, performance, ownership, firm characteristics, private characteristics.

Geiler and Renneboog (2015) examined the gender pay disparities of various compensation types of female executives in the United Kingdom.

Key findings: Female executives appeared strongly discriminated against, as they earned about £269k less per year. Given the average tenure of U.K. executive directors is about 5 years, female directors were paid £1.3 million less than male directors over this period. The study remarkably found this gender-based discrimination was largely limited to executive directors but not to CEOs, for whom total compensation and pay components did not significantly differ. This suggests that gender equality in terms of pay at the CEO level has been nearly achieved, but that female executive directors at the sub-top level (but still at board level) continue to face discrimination. In terms of the contract structure with focus on short- or long-term pay, little difference existed between contracts of male and female CEOs and other executive directors. The analysis of the question of whether the presence of female non-executive directors reduces the gender-based pay gap shows this was indeed the case. In industries with high concentrations of male executives, the gender wage gap was not greater, which contradicted the idea that women are less appreciated in a dominantly male environment, as suggested by Allen and Sanders (2002). For a small subsample, the authors found a pay gap for married non-CEO managers and that the pay gap between male and female managers who have children was larger. Neither the number of children nor marital status closed the observed gender pay gap for top executive directors, excluding the CEO.

Citation: Hensvik, L. E. (2014). Manager impartiality worker-firm matching and the gender wage gap. *ILR Review, 67*(2), 395–421. doi: 10.1177/001979391406700205

Data sources: Annual samples from administrative registers of Statistics Sweden from 1996–2008.

Population studied: 1.5 million workers and 28,000 unique Swedish establishments.

Country/Countries: Sweden.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X		X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
		X			X	

Hensvik (2014) used establishment fixed-effects models to correlate unobserved factors and manager gender. Following this, Hensvik followed workers over time and across managers to examine variation. Lastly, the study derived a predetermined measure of unobserved worker productivity in order to directly assess the increased representation of female managers on the gender and skill composition of new workers.

Key findings: This study investigated whether female managers in a firm impacted the gender wage gap. Hensvik found that the gender wage gap of nonmanagerial workers decreased by 3 percentage points during the study period, while the proportion of female managers increased by more than 10 percentage points.

This study also found a negative association between the proportion of female managers and within establishment's gender wage gap, both economically and statistically relevant. After researchers controlled for gender-related productivity differences, the relationship between female managers and gender wage gap became insignificant. This finding implies that there was a positive sorting of workers to establishments with same-gender managers. The study also implies that female hires had relatively higher skill levels than male hires under female management.

Citation: Hedija, V. (2017). Sector-specific gender pay gap: Evidence from the European Union countries. *Economic Research-Ekonomska Istrazivanja, 30*(1), 1804–1819. doi: 10.1080/1331677X.2017.1392886

Data sources: European Union Statistics on Income and Living Conditions data from 2012 and covers for 24 member-states of the European Union.

Population studied: Employees in the reference period who worked all 12 months in a full-time job (excluding self-employed), had no other employment, and earned an income.

Country/Countries: European Union member countries.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X					

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X	X		X	X	Health, partnership, sector, company size, contract, managerial position, and gross hourly wage.

Hedija (2017) used the following variables to analyze employees: age, level of education, sickness, partnership, occupation, sector, company size, contract, managerial position, and hourly gross wage. Hedija used a regression model with the sector-specific unexplained gender pay gap component as a dependent variable. Then, to determine the unexplained part of the gender pay gap, Hedija estimated the average treatment effect on the treated (ATT), which represents the component of the raw gender pay gap unexplained by known gender differences that could be the result of wage discrimination against women. The ATT is the average benefit resulting from being treated—or the mean effect for women in the form of a lower wage that results from the individual being a woman.

Key findings: Findings indicate that within the individual sectors of surveyed countries and among the individual countries, the raw gender pay gap varies. The predominant company size and proportion of female managers were not found to be statistically significant factors in explaining this variability. Factoring in only statistically significant estimates of the ATT, the average unexplained gender pay gap

for the individual sector ranges from -0.16 in public administration and defense to -0.33 in construction, agriculture, forestry, and fishing; however, there are significant differences among individual countries. The largest variability across countries was in the financial and insurance sectors (with a coefficient variation of approximately 98 percent), while smaller variations were found in real estate, professional, scientific and technical, administrative, and support service activities. The highest levels of sector-specific variation were found in Greece, and the lowest levels were found in Slovenia.

Citation: Heyman, F., Svaleryd, H., & Vlachos, J. (2013). Competition, takeovers, and gender discrimination. *ILR Review, 66*(2), 409–432. doi: 10.1177/001979391306600205

Data sources: Register-based datasets from Statistics Sweden (1990–2002); Regional Labor Market Statistics (1990–2002); and individual wage statistics database (1990–2002).

Population studied: Manufacturing firms with at least 20 employees and nonmanufacturing firms with at least 50 employees.

Country/Countries: Sweden.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X	X				

Heyman, Svaleryd, and Vlachos (2013) used a difference-in-difference framework (in which the firms without changes in ownership during the same time period served as the control group) to measure product market competition. More specifically, they used an individual-level regression to examine how the change in ownership of manufacturing firms (or "takeover") and product market competition impact the gender wage gap:

$$\ln(wage)_{ijt} = b_1 acquisition_{jt} \times wom_i + b_2 competition_{jt} \times wom_i + b_3\ acquisition_{jt} + b_4\ competition_{jt} + \mathrm{X}_{jt}'b + \mathrm{Z}_{it}'b + \mu_{ij} + \mu_t + \varepsilon_{ijt}$$

The outcome is the log of the full-time equivalent monthly wage for each individual, employed by firm *j,* at the time period *t*. In addition, the model also controls for time-varying firm-level factors and time-varying individual-level factors, includes a dummy variable *wom* as the independent variable representing gender, and includes a series of interaction terms.

Key findings: This study found that takeovers and product market competition positively impacted the relative position of Swedish female employees. Heyman et al. found an unexplained gender pay differential of 12 percent. When the product market competition was weak, a takeover resulted in a 1.3 percent increase in the share of female employees. Women with medium levels of education were more

likely to experience this effect. Heyman et al. found no effects on the share of managers and CEOs. Firms active in markets with medium to strong market competition did not face any gender composition changes as a result of a takeover. Heyman et al. also found that a takeover reduced the within-firm gender wage gap by 7.5 percent and reduced the gender differences in rent sharing.

Citation: Hirsch, B., König, M., & Moller, J. (2013). Is there a gap in the gap? Regional differences in the gender pay gap. *Scottish Journal of Political Economy, 60*(4), 412–439. doi: 10.1111/sjpe.12017

Data sources: The German Federal Employment Agency's Regional File of the IAB Employment Samples 1975–2004.

Population studied: Individuals aged 25–34 years in Western Germany who were employed full-time on June 30 of each year, excluding home workers, trainees, individuals with periods of minor employment, and high-skilled workers (workers with both a higher education and a completed vocational training or workers with some type of university education).

Country/Countries: Western Germany.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X				X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X				X	Urban/rural area, job title, regional unemployment rate.

The authors first ran descriptive statistics, then used a semiparametric propensity score matching approach, using nearest-neighbor matching without replacement and kernel matching as the most and least restrictive methods. The authors used matching methods to create a "synthetic" male comparison observation for each female observation and to estimate the unexplained gender pay gap in rural and urban areas.

Key findings: The study found a narrower unexplained gender pay gap in young workers in large, metropolitan areas than in smaller rural areas. While the unexplained gender pay gap in both region types decreased over time, there was a "gap in the gap" of about 10 percentage points that remained constant throughout the 30-year observation period. The findings show that more densely populated labor markets were more competitive, which restricted employers' ability to discriminate against women. The authors suggest that the gender differences in mobility due to differences in domestic responsibilities have decreased over time, which caused the overall decrease in the gender pay gap. However, gender differences in mobility decreased less in rural areas, further contributing to the "gap in the gap."

Citation: Hopp, C., & Martin, J. (2017). Does entrepreneurship pay for women and immigrants? A 30 year assessment of the socio-economic impact of entrepreneurial activity in Germany. *Entrepreneurship and Regional Development, 29*(5-6), 517–543. doi: 10.1080/08985626.2017.1299224

Data sources: German Socio-Economic Panel, 1984–2012.

Population studied: 2,634 German self-employed or full-time (who are not apprentices or trainees and who do not work in the agricultural sector) workers.

Country/Countries: Germany.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X	X		X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X			X		Self-employment versus wage employment, migrant, satisfaction with health, unemployment experience (in years), weekly hours worked, father self-employed, mother self-employed.

Hopp and Martin (2017) estimated ordinary least squares (OLS) regressions and used the coefficients from the OLS regressions to provide the basis for Oaxaca-Blinder decomposition, which allowed them to differentiate the overall earnings differential between the self-employed and the wage-employed into an "endowment effect" and a "treatment effect" and which allowed them to compare these effects between genders. The "endowment effect" represented the characteristics that positively affect an individual's earnings whether that person was self-employed or wage-employed—those with higher endowment effects were more able or willing to enter self-employment. The "treatment effect" represented the income effect solely due to the individual's decision to become self-employed.

Key findings: Hopp and Martin found that women had a lower endowment effect and a lower treatment effect than men. In terms of the endowment effect, self-employed males earned 16 percentage points more than wage-employed males even if they were wage-employed. The effect only accounted for 12 percentage points in females. The positive-yet-lower endowment effect showed that entrepreneurship alleviated some of the disadvantages in wage-employment, yet female entrepreneurs still earned less than male entrepreneurs. Hopp and Martin found that while entrepreneurial wage-employed males who became self-employed males earned about 4 percentage points more, entrepreneurial females who become self-employed earned about 9 percentage points less than wage-employed females. In addition, females were less likely to become self-employed and earned less in both self- and wage-employment compared to males.

Citation: Jellal, M., Nordman, C. J., & Wolff, F. C. (2008). Evidence on the glass ceiling effect in France using matched worker-firm data. *Applied Economics, 40*(24), 3233–3250. doi: 10.1080/00036840600994070

Data sources: Enquêtessur le Coût de la Main-d'Oeuvre et la Structure des Salaires en 1992 survey (conducted by the National Institute of Statistics and Economic Studies) data on labor cost and wage structure, a unique French employee–employer matched survey.

Population studied: 150,000 employees and 16,000 firms.

Country/Countries: France.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X		X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
					X	Nationality; executive status; number of hours paid work per year; type of contract; workplace in Paris or not.

Jellal, Nordman, and Wolff (2008) first determined the extent to which returns to exogenous factors differ between men and women. Then, the researchers followed Machado and Mata's (2005) method by performing a quantile decomposition of the gender wage gap. They decomposed the difference between male and female log earnings distributions into two components: differences in labor market characteristics between male and female employees and differences in rewards that both men and women received for their observable characteristics.

Key findings: Findings indicated that the gender wage gap at the top of the wage distribution (i.e., those individuals who receive larger compensation) decreased after accounting for firm-related characteristics; however, the wage gap remained much larger above the 75th percentile of the distribution. Furthermore, a quantile decomposition showed that this gender pay disparity was mainly due to differences in the returns to observed characteristics rather than the differences in unobserved characteristics between men and women.

Citation: Jones, M., Makepeace, G., & Wass, V. (2018). The UK gender pay gap 1997–2015: What is the role of the public sector? *Industrial Relation*s, *57*(2), 296–319. doi: 10.1111/irel.12208

Data sources: U.K.'s Labour Force Survey (LFS), 1997–2015.

Population studied: Working-age employees in the first or fifth waves of the survey whose information is not provided by a proxy interview.

Country/Countries: United Kingdom.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X		X	X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X			X	X	Temporary contracts, tenure, management responsibility.

Jones, Makepeace, and Wass (2018) first used ordinary least squares regression to estimate the unadjusted gender pay gap for the entire economy and by sector. Then, the authors conducted Oaxaca-Blinder decomposition to identify the explained gender pay gap and the unexplained contribution of the gender pay gap. The authors extended their decomposition to include a modified version of the Brown, Moon, and Zoloth (1980) approach to distinguish the contribution of within-sector gender pay gaps from the contribution of sector employment composition in determining the overall gender pay gap.

Key findings: The study compared the gender pay gap between sectors and identified the contribution of the concentration of women in the public sector to the overall pay gap. The study found lower raw and unexplained gender pay gaps in the public sector. Characteristics and differences in treatment of men and women in the public and private sectors explained roughly equal proportions of the overall gender pay gap in both the public and private sectors and accounted for a lower absolute pay gap in the public sector. The concentration of women in the public sector was largely unexplained and had a limited effect on the overall gender wage gap. In addition, further analysis showed long-term narrowing of the gender wage gap, stopping in 2010 both within and across sectors.

Citation: Karamessini, M., & Ioakimoglou, E. (2007). Wage determination and the gender pay gap: A feminist political economy analysis and decomposition. *Feminist Economics*, *13*(1), 31–66. doi: 10.1080/13545700601075088

Data sources: European Structure of Earnings, conducted in Greece by the National Statistical Service, including one dataset from the industrial sector and one dataset from the service sector.

Population studied: 30,789 employees from 1,980 establishments in the industrial sector; 22,186 employees from 1,605 firms in the service sector.

Country/Countries: Greece.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X			

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X			X (dummy variable)	X	Shift work, overtime, supervisory tasks, nationality, public/private ownership of firm, duration of contract, average characteristic values (for each variable) for males and females.

Karamessini and Ioakimoglou (2007) used two equations to develop and test their own decomposition method. The first equation averaged occupational wages in different industries, and the second measured individual wages' deviations from average occupational wages across industries. They estimated these equations through ordinary least squares regression and decomposition. In addition, Karamessini and Ioakimoglou compared the results of their own method with the Oaxaca-Blinder decomposition method and to the Brown, Moon, and Zoloth (1980) method.

Key findings: According to the novel two-equation decomposition method, Karamessini and Ioakimoglou found the explained portion of the gender pay gap was best determined by the gender segregation of employment by occupation and industry, followed by accumulated work experience. By using the Oaxaca-Blinder method, Karamessini and Ioakimoglou found that accumulated work experience was the main determinant of gender pay differences, and gender segregation of employment accounted for fewer differences. The study findings imply that structural determinants of gender wage discrimination, such as employment segregation by gender and gender differences in work experience, contributed to the gender pay gap much more than employers' overt pay discrimination against women.

Citation: Lindley, J. K. (2016). Lousy pay with lousy conditions: The role of occupational desegregation in explaining the UK gender pay and work intensity gaps. *Oxford Economic Papers, 68*(1), 152–173. doi 10.1093/oep/gpv056

Data source: Skills Employment Survey, 1987 to 2012.

Population studied: 4,181 full-time workers aged 20 to 60.

Country/Countries: United Kingdom.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X						

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X						National Vocational Qualification, skill use, work more than 48 hours per week, job requires working very hard, job requires working at high speed or to tight deadlines more than three quarters of the time.

Lindley (2016) examined how gender differences in work intensity and job quality are related to the gender pay gap. The authors used ordinary least squares regressions of Mincerian wage equations to estimate gender differentials in log hourly wages.

Key findings: The authors found that the pay gap fell from 14.8 percent in 1997 to 7.5 percent in 2012. In addition, while working long hours does not result in higher pay for laborers in the United Kingdom, working to tight deadlines is associated with higher pay. Overall, women report higher levels of factors

that may be associated with poor job quality and lower pay, which may be factors that impact the gender pay gap.

Citation: Murphy, E. & Oesch, D. (2016). The Feminization of Occupations and Change in Wages: A Panel Analysis of Britain, Germany, and Switzerland. *Social Forces*, 94(3) 1221–1255. doi: 10.1093/sf/sov099

Data source: British Household Panel Survey 1991–2009, the German Socio-Economic Panel 1991–2010, and the Swiss Household Panel 1999–2011.

Population studied: Employees who work 15 hours or more per week who are not self-employed, not in the armed forces, not in full-time education, and not employed by the government with no missing values on relevant covariates (4,700 British women and 4,808 British men; 7,235 German women and 8,812 German men; 2,147 Swiss women and 2,427 Swiss men).

Country/Countries: Britain, Germany, and Switzerland.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X		X	X			Job training (occupation mean); individuals' received job training (past 12 months); job tenure; hours of housework (per week); hours of overtime (per week).

Murphy and Oesch aim to analyze the impact of occupational feminization on monthly earnings of men and women. They run descriptive statistics and estimate several ordinary least squares wage regressions for women and men from Britain, Germany, and Switzerland, including individual fixed effects.

Key findings

After accounting for firm characteristics, human capital, and job-specific skills, the study found that occupational feminization has a negligible effect on the wages of German men, German women, and Swiss men but has a substantial effect on the wages of Swiss women, British men, and British women. British workers in entirely female occupations receive 10 percent lower wages than those in entirely male occupations, holding everything else equal. This applies to not only women with children but childless women and men as well. Findings also showed that differences in union membership and coverage do not explain the lower wages in female-dominated occupations. Authors concluded that these wage differences between male and female occupations reflect social norms that accord higher value to male work effort.

Citation: Schulze, U. (2015). The gender wage gap among PhDs in the UK. *Cambridge Journal of Economics, 39*(2), 599–629. DOI:10.1093/cje/bev001

Data source: The Destination of Leavers from Higher Education survey from the Higher Education Statistics Agency, 2004–2005.

Population studied: 1,391 doctoral degree graduates from 2004 and 2005 who were employed full-time 6 months and 42 months after graduation.

Country/Countries: United Kingdom.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X						

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
					X	Education field; job in academia or outside academia; research or non-research job; university rank; PhD background (length of study, fulltime, funded); same job 6 months after graduation; career break in last 3 years; number of jobs since graduation; regional mobility; promotion.

Schulze (2015) estimated the gender wage gap among PhD graduates in the United Kingdom using ordinary least squares and quantile regression.

Key findings: The author found that the gender wage gaps were 5.2 log points and 18.8 log points inside and outside of academia, respectively. The mean wages for female PhD graduates were nearly £5,000 lower than those for men, and this discrepancy appeared to be almost entirely driven by the gap outside academia.

Citation: Magnusson, C. (2010). Why is there a gender wage gap according to occupational prestige? An analysis of the gender wage gap by occupational prestige and family obligations in Sweden. *Acta Sociologica, 53*(2), 99–117. doi: 10.1177/0001699310365627

Data source: Individual-level data from the Swedish Level-of-Living Survey (Levnadsniva underso¨kningen), 1991 and 2000.

Population studied: First pooled sample consists of 5,487 employees between the ages of 19 and 65; second sample restricted to 1,714 married/cohabiting respondents with children.

Country/Countries: Sweden.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Prestige score, public sector, business travel, working overtime, unpaid overtime work, management, number of subordinates.

Magnusson (2010) used ordinary least squares to examine the gender disparity in returns to occupational prestige and how this disparity differs among singles, married/cohabiting couples, and married/cohabiting couples with children. The author then conducted additional analyses controlling for variables that could affect the relationships between wages, gender, and prestige.

Key findings

The author found that the gender wage gap for the same occupational prestige is wider for married/cohabiting respondents than it is for single respondents. This gap is also wider for married/cohabiting respondents with children than for married/cohabiting respondents without children. The gender wage gap in return to occupational prestige is only significant among married/cohabiting respondents with children. The interaction effect between gender and prestige decreased or became insignificant for married/cohabiting respondents with children when controlling for time-consuming work, which supports the idea that married/cohabiting mothers are more likely than fathers to have jobs with work characteristics that are hard to balance with family responsibilities.

Citation: Oostendorp, R. (2009). Globalization and the gender wage gap. *The World Bank Economic Review, 23*(1), 141–161. doi: 10.1093/wber/lhn022

Data source: International Labour Organization October Inquiry, 1983–1999.

Population studied: Men and women across 161 occupations and 83 countries.

Country/Countries: 83 countries.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X							

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X						GDP, FDI, aggregate trade, communist country, year.

Oostendorp (2009) focused on the within-occupation gender gap in the context of globalization. Given that trade may have different impacts on the gender gap depending on the income level of the country,

he estimated separate regression models for low and lower middle income countries and high and higher middle income countries.

Key findings

Findings showed that in richer countries, the occupational gender wage gap tends to decrease as economic development increases. The occupational gender wage gap also tends to decrease with trade and FDI in richer countries. However, the study found little evidence that trade and FDI have any impact on the occupational gender wage gap in poorer countries. Therefore, evidence that trade and FDI narrow the occupational gender wage gap seems to primarily apply to richer countries.

Citation: Russo, G., & Hassink, W. (2012). Multiple glass ceilings. *Industrial Relations, 51*(4), 892–915. doi: 10.1111/j.1468-232X.2012.00705.x

Data source: The Dutch Ministry of Social Affairs and Employment (Vanema and Faas, 1999), which constructs an employer–employee matched dataset compiled from administrative records of a broad sample of firms from all economic sectors.

Population studied: 77,707 workers, of whom 52,402 are men and 25,305 women (67.5 percent and 32.5 percent, respectively).

Country/Countries: The Netherlands.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X		X		X	Foreign worker; level of job complexity; collective bargaining at industry and firm levels; union; hourly base wage, hourly full wage, overtime.

Russo and Hassink (2012) estimated the log of the hourly based wage by first using a generalized form of the Oaxaca-Blinder decomposition to decompose the wage within and between job-level components. Subsequently, they applied a quantile decomposition technique to the intra-job-level wage distribution to investigate whether the behavior of the gender wage gap across the within-job-level wage distribution is consistent with the presence of a glass ceiling. Finally, they characterized the type of glass ceiling model by examining the incidence of women in the highest and lowest deciles of the within-job-level wage distribution.

Key findings: The authors found the presence of multiple glass ceilings, one for each job level. More specifically, at higher job levels, the unexplained gender wage gap (which accounts for 47 percent of the gender wage gap) widens across the deciles of the intra-job-level wage distribution.

Citation: Scicchitano, S. (2012). The male-female pay gap across the managerial workforce in the United Kingdom: a semi-parametric decomposition approach. *Applied Economics Letters*, *19*(13), 1293–1297. doi: 10.1080/13504851.2011.619488

Data source: European Union Statistics on Income and Living Conditions 2007.

Population studied: 2,413 British individuals (1,079 female and 1,334 male) aged 25–65 who have managerial tasks, excluding students, military, and self-employed.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X					

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X			X (dummy)		Urban; Household type; Citizenship; Consensual union; Limitation due to health; Permanent

Scicchitano (2012) used a semi-parametric decomposition approach and quantile regression to investigate the gender pay gap in Great Britain and determine whether the gap is the result of gender differences in labor market characteristics or gender differences in rewards for those characteristics. The author also developed a revenue generation index from the unexplained gender differentials in pay relative to productivity characteristics, focusing on the nursing sector. Scicchitano juxtaposed nursing sector gender pay differentials to those among the teaching sector using regression analysis in order to counterfactually indicate how much the nursing gender pay differential would shift if female nurses were rewarded for their productivity characteristics on the same level as their counterpart male nurses.

Key findings: The study found that women face a significant pay gap across the entire wage distribution, even after controlling for a wide variety of individual and employment characteristics. The counterfactual analysis indicated significant sticky floor and glass ceiling effects.

Citation: Scicchitano, S. (2014). The gender wage gap among Spanish managers. *International Journal of Manpower, 35*(3), 327–344. doi: 10.1108/IJM-05-2012-0075

Data sources: The 2007 version of the European Union Statistics on Income and Living Conditions database.

Population studied: Spanish individuals 25–65 years of age in managerial positions.

Country/Countries: Spain.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X		X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
			X	X (dummy variable)	X	Household type, citizenship, limitation of activity due to health problems, permanent or temporary contract employment (dummy variable).

Scicchitano (2014) utilized ordinary least squares and a quantile regression to decompose the gender wage gap into one component based on differences in personal characteristics. One component is based on differences in coefficients across the wage distribution. The outcome of interest was a logarithm of hourly gross wage.

Key findings: Scicchitano found a significant gender wage gap across the entire wage distribution (i.e., across all wage quantiles examined), even after controlling for many other factors. Interestingly, when examining the wage quantiles at the highest end of the wage distribution, Scicchitano found that the control variables (e.g., the personal characteristics) included in the model contributed little in explaining the wage gap detected between men and women. This indicates that men and women managers at the highest quantiles of the wage distribution possess essentially the same characteristics; however, women are still earning less.

Citation: Terjesen, S., & Singh, V. (2008). Female presence on corporate boards: A multi-country study of environmental context. *Journal of Business Ethics, 83*(1), 55–63. doi: 10.1007/s10551-007-9656-1

Data source: Surveys of gender diversity on corporate boards between 2003 and 2005; sources include the European Commission (2006), McKinsey (2005), Catalyst (2004), Center for Corporate Diversity (2004), Corporate Women Directors International (2004), Ding and Charoewong (2004) and Izraeli (2001).

Population studied: Percentage of women on corporate board

Country/Countries: 43 countries.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X							

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X		**X**				Percentage of females in the legislature, senior official and management positions; year that the first woman was elected to political office; ratio of earned income by females and males.

Terjesen and Singh (2008) examine the relationship between female membership on corporate boards and broader gender-based labor market outcomes, including the gender pay gap.

Key findings: The study finds that countries with a higher proportion of females in the legislature, senior official, and management positions are significantly more likely ($p < 0.001$) to have higher representation of women on corporate boards; hence, Hypothesis 1 is supported. Results indicate that countries with a longer history of elected female officials are significantly less likely to have women on corporate boards; hence, Hypothesis 2a is not supported. In fact, the opposite is the case and thus supports Hypothesis 2b: countries with a longer history of female political representation are significantly less likely ($p < 0.001$) to have women on their boards. Finally, results indicate that countries in which women earn a more similar income ratio to that of men are significantly more likely to have higher numbers of women on their corporate boards ($p < 0.001$); thus, Hypothesis 3 is supported.

Citation: Vecchio, N., Scuffham, P. A., Hilton, M. F., & Whiteford, H. A. (2013). Differences in wage rates for males and females in the health sector: A consideration of unpaid overtime to decompose the gender wage gap. *Human Resources for Health*, *11*(9). doi: 10.1186/1478/4491-11-9

Data source: Work Outcomes Research Cost-benefit Project (2005 and 2006) and Health and Performance at Work Questionnaire of the World Health Organization.

Population studied: Study sample = 10,066 full-time employees of the health sector; excludes employees age 25 and younger and 65 and older.

Country/Countries: Australia.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X						Actual hours worked, expected hours worked, unpaid overtime, private/public sector, supervision.

Vecchio, Scuffham, Hilton, and Whiteford (2013) used Oaxaca-Blinder and regression analysis to estimate the gender wage gap, for which the outcome of interest was log hourly wages.

Key findings: Males and females had significant differences regarding their human capital endowments, job characteristics, and family responsibilities that partly explained the gender wage gap in Australia's health sector. The Oaxaca-Blinder decomposition revealed that, after adjusting for endowments, a gap of 16.7 percent remained unexplained, in line with other Australian studies across all sectors reporting estimates between 10–20 percent. Consistent with other research, the study also found a wider gender wage gap among higher-paid occupations. Among the latter in the health sector, there is scope for bargaining and managerial discretion (for example, individual pay setting) to reward employees that signals their greater productivity, resulting in the presence of a substantial gender wage gap for the

higher-paid occupations. The gender wage gap may be partly explained by workers with more complex job tasks and/or leadership roles having a greater mismatch between paid work hours and actual work hours.

Citation: Wahlberg, R. (2010). The gender wage gap across the wage distribution in the private and public sectors in Sweden. *Applied Economics Letters, 17*(15), 1465–1468. doi: 10.1080/13504850903035915

Data source: Swedish Longitudinal Individual Data.

Population studied: People aged 18–64, excluding self-employed workers, students, and individuals with missing values on observed characteristics (46,392 men and 44,764 women).

Country/Countries: Sweden.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
x	x	x	x (age-education)			x (ethnicity, i.e., native-born)	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X (dummy variable)		Local employment rate.

Wahlberg (2010) examined the gender pay gap across the income distribution for Swedish workers in both the public and private sectors.

Key findings: The author found a glass ceiling effect for women across the income distribution in both sectors. In addition, the pay gap increases throughout the income distribution for both sectors. However, despite the presence of a gap, the gender pay gap in Sweden is much lower than in most other developed countries.

Citation: Yanadori, Y., Gould, J. A., & Kulik, C. T. (2018). A fair go? The gender pay gap among corporate executives in Australian firms. *The International Journal of Human Resource Management, 29*(9), 1636–1660.

Data source: Sirca Corporate Governance database 2011–2014.

Population studied: 7,527 male and 816 female Australian executives from the 500 largest public firms measured by market capitalization.

Country/Countries: Australia.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X							

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X	X			X	Position tenure (in years), firm performance (measured by firm return on assets), firm's corporate governance structure, proportion of outside directors on the board, presence of women on the board, 3-year indicator variables.

To examine gender pay equity among Australian executives, Yanadori, Gould, and Kulik (2018) estimated a series of wage regression models separately for men and women controlling for a variety of occupational and firm-level characteristics.

Key findings

Findings showed that female executives receive 80.7 percent of the total mean pay that male executives receive. This gender pay gap is, in large part, explained by differences in position, as female executives are underrepresented in high-paid executive positions. After controlling for other individual and firm characteristics, including executive position, a 15.1 percent gap in pay between male and female executives still exists.

Work Experience, Career Interruptions, and Labor-Force Attachment

Citation: Albrecht, J. B., Bronson, M. A., Thoursie, P. S., & Vroman, S. (2018). The career dynamics of high-skilled women and men: Evidence from Sweden. *European Economic Review, 105*, 83–102. doi: 10.1016/j.euroecorev.2018.03.012

Data sources: Longitudinal data from 1985–2013 from five data sources - (1) LOUISE database,[6] (2) Multigenerational Register, (3) Wage Structure Statistics, (4) Employment and Firms Registers, and (5) Parental Leave Register (compiled by the Social Insurance Agency).

Population Studied: 30,725 men and women (almost equally split) born in the years 1960–1970 who completed at least 3 years of university education (equivalent to a U.S. bachelor's degree) in either business or economics.

Country/Countries: Sweden.

[6] In 2004, LOUISE was expanded and renamed "LISA." (https://www.scb.se/en/services/guidance-for-researchers-and-universities/vilka-mikrodata-finns/longitudinella-register/longitudinal-integration-database-for-health-insurance-and-labour-market-studies-lisa/)

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X				X		

Occupation	Industry	Percent Female	Union	Full- or Part-Time	Firm Size	Other
					X	Firm characteristics (i.e., firm size, high-paying firms); mobility (i.e., switching versus staying at a firm).

Albrecht, Bronson, Thoursie, and Vroman (2018) examined matched worker-first data to track careers of men and women who earned a university degree in either business or economics and who worked in the private sector. The authors used regression analysis and Oaxaca-Blinder decomposition to examine how the mobility and log wage gains associated with either switching firms or staying with their current firm affected the gender log wage difference.

Key Findings: The findings suggest that, controlling for time-to-first-birth effects and year-fixed effects, men and women with economics and business degrees begin their careers with similar earnings; however, as they age, men have a steeper incline in wage earnings compared to women. When examining the effects of the birth of a first child on wage earnings for men and women, Albrecht et al. found that, until the birth of a first child, the wage earnings for both men and women increase; however, once the birth of the first child has occurred, women experience a "motherhood penalty" (a large and persistent wage gap between men and women) that persists for at least 10 years.

Findings for whether men work in "better" firms than women indicate that, controlling for time-to-first-birth, women tend to begin their careers at smaller firms compared to men, but as they age, they tend to move to larger firms, whereas at the same time, men move to smaller firms. Albrecht et al. indicate that this finding is consistent with the notion that women move to workplaces that allow for more flexible work schedules (including fewer working hours). Second, when examining the earning of high-skill male coworkers, findings indicate that men have a greater likelihood of working for higher paying firms compared to women, but this difference disappears over time. Additionally, men are more likely to work in firms where other highly skilled men earn high wages (and work longer hours). Albrecht et al. noted that smaller firms (to which more men tend to gravitate throughout their careers) tend to pay higher wages, which is partially explained by the longer working hours. Finally, women are more likely to work at "family-friendly" firms (defined as the proportion of high-skill workers who work part time [i.e., ≤ 35 hours]) compared to men.

Findings indicate that switching between firms declines with age; more than 35 percent of both men and women switch firms annually at age 25 compared to about 18 percent at age 45. When controlling for time-to-first-birth, men were slightly more likely to switch firms before age 35, but then were about as likely to switch firms as women after age 39. However, when examining the effect of the birth of a child on the likelihood of switching firms, women are more likely (up to 1 year before the birth of their first child) to switch firms than men; at 1–3 years after giving birth, women are much less likely to switch firms compared to men. However, the birth of a child does not appear to affect the likelihood of men switching firms. Findings also indicate that both men and women who switch firms at the beginning of their careers (before the birth of their first child) tend to experience wage gains, whereas switching

firms in the first few years after the first child's birth appears to have negative effects on wages. Interestingly, Albrecht et al. used decomposition and found that switching from or staying with a firm does not account for the differences in annual log wage gains between men and women.

Citation: Albrecht, J., van Vuuren, A., & Vroman, S. (2009). Counterfactual distributions with sample selection adjustments: Econometric theory and an application to the Netherlands. *Labour Economics, 16*(4), 383–396. doi: 10.1016/j.labeco.2009.01.002

Data sources: Netherlands' Organization of Strategic Labour Market Research Labour Supply Panel, 1986–1996.

Population studied: This study examined full-time employees (39 women and 1,233 men) between 25 and 55 years old.

Country/Countries: Netherlands.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X			

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X		

Albrecht, van Vuuren, and Vroman (2009) extended Machado and Mata's (2005) quantile regression composition technique to account for selection.

Key findings: Albrecht at al. found an average gap in log wages of full-time workers across the wage distribution of around 15 to 20 percent, with a higher gap at the upper end of the distribution, indicating the presence of a glass ceiling effect. After accounting for selection into full-time employment, the authors found that the gap would be much higher if all workers were full-time, suggesting positive selection into full-time employment. They illustrated the importance of selection correction in an analysis of wage distributions for male and female workers in the Netherlands.

Citation: Arulampalam, W., Booth, A. L., & Bryan, M. L. (2007). Is there a glass ceiling over Europe? Exploring the gender pay gap across the wage distribution. *Industrial & Labor Relations Review*, *60*(2), 163–186. doi: 10.1177/001979390706000201

Data sources: Quantitative data from the European Community Household Panel, 1994–2001.

Population studied: 5,000 individuals who are 22–54 years old and working at least 15 hours per week from 11 European countries

Country/Countries: 11 European countries (Austria, Belgium, Britain, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, and Spain).

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X			X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
			X	X	X	"public vs. private," training received in the last year, tenure, health status, experience of unemployment since 1989, and fixed term and casual contracts

Arulampalam, Booth, and Bryan (2007) conducted wage gap calculations for a pooled model, excluding occupation and industry controls, and included a dummy for the private sector. First, they estimated quantile regressions by gender and by sector (when necessary). They then calculated the predicted wage at different parts of the wage distribution by gender and sector, focusing on determining the part of the wage gap attributable to differing returns between men and women. The authors used men's characteristics in counterfactual calculations, meaning that a positive wage gap implies that the returns on men's characteristics are higher than those of women and a negative wage gap implies the reverse. In calculating the male counterfactuals, the authors follow the bootstrap procedure suggested by Machado and Mata (2000)[7] by using the distribution of interest rather than the average characteristics of the male sample.

Key findings: Findings indicate that the gender wage gap was typically larger at the top of the wage distribution, which the authors interpreted as a "glass ceiling effect." They also observed in some E.U. countries that the gender pay gap widens significantly at the bottom of the wage distribution (i.e., the "sticky floor effect"). They also found that the gender pay gap is usually larger at the top than the bottom of the wage distribution, which implies that glass ceilings are more prevalent than sticky floors. The study also showed that differences in returns account for a large portion of the variation in the gender pay gap across the wage distribution.

Citation: Boll, C., Rossen, A., & Wolf, A. (2017). The EU gender earnings gap: Job segregation and working time as driving factors. *Jahrbucher Fur Nationalokonomie Und Statistik, 237*(5), 407–452.

Data source: 2010 wave of the EU Structure of Earnings Survey, including linked employee-employer characteristics.

Population studied: Business enterprises with at least 10 employees; self-employed are excluded; total sample size is 8,829,191.

Country/Countries: 21 European Union countries plus Norway.

[7] At the time of this publication, this paper was forthcoming; however, this final published paper is: Machado, J. A., & Mata, J. (2005). Counterfactual decomposition of changes in wage distributions using quantile regression. *Journal of Applied Econometrics, 20*, 445–465.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X					

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X				X	Contract type (temporary v. permanent), firm tenure, hours of work, firm ownership.

Boll, Rossen, and Wolf (2017) examined gender pay differentials across 22 European countries. The authors used Oaxaca-Blinder decomposition to estimate gender pay gaps and studied the role of selection into industries and occupation in explaining male-female pay gaps.

Key findings: The authors found that gender pay gaps persist across Europe, with a gap of 15.3 percent across all countries, where 10.9 percent is unexplained. The authors suggest that increasing the time flexibility of positions would allow women to work in higher paying occupations and industries.

Citation: Bowlus, A. J., & Grogan, L. (2009). Gender wage differentials, job search, and part-time employment in the UK. *Oxford Economic Papers, 61*(2), 275–303. doi: 10.1093/oep/gpn038

Data sources: British Household Panel Survey, 1991–2000.

Population studied: 20–40-year-old individuals either working, unemployed, or nonparticipants because of family care needs in January 1992. The following populations were excluded: students; individuals on government training programs; individuals not reporting labor market status; individuals on sickness or disability leave; individuals who are self-employed; individuals who are retired; and individuals who were observed to transit directly to retirement, training schemes, self-employment, long-term sick leave, or higher education in January 1992.

Country/Countries: United Kingdom.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
		X		X		Job spell/duration.

Bowlus and Grogan (2009) examined the extent to which decisions among women to work full- or part-time explain gender pay differentials. The authors used a three-state (employed, unemployed, and non-participation in the labor force) equilibrium search model and estimation procedure based on Bowlus (1997) and Mortensen (1990).

Key findings: Bowlus and Grogan found that, for individuals with lower levels of education, 33 percent of the wage gap among full-time male and female workers is due to differences in reservation wages,

while 30 percent is due to differences in search frictions of employed workers. For more educated university graduates, search frictions played no role in gender wage differentials.

Citation: Boye, K., Halldén, K., & Magnusson, C. (2017). Stagnation only on the surface? The implications of skill and family responsibilities for the gender wage gap in Sweden, 1974–2010. *The British Journal of Sociology, 68*(4), 595–619. doi: 10.1111/1468-4446.12252

Data sources: Cross-sectional data from five waves of the Swedish Level-of-Living Survey.

Population studied: The population includes all employed women and men.

Country/Countries: Sweden.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X			X	X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X					Job seniority (number of years with current employer); parent; number of hours per week spent doing housework (i.e., buying groceries, cooking, washing dishes, cleaning, laundering, ironing, and engaging in other clothing care activities).

This study measured the natural log of hourly wage, using standard ordinary least squares regression analyses for each year. Separate regressions were also produced by segmenting data by skill level, including variables for family responsibility, and interactions between sex and family responsibility.

Key findings: The findings of Boye et al. (2017) indicate that women's greater responsibility for children and the household significantly influenced the gender wage gap in skilled occupations. Further, the gender wage gap is largest among parents in skilled occupations and smallest among childless individuals, regardless of skill level.

Interestingly, the findings also suggest that the gender wage gap for those in less skilled occupations has dropped dramatically, while it has remained stagnant for those in skilled occupations. While there was a 23 percent gender wage gap in less skilled occupations in 1974, this gap dropped to 7 percent by 2010. Through this same period, the gender pay gap among skilled occupations remained at approximately 17 percent.

Citation: Cebrián, I., & Moreno, G. (2015). The effects of gender differences in career interruptions on the gender wage gap in Spain. *Feminist Economics, 21*(4), 1–27. doi: 10.1080/13545701.2015.1008534

Data source: Muestra Continua de Vidas Laborales 2005–2010.

Population studied: 393,442 Spanish full-time employees between 20 and 64 years old who have at least a single episode of full-time employment registered in Social Security.

Country/Countries: Spain.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X		X		X		X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X				X	Type of contract, size of town, starting year, type of employer, foreigner status.

Cebrián and Moreno (2015) used Oaxaca-Blinder decomposition to estimate the gender gap in daily wages, focusing on the contribution of differing gender patterns of work interruptions.

Key findings

In examining the gender wage gap, the authors found that male employees receive a 13.09 percent higher daily wage than female employees. Decomposition of the gap revealed that only 10.65 percent of the gap can be explained by observable factors, suggesting possible evidence of discrimination within Spain's labor market. In addition, 5.7 percent of the explained gap is accounted for by women's higher index of work interruptions, which indicates the negative impact on women's wages of the higher frequency and length of their work interruptions.

Furthermore, the findings indicated that females have more work interruptions compared to their male counterparts. Women are also out of employment longer, particularly in their middle age when many experience motherhood and face more pressure to balance work and family life. Employment interruptions result in similar decreases in salary earnings for both genders. Specifically, a 1 percent increase in the work interruptions index implies a 0.26 percent reduction in male wages and a 0.27 percent reduction in female wages.

Citation: Cutillo, A., & Centra, M. (2017). Gender-based occupational choices and family responsibilities: The gender wage gap in Italy. *Feminist Economics, 23*(4), 1–31. doi: 10.1080/13545701.2017.1285041

Data source: Italian National Institute for Workers' Professional Development (ISFOL) 2007: Indagine sui differenziali salariali di genere (gender pay gap survey)

Population studied: Study sample=8,383 workers

Country/Countries: Italy.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X		X		X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
						Demographic size of the municipality; Non-national citizenship; Other adult household components; Other income earners; Number of job changes; Mother employed; Job security; Employment benefits; Flexible work schedule

The authors addressed several factors that drive selection into different occupations (labor market conditions, financial constraints, family background, education, family responsibilities), with added instruments and several explanatory variables, before decomposing the gender wage gap through a modified version of the Oaxaca-Blinder decomposition.

Key findings: Because jobs are not randomly allocated to individuals, different gender crowding effects occur in different occupations. Job security, employment benefits, and control over time-use are more important in women's decisions, while pay grade is more important in men's decisions. Female characteristics are rewarded less than male ones; as unexplained components, these are about four times higher among female-dominated jobs than among those in male-dominated or gender-neutral jobs. This result is consistent with gender discrimination by employers. Since women are crowded in certain occupations even in accordance with their preferences and needs, the authors' interpretation is that employers penalize wages of women when hiring them in the jobs they desire to achieve a satisfactory work-life balance. Finally, the study finds that family responsibilities differently impact the effort to devote oneself to market production for women and men. Both men and women increase their effort to earn more in Italy, but because domestic home and family functions are almost entirely entrusted to women, their unpaid domestic work negatively impacts women's market productivity.

Citation: Diaz, M. A., & Sánchez, S. R. (2011). Gender and potential wage in Europe: A stochastic frontier approach. *International Journal of Manpower, 32*(4), 410–425. doi: 10.1108/01437721111148531

Data sources: European Community Household Panel Data from 1995–2001.

Population studied: Workers employed in the industrial and service sectors aged 25–65, working at least 15 hours or more per week and having observations for at least 3 consecutive years in the data.

Country/Countries: Germany, Denmark, France, Italy, Spain, and the United Kingdom.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X		X		X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X				X (Continuous – number of hours worked).		Type of contract, private sector, previous unemployment, mobility, household income, and level of job satisfaction.

Diaz and Sánchez (2011) estimated the log gross hourly wage equations for the six countries separately to determine the maximum wage that a worker with given characteristics can obtain.

Key findings: Diaz and Sánchez found that in France, Germany, Italy, Spain, and the United Kingdom, the potential wages for women compared to men are smaller, but this is not so in Denmark. This might be related to women being promoted less often in those countries.

Citation: Galego, A., & Pereira, J. (2010). Evidence on gender wage discrimination in Portugal: Parametric and semi-parametric approaches. *Review of Income and Wealth*, *56*(4), 651–666. doi: 10.1111/j.1475-4991.2010.00413.x

Data source: European Community Household Panel for 2001.

Population studied: 2,595 men and 3,099 women aged 16–65, who were either employed or not working at the time of the survey and were not in the military, studying, unpaid, self-employed, working in the agricultural sector, or had never worked.

Country/Countries: Portugal.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X		X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
					X	Health status; age squared; assumption that individuals will maintain their previous occupation, as well as remain in the same industry sector, when making a transition between non-employment and employment; professional worker; dummy indicating whether other members of the family working.

Galego and Pereira (2010) used ordinary least squares (OLS) and traditional decomposition methods, in addition to semi-parametric and parametric approaches, to estimate gender wage discrimination among workers in Portugal. These methods are used to control for potential sample selection bias.

Key findings: The authors found discrimination to be a key factor in explaining the gender wage gap. Specifically, for the OLS estimates, the authors found a wage gap of 0.16, with discrimination playing a significant role. However, results using the parametric and semi-parametric methods indicated that discrimination was not a significant factor.

Citation: Grönlund, A. (2017). On different tracks? Gender, professional strategies, and early career wage gaps. *Nordic Journal of Working Life Studies, 7*(2).

Data source: 2013 survey of newly graduated, highly educated men and women in five occupations in Sweden.

Population studied: 2,400 Swedish men and women who recently graduated from 5 higher educational programs, leading to occupations with different gender compositions.

Country/Countries: Sweden.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X			X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X						

Grönlund (2017) used ordinary least squares regressions to examine whether men and women differ in their professional strategies related to career and family balance, whether women's strategies are related to their occupation's gender composition, and whether gender differences in strategies increase with parenthood. A main focus of the study is how these strategies impact gender pay differentials. The author estimates OLS regressions gender differences in professional strategies on logged monthly wages, controlling for several work-related variables.

Key findings

The author found a significant gender wage gap in the Swedish population studied. However, this gap does not appear to be caused by women trading off occupational aspirations and pecuniary rewards to accommodate their family lives. Finally, professional strategy accounted for none of the gender wage gap.

Citation: Hirsch, B. (2013). The impact of female managers on the gender pay gap: Evidence from linked employer–employee data for Germany. *Economics Letters, 119*(3), 348–350.

Data source: 2008 cross-section of the Linked Employer–Employee Dataset of the Institute for Employment Research.

Population studied: Full-time workers, who are not in managerial positions, in private-sector plants in East and West Germany.

Country/Countries: Germany.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
			X			

Hirsch (2013) examined whether or not the gender pay gap is associated with the presence of female plant managers. The author estimated the gender wage gap using regression analysis of a traditional Mincerian wage equation.

Key findings: Overall, the author found an unexplained pay gap of 16.1 log points. However, when controlling for female share of management, the wage gap is lowered by 1.1 log points due to a reduction in men's wages. These findings may indicate that there is less gender-based discrimination in firms with a higher share of female managers.

Citation: Hirsch, B., Schank, T., & Schnabel, C. (2010). Differences in labor supply to monopsonistic firms and the gender pay gap: An empirical analysis using linked employer-employee data from Germany. *Journal of Labor Economics*, *28*(2), 291–330. doi: 10.1086/651208

Data sources: German Linked Employer-Employer Dataset, 2000–2002.

Population studied: 402,105 full-time West German employees, working for 3,560 establishments, whose wages are below the Social Security contribution ceiling.

Country/Countries: Germany.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X				X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X	X			X	German citizenship, good/bad economic performance; proportion of qualified workers; works council, new production technology, year, collective agreement at firm level, collective agreement at sector level.

Hirsch, Schank, and Schnabel (2010) estimated labor supply elasticities using a semi-structural approach, which depends on methods of survival analysis, that allowed for wage-elastic transitions from and to nonemployment and transitions among employers.

Key findings: The study found that women's labor supply to the firm is less elastic than men's, meaning that women's labor supply curve to the firm is steeper than that of men. Using the estimated labor supply elasticities, Hirsch et al. found that men earn 4.6 percent to 17.4 percent more than women. The authors conclude that at least one-third of the gender wage gap may be wage discrimination by profit-maximizing monopsonistic employers.

Citation: Huertas, I. P., Ramos, R., & Simon, H. (2017). Regional differences in the gender wage gap in Spain. *Social Indicators Research, 134*(3), 981–1008. doi: 10.1007/s11205-016-1461-8

Data sources: Surveys of Earnings Structure 2002, 2006, and 2010.

Population studied: 122,291 employees in 2002, 138,834 employees in 2006, and 161,412 employees in 2010 in workplaces registered in Spain's Social Security system, ranging in age from 16–65, with hourly wages of more than 200 euros.

Country/Countries: Spain.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X		X				X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X		X		X	Permanent or fixed-term; type of collective agreement (firm agreement, national sectoral agreement, and intranational sectoral agreement).

This study examined regional differences in gender wage disparity in Spain using matched employer-employee microdata, two different econometric decomposition methods (Oaxaca-Blinder and Juhn, Murphy and Pierce [1993]) decomposition, and panel data techniques.

Key findings: Findings suggest that Spain shows a significant regional heterogeneity in the size of its raw wage gap that is roughly equivalent to that of international variations across Europe. Although the bulk of the gender pay disparity in Spain was a result of the endowments of productive characteristics between males and females, a significant portion of the gap remained unexplained. Huertas, Ramos, and Simon (2017) found that the higher the minimum wage and age gap at the first marriage and the lower the union density, employment rate, and fertility rate, the lower the gender wage gap.

Citation: Ichino, A., & Moretti, E. (2009). Biological gender differences, absenteeism, and the earnings gap. *American Economic Journal-Applied Economics, 1*(1), 183–218. doi: 10.1257/app.1.1.183

Data sources: Personnel data for all employees of a large Italian bank with branches in every region of Italy.

Population studied: 14,857 full-time employees (2,965 women and 11,892 men) who worked at the large Italian bank continuously from 1993–1995 and who had at least one illness-related absence during the 3-year period.

Country/Countries: Italy.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X					

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X						Non-cyclical absences.

To investigate the effect of absenteeism on women's earnings, Ichino and Moretti used a model of statistical discrimination. Log earnings were regressed on a dummy variable for female, the yearly number of cyclical absences, and the interaction of female and cyclical absences.

Key findings: This study found that, when compared to men, women were younger, slightly more educated, had significantly more sick days, were paid an average of 20 percent less, and were heavily underrepresented in the managerial ranks. Further, the absences of women younger than age 45 follow a 28-day cycle, while the absences of men and women older than age 45 do not. After controlling for a quadratic in age and the number of noncyclical absences, the earnings gap declines to 13.5 percent. Ichino and Moretti found that approximately one-third of the gender gap in days of absence and two-thirds of the gender gap in the number of absence spells appear to stem from the menstrual cycle; additionally, increased absenteeism associated with the 28-day cycle explains at least 14.1 percent of the gender pay gap.

Citation: Johnston, D. W., & Lee, W. S. (2012). Climbing the job ladder: New evidence of gender inequity. *Industrial Relations, 51*(1), 129–151. doi: 10.1111/j.1468-232X.2011.00667.x

Data sources: Household, Income, and Labour Dynamics in Australia survey.

Population studied: 726 men and 881 women who were employees (non-self-employed), not studying full-time, university-educated, have fewer than 20 years of experience, and had nonmissing wage, mobility, and demographic information.

Country/Countries: Australia.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X		X	X	X	Whether they have been promoted on work in the past 12 months; whether they have changed employers in the last 12 months; job satisfaction (0–10 scale); extroversion personality scale; agreeableness personality scale; conscientiousness personality scale; emotional stability personality scale; openness to experience personality; time use (hours spent on main job, housework, commuting, errands, caring for relatives).

In addition to descriptive statistics, Johnston and Lee (2012) estimated probit models for promotion to analyze the estimated effect of gender on promotions and how they changed when controlling for increasing numbers of covariates. Johnston and Lee exploited the longitudinal structure of the data by estimating random effects probit models.

Key findings: Johnston and Lee found women were less likely to be promoted than men. In addition, when women were promoted, they received significantly lower wage raises. There were no gender differences in employer-change rates, but women on average received a wage penalty when changing employers. When compared to men, women who received promotions or changed employers had similar satisfaction with their hours worked, work-life balance, and work content. The findings did not support the hypothesis that women value nonmonetary aspects of employment more than men and, as a result, tend to choose jobs that allow them to spend more time engaged in other activities. In addition, these findings illuminated how dynamics of promotions and employer changes exacerbated the gender pay gap.

Citation: Leuze, K., & Strauß, S. (2016). Why do occupations dominated by women pay less? How "female-typical" work tasks and working-time arrangements affect the gender wage gap among higher education graduates. *Work Employment and Society, 30*(5), 802–820. doi: 10.1177/0950017015624402

Data sources: Hochschul-Informations-System-Absolventenpanel, 2001.

Population studied: Higher education graduates who received their degree from a German higher education institution in 2001.

Country/Countries: Germany.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
		X		X	X	Working in the public sector, having a leadership position, being self-employed, number of months in family-related employment breaks, number of months in unemployment.

Leuze and Strauß (2016) used ordinary least squares to estimate respondents' logged gross hourly wages 5 years after graduation. Oaxaca-Blinder decompositions were also estimated to quantify the different explanatory variables' effect on the wage gap.

Key findings: Leuze and Strauß found that occupational overtime increased women's wages and occupational part-time work decreased women's wages, which indicated that, generally, occupations dominated by women have lower wages due to their "female-typical" working-time arrangements. However, this conclusion did not hold true for highly qualified occupations (such as teachers), which increased women's wages. Leuze and Strauß suggested that the German "modified male breadwinner model" (i.e., a full-time working husband and a wife working, at most, part-time) was supported by the structure of occupations, since jobs with a "male-typical" work schedule mostly enabled male workers to support their families, while "female-typical" work schedules mostly enabled a career and family combination.

Citation: Ludsteck, J. (2014). The impact of segregation and sorting on the gender wage gap: Evidence from German linked longitudinal employer-employee data. *ILR Review, 67*(2), 362–394. doi: 10.1177/001979391406700204

Data sources: German Federal Employment Agency registry data.

Population studied: Western German sample included establishments that appeared at least once in the period 1990–2005 and had at least 10 employees. The Munich sample included establishments in the city of Munich combined with 155 surrounding communities that had at least 20 employees.

Country/Countries: Germany.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X		X		X	X	Experience, qualification level, nonsingular job.

To examine the association between segregation in the workplace (defined as the proportion of women in the job) and the gender wage gap, Ludsteck (2014) employed a series of ordinary least squares regressions for males and females, respectively, controlling for several other factors (e.g., level of experience, an interaction term of experience and education). The outcome of interest was the log of daily wages. In addition, Ludsteck performed an Oaxaca-Blinder decomposition.

Key findings: The study found that the gender wage gap increased as the job-cell (or work group/similar job) level proportion of women increased, which was in part due to women experiencing greater wage declines than men when more women entered their job-cells. Ludsteck found that controlling differences at the individual, establishment, and occupation levels reduced the proportion of female effects on women's wages and reduced the proportion of effects on the wage gap; notably, these same control variables had either no effects or positive effects on men's wages.

Citation: Matteazzi, E., Pailhé, A., & Solaz, A. (2018). Part-time employment, the gender wage gap and the role of wage-setting institutions: Evidence from 11 European countries. *European Journal of Industrial Relations, 24*(3), 221–241.

Data source: European Union Statistics on Income and Living Conditions 2009.

Population studied: Women and men aged 25–59.

Country/Countries: Austria, Belgium, Finland, France, Germany, Italy, the Netherlands, Norway, Poland, Spain, and the United Kingdom.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X				X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X				X	Country of birth; degree of urbanization of area of residence; managerial position with supervisory responsibility; type of contract.

Matteazzi, Pailhé, and Solaz (2018) conducted micro- and macro-level analyses of the gender wage gap. At the micro level, they used the Neuman-Oaxaca double decomposition (by gender and by full time versus part time status among women) of the gender wage gap to evaluate the extent to which female part-time employment contributes to the gap. The double decomposition method allows for the correction of potential selection bias that arises from women self-selecting into full-time and part-time employment. Log wage equations for men and selectivity-corrected low-wage equations for women are estimated by ordinary least squares. At the macro level, the authors examined the correlation between the rate of part-time employment and the predicted gender hourly wage gap and how wage-setting institutions affect the gender wage gap and its components.

Key findings: The study found that both female part-time and full-time employees are highly segregated into low-wage sectors and occupations relative to males. It also found that the gender wage gap among full-time employees is mostly unexplained after controlling for a variety of factors. In addition, the gender wage gap tends to be higher in countries where part-time employment is widespread.

Citation: Mortelmans, D., & Frans, D. (2017). Wage differentials after a career break: A latent growth model using Belgian register data. *Longitudinal and Life Course Studies, 8*(2), 169–190. doi: 10.14301/llcs.v8i2.359

Data source: Datawarehouse Labor Market and Social Security of Belgium.

Population studied: 5,537 people who took one career break that ended before 2003.

Country/Countries: Belgium.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X				X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X (dummy)		Younger or older than age 50 when career break taken (for the control group, this dummy refers to whether the person was younger/older than 50 in Q1 of 2003).

To analyze the extent to which the impact of a career break on income varies between genders, Mortelmans and Frans (2017) utilized longitudinal growth models (i.e., multilevel models). They examined income changes before, during, and after the career break. They then predicted models that analyzed the amount of variance on each level considering gender, time, and gender-time interaction effects, as well as the income differentials among different types of career breaks for men and women.

Key findings: While both genders experience an income penalty after taking a career break, the study found that men are penalized more for taking a career break than women. However, of the employees studied who took a career break, 74.9 percent were female.

Citation: Olivetti, C. & Petrongolo, B. (2016). *The evolution of gender gaps in industrialized countries*. National Bureau of Economic Research Working Paper No. 21887.

Data source: Pre-WWII data from International Historical Statistics; post-war data from the International Labour Organization.

Population studied: Unbalanced panel of 19 high-income countries for the period 1850–2008. Labor force is defined as employed and age 15 and older.

Country/Countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom, and the United States.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other

Olivetti and Petrongolo (2016) examined long-term trends in employment outcomes, including wages, labor force participation, and hours worked, for women and men across 19 countries from the middle of the 19th century through 2008. The authors estimated raw gender wage gaps over time to examine the convergence of male and female wages.

Key findings: Overall, the authors illustrated that increased female labor force participation during the post-WWII period coincided with a large increase in the female share of hours worked, reduction in the gender wage gap, and the secular decline in the labor force participation of men over the same time period. Specifically, the authors found that the male-female earnings ratio increased by nearly 0.4 percentage points per year from 1970 to 2010. While women earn 80 percent of male earnings in most countries, that ratio is higher in Belgium, Denmark, Ireland, and Mediterranean countries and lower in Japan and Korea.

Citation: Ropero, M. A. (2018). Women's access to supervisory jobs and gender inequality. *International Journal of Manpower, 39*(5), 687–709. doi:10.1108/IJM-10-2016-0196

Data sources: Employer-matched data from 2010 Wage Structure Survey conducted by the Spanish National Institute of Statistics.

Population studied: Sample of 213,709 workers in the Spanish labor market from 24,848 establishments (with > 500 workers) located in Spain.

Country/Countries: Spain.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X		X	X	

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X	X	X	X (dummy variable)	X	Employee: temporary contract, seasonal employment, personal disabilities, sickness, maternity or paternity leave, family caretaker, on strike or suspended from job at any point, nationality. Firm: ownership, state or private ownership, regional or national sales, and proportion of women among supervisors.

Ropero (2018) employed a two-step process for analyses. First, the study estimated a probit model for the supervisory job decision with the whole sample. Then, he substituted the predicted probabilities into the equations to estimate separate wage regressions for each group of workers (i.e., workers in supervisory and nonsupervisory roles) to control for a sample section bias of persons with and without supervisory jobs. The outcome of interest is the log gross hourly wage.

Key findings: Holding all other included variables constant, Ropero found a wage gap of 13.3 percent and 10.5 percent between men and women in supervisory and nonsupervisory roles, respectively. Interestingly, as the percentage of women within an industry increased, the wage decreased, but this phenomenon was not as pronounced when there were more women supervisors. More women in supervisory roles narrowed the gender wage gap by 17.7 percent and 8.5 percent among supervisors and nonsupervisors, respectively. Finally, a higher proportion of women supervisors increased the gender wage gap of supervisors and nonsupervisors.

Citation: Simon, H., Sanroma, E., & Ramos, R. (2017). Full- and part-time wage differences in Spain: An analysis along the wage distribution. *International Journal of Manpower, 38*(3), 449–469. doi: 10.1108/IJM-09-2015-0151

Data sources: The most recent wave of the Encuesta de Estructura Salarial, a nationally representative survey from 2010 that included a matched employer–employee dataset.

Population studied: This sample included individuals 16–65 years of age who had hourly wages between 2.5 and 200 euros. The final sample comprised 152,099 observations, 89,344 of whom were men and 62,755 of whom were women.

Country/Countries: Spain.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X				X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X		X	X (dummy variable)	X	Nationality and contract.

Simon, Sanroma, and Ramos (2017) used an econometric decomposition technique proposed recently by Firpo , Fortin, and Lemieux (2011) to decompose wage differences between part-time and full-time workers by quantiles of the wage distribution.

Key findings: Simon et al. found that part-time workers in Spain experienced a significant raw wage gap that differed substantially along the wage distribution. For part-time females, the wage disadvantage was primarily explained by their relative endowments of characteristics, especially by lower endowments of human capital and segregation into low-wage sectors, but a significant wage penalty still existed, increasing along the wage distribution. For males, the wage disadvantage for part-time work

was only found in the lower part of the wage distribution and was a result of both the worst endowments of characteristics and a significant wage penalty.

Citation: Van der Meer, P. H. (2008). Is the gender wage gap declining in the Netherlands? *Applied Economics, 40*(2), 149–160.

Data source: Dutch Institute for Labour Studies.

Population studied: Cross-sectional analyses: In 1985 there are 1,779 persons; in 1986 - 1,780 persons, in 1988 - 1,688 persons, in 1994 - 2,292 persons, in 1996 - 2,447 persons, and in 1998 - 2,323 persons.

Panel analysis: Total 8,590 observations of 3,208 individuals.

Country/Countries: The Netherlands.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X		X			X	Changed employer in the last 2 years, changed job for current employer, log hours worked, years at current employer, performing unpaid overtime, being a supervisor.

Van der Meer (2008) aimed to determine whether the decreasing gap in labor force participation between men and women in the Netherlands can explain trends in the gender wage gap. The author estimated wage differentials, by year, using traditional decomposition methods. Besides the cross-section analyses, the author estimated a wage equation on panel data using a random effects model and contains both time-variant and time-invariant variables.

Key findings: The study found a consistent gender gap of approximately 20 percent. Although men and women show significant differences in productive characteristics, these differences accounted for only 25 to 30 percent of the gap. Since some productivity characteristics favor men and some favor women, the total effect cancels out. Price differences accounted for the largest component of the gender wage gap: men are overpaid, while women are, to a larger extent, underpaid. These conclusions are supported by both the panel and the cross-sectional analysis.

Citation: Vecchio, N., Scuffman, P. A., Hilton, M. F., & Whiteford, H. A. (2013). Differences in wage rates for males and females in the health sector: A consideration of unpaid overtime to decompose the gender wage gap. *Human Resources for Health, 11*, 1–11. doi: 10.1186/1478-4491-11-9

Data sources: The Health and Performance at Work Questionnaire developed by the World Health Organization, 2005–2006.

Population studied: 10,066 Australian full-time employees within the health sector. The sample included Queensland employees aged 25–64.

Country/Countries: Australia.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X		X	X		

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X					Actual hours worked, expected hours worked, unpaid overtime, private/public sector.

Vecchio, Scuffman, Hilton, and Whiteford (2013) used ordinary least squares regression to identify the gender wage gap when unpaid overtime was included and then excluded from the model. Then they stratified the sample by gender and by occupation. For the regression models, the outcome variable was the log of hourly wage. Finally, Oaxaca-Blinder decomposition was used to examine the gap in wage between men and women with the equation below:

$$ln(W^M) - ln(W^F) = \left[\left(x_{ij}{}^M - x_{ij}{}^F\right)\beta_{ij}{}^M\right] + \left[\left(\beta_{ij}{}^M - \beta_{ij}{}^F\right)x_{ij}{}^F + \left(\beta_0{}^M - \beta_0{}^F\right)\right]$$

Key findings: Findings from Vecchio et al. revealed differing gender wage gaps by occupation. For example, the wage gap for managers was 15.8 percent; the wage gap was 19.4 percent for professional/technical; and the wage gap was 9.3 percent for clerical/service. Furthermore, when they included unpaid overtime in the analysis, they found a slight reduction in the wage differential. More specifically, mean income including unpaid overtime is 16.6 percent lower for women than men, but when unpaid overtime is excluded, the mean income is 17.7 percent lower for women than men. Results from the Oaxaca-Blinder decomposition revealed an unexplained wage gap of 16.7 percent between men and women.

Citation: Wilner, L. (2016). Worker-firm matching and the parenthood pay gap: Evidence from linked employer-employee data. *Journal of Population Economics*, *29*(4), 991–1023. doi: 10.1007/s00148-016-0597-9

Data source: DADS-EDP panel 1995–2011, which is a merged dataset composed of the Declaration Annuelle de Donnees Sociales (DADS) and the Echantillon Demographique Permanent (EDP).

Population studied: 41,531 individuals ages 16–65 working in the French private sector, whose annual wage exceeds 10 euros.

Country/Countries: France.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X		X	X	X		X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
	X			X (continuous)	X	First year in panel; seniority; number of working days; year dummies.

Wilner (2016) estimated separate hourly wage equations for men and women, including worker- and firm-fixed effects, to analyze whether a parenthood pay gap exists and the extent to which gender plays a role. In addition, he simulated a counterfactual scenario in which women and men experience the same childbirth penalty in order to discern how much of the gender wage gap is explained by the parenthood wage gap.

Key findings: The study found that mothers experienced a wage loss of approximately 2.2 percent per child compared to non-mother counterparts, after a loss of 4.7 percent after their first child's birth. Fathers do not experience any wage loss after the birth of a child, although the author did not find evidence of a fatherhood premium. His results suggest gender inequalities with respect to the impact of parenthood on wages. His counterfactual scenario revealed that the parenthood pay gap accounts for approximately a third of the gender pay gap.

Other

DATA AND/OR METHODOLOGICAL IMPROVEMENT

Citation: Bauer, T. K., & Sinning, M. (2010). Blinder–Oaxaca decomposition for Tobit models. *Applied Economics, 42*(12), 1569–1575. doi: 10.1080/00036840701721612

Data sources: German Socio-Economic Panel for 2004.

Population studied: 3,610 men and 2,465 women.

Country/Countries: Germany.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X	X		X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X		Immigrant status.

Bauer and Sinning (2010) developed an Oaxaca-Blinder type decomposition method for Tobit models. First, they estimated separate wage equation for males' and females' gross hourly wages using ordinary least squares, as is conventional in the Oaxaca-Blinder decomposition. Next, the authors censored the distribution of gross hourly wages at the lower and upper 10th percentile and re-estimated the wage equation to demonstrate the potential bias in estimation results and wage decomposition when ignoring censoring of the dependent variable. Finally, the authors estimated the wage equation using a Tobit model and applied the Tobit-Oaxaca-Blinder decompositions.

Key findings: The decomposition found that 67.6 percent of the gender wage differential is attributable to differences in observable characteristics. Censoring the dependent variable from below or both sides of the wage distribution in the original Oaxaca-Blinder decomposition increases the unexplained portion of the wage differential. However, only censoring above the wage distribution does not change the results as much. The authors concluded that the Tobit decomposition method produced better results than the original Oaxaca-Blinder decomposition when they censored wages from below and from both sides of the wage distribution.

GENDER ROLES

Citation: Castagnetti, C., & Rosti, L. (2013). Unfair tournaments: Gender stereotyping and wage discrimination among Italian graduates. *Gender & Society*, *27*(5), 630–658. doi: 10.1177/0891243213490231

Data sources: Survey on the Early Career of College Graduates conducted by the Italian Institute of Statistics (ISTAT).

Population studied: 9,895 full-time workers (5,392 males and 4,503 females) who graduated in 2004 and worked more than 30 hours per week in 2007.

Country/Countries: Italy.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X			X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X				X	Hours worked per week, parents' educational level and type of occupation.

To measure gender differences in monthly earnings, Castagnetti and Rosti (2013) first estimated separate wage equations for men and women and then decomposed the gross differential into explained and unexplained components with Oaxaca-Blinder decomposition. However, they also used the Heckman-two step approach to control for sample selection.

Key findings: Findings showed a significant raw gender pay gap of 11 percent in graduate employees at the beginning of their careers. Only 12 percent of this gap remained unexplained by differences in observable factors. The study further found that the unexplained component of the gender pay gap is

more prevalent in workplaces with more ambiguity and room for favoritism in terms of assessing individual productivity. Compared to high-skilled jobs, they found a higher unexplained wage gap in low-skilled jobs, in which the employer is less motivated to make accurate judgements and in which stereotypes play a larger role. In contexts for which stereotypes are most likely to occur, the unexplained component of the gender pay gap is also higher.

Citation: Lalive, R., & Stutzer, A. (2010). Approval of equal rights and gender differences in well-being. *Journal of Population Economics, 23*(3), 933–962. doi 10.1007/s00148-009-0257-4

Data source: 13 waves of the Swiss Labor Force Survey (SLFS) starting in 1991; Swiss Household Panel (SHP), 1999–2001.

Population studied: 2,896 communities in the SLFS; approximately 7,000 individuals across 1,000 communities in the SHP.

Country/Countries: Switzerland.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X		X	X	X			X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
				X (dummy variable)		Years of tenure, nationality, time dummies.

Lalive and Stutzer (2010) examined the extent to which beliefs about gender norms may impact the gender wage gap. The authors used the results of a 1981 referendum on an equal rights amendment to assess beliefs of a given community.

Key findings: The authors found a smaller wage gap in areas that registered more support for equal rights. Regression analysis indicated that the mean gender wage gap is narrowed by nearly one-sixth as the result of one standard deviation increase in the approval rights amendment.

GEOGRAPHY

Citation: Furno, M. (2016). Decomposition and wage inequality. *International Review of Applied Economics*, *30*(2), 188–209. doi: 10.1080/02692171.2015.1085004

Data source: Survey on Household Income and Wealth 2008 and 2010.

Population studied: Italian men and women (5,230 in 2008 and 4,997 in 2010).

Country/Countries: Italy.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X				X

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other

Furno (2016) first estimated separate standard Mincerian wage equations for men and women in northern and southern Italy to analyze the effect of gender differences on inequalities in the wage distribution. The author then estimated ordinary least squares regressions and conducted Oaxaca-Blinder decomposition.

Key findings: The study found an unexplained gender effect at lower wages, indicating sticky floor effect. This unexplained gender effect decreases at higher wages. The prevalence of female characteristics is not properly rewarded at higher wages, which suggests a glass ceiling effect.

Citation: Schirle, T. (2015). The gender wage gap in the Canadian provinces, 1997–2014. *Canadian Public Policy-Analyse De Politiques*, *41*(4), 309–319. doi: 10.3138/cpp.2015-012

Data source: Labour Force Survey 1997–2014.

Population studied: Canadian full-time employees aged 25–59 whose main job is in the private sector, excluding employees in public administration, utilities, or educational services.

Country/Countries: Canada.

Methods/Measure:

Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X	X			

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X	X	X	X			Tenure.

To analyze the private-sector gender wage gap, Schirle (2015) estimated several wage regressions for each year between 1997 and 2014 for each Canadian province. The author then used Oaxaca-Blinder decomposition to establish the extent to which the gender wage gap in each year and province can be explained by differences in observable characteristics.

Key findings: The study found that the gender wage gap and the extent to which it can be explained by gender differences in observable characteristics varied considerably across provinces and over time. In some provinces, the gender wage gap has decreased substantially, yet in other provinces, it has barely changed. After accounting for industry and occupational characteristics, provincial differences in the size of the gap largely decreased. In addition, the unexplained portion of the gap has decreased over time in most provinces studied.

RACE/ETHNICITY

Citation: Yap, M. (2010). Slicing and dicing the gender/racial earnings differentials. *International Journal of Manpower*, 31(4), 466–488. doi: 10.1108/01437721011057038

Data sources: Proprietary dataset obtained from the human resource information system of a large Canadian firm in 1999.

Population studied: 12,983 regular, full-time, nonunionized employees as of year-end 1999 who self-identified their ethnicities in the data.

Country/Countries: Canada.

Methods/Measure:

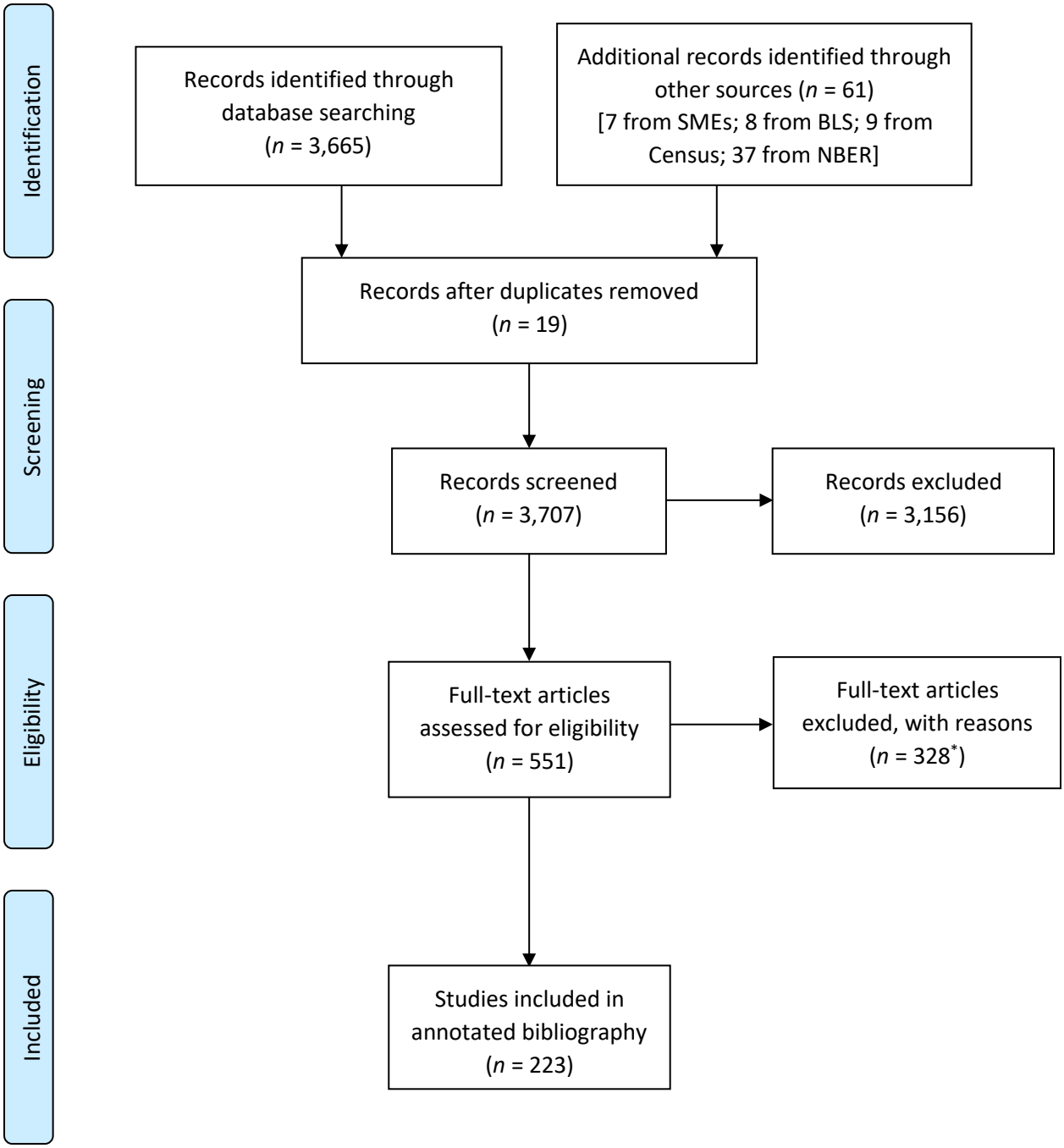
Gender/Sex	Age	Education	Experience	Married	Children	Race	Region
X	X	X	X				

Occupation	Industry	Percent Female	Union	Full or Part Time	Firm Size	Other
X						Performance ratings, break in service and incidence/reason for separation, job level (measure of vertical segregation), job family (measure of horizontal segregation), incidence of promotions.

Yap (2010) estimated a cross-sectional earnings equation based on a standard human capital model in order to explore the determinants of earnings. In addition to productivity-related variables, the equation included four variables to represent race and gender: white males, white females, minority males, minority females. Yap then conducted an Oaxaca-Blinder decomposition.

Key findings: The study found that both white and minority women suffer small yet statistically significant earnings disadvantages when compared to white men. The most important factor in explaining these earnings differences is position in organizational hierarchy within an institution. Yap also found that the model's variables explain 80–90 percent of this wage gap, leaving a small unexplained gender wage gap.

APPENDIX A. FLOWCHART OF SEARCH AND INCLUSION/EXCLUSION PROCESS



Notes: * – Most articles were excluded as they were either theoretical and had no data analysis or no discussion of gender wage gap.

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