

The Gender Pay Gap and its Determinants across the Human Capital Distribution

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Gender pay gap has narrowed, but persists

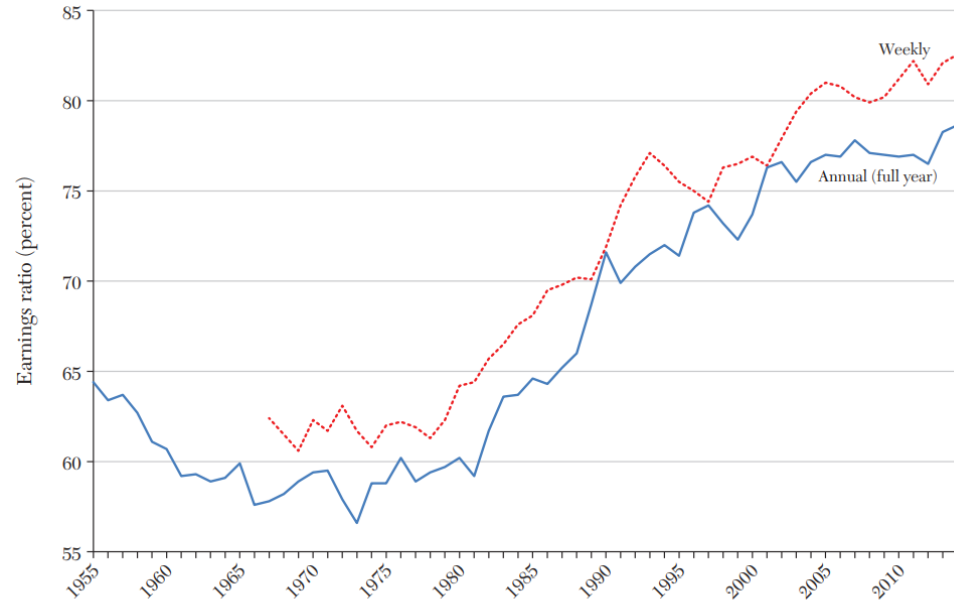


Figure 1. Female-to-Male Earnings Ratios of Full-Time Workers 1955–2014

Notes: Workers aged sixteen and over from 1979 onward, and fourteen and over prior to 1979.

Source: Fig. 7-2 "Evidence on Gender-Differences in Labor Market Outcomes," Francine D. Blau and Anne E. Winkler, *The Economics of Women, Men, and Work*, eighth edition. (New York: Oxford University Press 2018), p.173. By permission of Oxford University Press, USA.

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Gender pay gap in U.S. hasn't changed much in two decades

BY CAROLINA ARAGÃO

The gender gap in pay has remained relatively stable in the United States over the past 20 years or so. In 2022, women earned an average of 82% of what men earned, according to a [new Pew Research Center analysis](#) of median hourly earnings of both full- and part-time workers. These results are similar to where the pay gap stood in 2002, when women earned 80% as much as men.

These trends occurred as gender gaps in standard human capital variables (i.e. years of education, college degree attainment, work experience) greatly narrowed or even reversed.

Prior studies of the gap come in two forms

- Primary strand (e.g. Altonji and Blank 1999; Bertrand 2011; Blau and Kahn 2017):
 - measure average gender difference in pay in full population.
 - decompose into differences in human-capital and other characteristics.
- Newer strand (e.g. Bertrand et al. 2010; Matsa and Miller 2011; Goldin 2014; Wiswall and Zafar 2018; Wasserman 2023):
 - analyze subsamples with “high human capital”, e.g. top percentiles of the pay distribution; top professional occupations; advanced-degree or elite college graduates.
 - Factors other than general human capital: specialized training, occupation choice, labor supply, preferences (cultures, biased networks) that guide (dictate) these choices.

These forms may miss important heterogeneity

- Diversification of U.S. higher education system (Gerber and Cheung 2008; Hoxby 2009; Lovenheim and Smith 2022).
 - Increased variance in the levels and types of training graduates bring to the labor market.
 - Increased variance in opportunities conditional on preparation.
- Average pay gap regressions mask potential differences in gap levels and mechanisms across disparate subgroups of graduates, who face different contexts and challenges.
- Glass-ceiling dynamics at “the top” may not (or may) be relevant for other subgroups.
- Can inform **tailored** designs of postsecondary curricula and support networks to foster inclusion.

Our research questions

- How does the gender pay gap, and its proximate mechanisms, vary across **levels** of postsecondary training?
- How does field of study (**types** of training) contribute to the gap, and how does this contribution vary across degree levels?
- How does the gap evolve with parenthood, and which mechanisms are most important in this evolution?

We construct a novel dataset to answer these questions

- Link postsecondary transcript records provided by the PSEO partnership to:
 - Barron's competitiveness ratings and other institutional characteristics.
 - ACS information on occupation, earnings, and labor supply.
 - Census Household Composition Key (CHCK) information on childbearing.
- Large sample, credentials range from community college certificates to bachelor's degrees conferred by top American colleges.
- Observe **graduation date, detailed degree type, detailed degree field, and parental status.**

Preview of findings

- **The gender gap is not highest for top postsecondary graduates.**
 - By one measure, gap is uniform across degree levels.
 - By another, gap falls as degree level rises.
 - Effects of children are similar.
- **Mechanisms differ across degree levels.**
 - Field of degree, occupation more important at top.
 - Labor supply, residual channels more important at bottom.

Data

- **PSEO degree files** from 9 higher education systems covering 1997-2020.
- **ACS person files** for survey years 2005-2019.
- **PIK crosswalks** to link ACS to PSEO.
- Sample criteria:
 - aged 19-42 at graduation,
 - graduated in 2003-2013,
 - aged 19-59 when responded to ACS,
 - responded to ACS in year of graduation or later.

Data

State Higher Education Systems in Our Sample

System	PSEO	Our Sample	
	Coverage	Coverage	N
Connecticut State Colleges and Universities (CSCU)	2001-2020	2003-2013	14,500
City University of New York (CUNY)	2001-2019	2003-2013	38,500
Louisiana Board of Regents (LABOR)	2001-2019	2003-2013	35,500
Missouri Department of Higher Education and Workforce Development (MDHEWD)	2005-2020	2005-2013	37,500
Ohio Department of Higher Education (ODHE)	2002-2020	2003-2013	108,000
State Council of Higher Education for Virginia (SCHEV)	1997-2020	2003-2013	93,000
State University of New York (SUNY)	2002-2019	2003-2013	107,000
Texas Higher Education Coordinating Board (THECB)	2000-2019	2003-2013	185,000
Utah System of Higher Education (USHE)	2010-2020	2010-2013	11,500
Total			630,000

Source: PSEO transcript records linked to the 2005-2019 ACS and the 2004 Barron's Guide.

Note: Ns rounded for disclosure avoidance purposes.

Data

Summary Statistics of PSEO-ACS Linked Sample

Panel A. Demographics			Panel B. Human Capital and Earnings		
	Mean	SD		Mean	SD
Woman	0.59	0.49	Certificate	0.09	0.28
Age at graduation	25.2	5.0	Associate	0.31	0.46
Age	31.3	6.4	Bachelor	0.61	0.49
Graduation year	2008	3.1	Selective Bachelor	0.23	0.42
ACS year	2014	3.7	Total earnings, women	38.7	39.3
White, non-Hispanic	0.71	0.45	Total earnings, men	53.2	56.2
Black, non-Hispanic	0.09	0.28	Wage/sal earnings, women	38.0	38.6
Asian, non-Hispanic	0.05	0.22	Wage/sal earnings, men	51.5	53.9
Other, non-Hispanic	0.03	0.17	Earned < \$5000, women	0.17	0.37
Hispanic	0.12	0.32	Earned < \$5000, men	0.12	0.32
N = 630,000					

Source: PSEO transcript records linked to the 2005-2019 ACS and the 2004 Barron's Guide.

Note: Earnings are expressed in thousands of US dollars at 2018 prices.

Data

- Merge on institutional characteristics for Bachelor programs from **2004 Barron's guide** and **the College Scorecard**.

Average Institutional Characteristics by Barron's Category

Condensed Barron's Rating	Rejection Rate	Expenditures / FTE student	Graduation Rate (4-year)	Male Total Earnings	N Students	N Institutions
Non-Competitive	0.046	4,960	0.294	52,200	36,500	25
Less Competitive	0.188	4,660	0.335	52,100	36,000	22
Competitive	0.301	5,700	0.468	55,500	150,000	64
Very Competitive	0.331	7,180	0.606	62,900	75,500	22
Highly Competitive	0.418	7,570	0.717	71,400	54,000	9
Most Competitive	0.625	10,040	0.903	85,200	12,500	6

Source: PSEO transcript records linked to the 2005-2019 ACS and 2004 data from Barron's Guide and the College Scorecard.

Note: Earnings are expressed at 2018 prices. Expenditures are expressed in current dollars as of the 2004-05 fiscal year.

- Consider ten degree levels in total: Certificate (short-term, 1-2-year), Associate, Bachelor (not rated, 6 different Barron's categories).

Data

- Use **Census Household Composition Key (CHCK)** to measure parental status.
 - Advantage: does not rely on ACS relationship variables.
 - Disadvantage: only covers births since 1997. May miss births for folks that had children young and then returned to school to pursue a degree.
- Children analysis subsample: individuals aged 28-37, observed in ACS years 2016-2019.

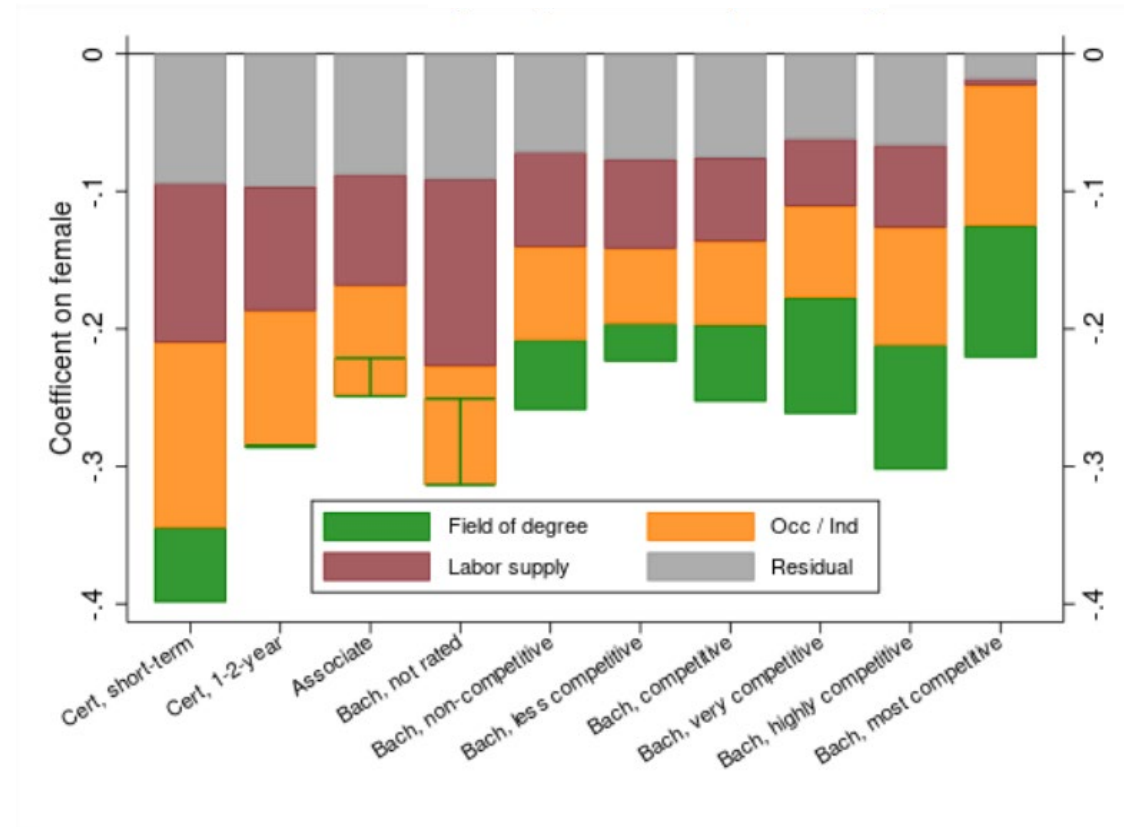
Methodology

- Outcome variables:
 - Total real earnings (including zeros);
 - $\ln(\text{real wage and salary earnings})$. Focus on this outcome today.
- Explanatory variables:
 - **Field** of degree: 2-digit CIP code fixed effects.
 - **Occupation** and **industry** fixed effects.
 - **Labor supply**: interaction of 6 “weeks worked” bins with 8 “usual weekly hours” bins.
- Stratifying variables:
 - **Level** of degree.
 - **Parental status**.

Methodology

- $y_{id} = \alpha_d^0 + \beta_d^0 W_{id} + \varepsilon_{id}.$
- Baseline gender pay gap estimate for degree type d is:
 - $\widehat{\beta}_d^0 / \widehat{\alpha}_d^0$ when y is measured in levels.
 - $\widehat{\beta}_d^0$ when y is measured in logs.
- Sequentially add controls for (1) degree field, (2) occ/ind, and (3) labor supply:
 - $y_{id} = \alpha_d^1 + \beta_d^1 W_{id} + \gamma_d' F_{id} + \varepsilon_{id}.$
 - Amount of gender gap explained by field of degree is $\widehat{\beta}_d^0 - \widehat{\beta}_d^1$. Remaining gap is $\widehat{\beta}_d^1$.

Decompositions by degree level: full sample



Source: PSEO transcript records linked to the 2005-2019 ACS and the 2004 Barron's Guide.

Decompositions by binned degree level: full sample

	Non-Bachelor		Bachelor			
	Certificate	Associate	Not Selective	Selective	Very Selective	Most Selective
Total gap	-0.347 (0.009)	-0.221 (0.005)	-0.243 (0.006)	-0.253 (0.005)	-0.279 (0.005)	-0.221 (0.019)
Field of degree	-0.027 (0.015)	0.028 (0.007)	-0.019 (0.009)	-0.056 (0.007)	-0.087 (0.008)	-0.097 (0.027)
Occupation	-0.119 (0.016)	-0.080 (0.007)	-0.068 (0.010)	-0.060 (0.007)	-0.075 (0.008)	-0.102 (0.027)
Labor supply	-0.105 (0.014)	-0.081 (0.006)	-0.079 (0.008)	-0.061 (0.006)	-0.053 (0.007)	-0.005 (0.023)
Residual	-0.097 (0.008)	-0.088 (0.003)	-0.077 (0.005)	-0.076 (0.004)	-0.064 (0.004)	-0.017 (0.013)
<i>N</i>	46,000	168,000	81,500	135,000	118,000	11,000

Source: PSEO transcript records linked to the 2005-2019 ACS and the 2004 Barron's Guide.

Note: Standard errors appear below coefficient estimates in parentheses. **Bold** point estimates are significantly different from the estimate for Most Selective Bachelor graduates at the 10 percent level or less.

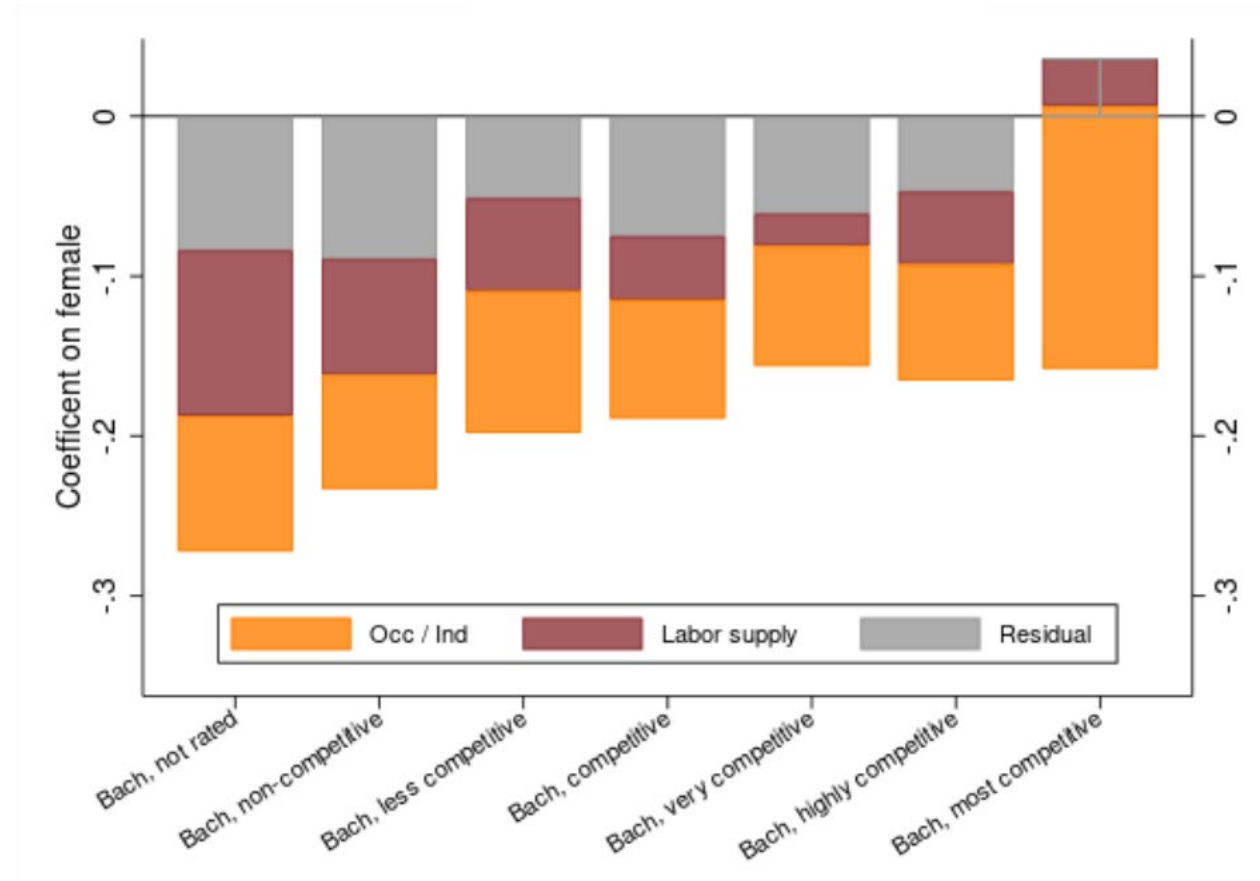
Effects of parenthood on the gender pay gap

	<i>Certificate Grads</i>			<i>Top Bachelor Grads</i>		
	With Children	Without Children	Difference	With Children	Without Children	Difference
Total gap	-0.580 (0.024)	-0.162 (0.029)	-0.418 (0.038)	-0.645 (0.024)	-0.167 (0.015)	-0.478 (0.028)
Field of degree	-0.041 (0.042)	-0.005 (0.045)	-0.036 (0.062)	-0.084 (0.036)	-0.074 (0.022)	-0.010 (0.042)
Occupation	-0.119 (0.050)	-0.086 (0.050)	-0.033 (0.071)	-0.188 (0.036)	-0.063 (0.022)	-0.125 (0.042)
Labor supply	-0.206 (0.045)	-0.041 (0.045)	-0.165 (0.064)	-0.253 (0.032)	-0.008 (0.019)	-0.245 (0.037)
Residual	-0.214 (0.026)	-0.030 (0.027)	-0.184 (0.037)	-0.120 (0.019)	-0.022 (0.012)	-0.098 (0.022)
<i>N</i>	5,100	3,900		6,200	12,400	

Source: PSEO transcript records linked to the 2005-2019 ACS, the 2004 Barron's Guide, and the Census Household Composition Key.

Notes: "Top Bachelor" refers to Bachelor graduates from Highly or Most Competitive institutions. Standard errors appear below coefficient estimates in parentheses. **Bold** point estimates indicate statistically significant effects of children at the 10 percent level or less.

Focusing on Business graduates



Source: PSEO transcript records linked to the 2005-2019 ACS and the 2004 Barron's Guide.

Conclusion

- We provide the first detailed analysis of how the gender pay gap varies across the distribution of pre-labor-market human capital.
 - Fills a gap in a literature that focuses on the average pay gap, or gender inequality in elite subpopulations.
 - Gap varies little, or declines, as degree level rises.
- **Mechanisms** differ by degree level:
 - Field and occupation sorting more important among Top Bachelor graduates.
 - Labor supply and residual channels more important among non-Bachelor and less-competitive Bachelor graduates.
 - Equalizing field of degree choices might significantly improve gender inequality for Top Bachelor graduates relatively early in their careers. Occupation sorting ends up being key.
 - Easing work-family constraints to promote fulltime labor supply and fair treatment by employers might have a particularly large impact on gender inequality for other graduates.

Appendix slides

Other related literature

- Gender pay gap and inequality.
 - Prior studies measure how overall inequality affects *average* gap (Blau and Kahn 1997; Mulligan and Rubinstein 2008; Fortin et al. 2017).
 - Different emphasis from unconditional percentile comparisons (e.g. Arulampalam et al. 2007).
 - Detailed field-of-degree categories; compare to older NLS72 study (Brown and Corcoran 1997).
- Different look at mechanisms behind “child penalties” (many studies).
- Large sample of Business graduates allows us to analyze them separately (Bertrand et al. 2010; Francesconi and Parey 2018; Cortes et al. 2021).

Comparison to ACS sample

	PSEO sample	ACS sample
Share White non-Hispanic	0.71	0.63
Share Black non-Hispanic	0.09	0.12
Share Asian non-Hispanic	0.05	0.09
Avg total earnings, women	38,700	37,200
Avg total earnings, men	53,200	57,200
Share earning < \$5000, women	0.17	0.20
Share earning < \$5000, men	0.12	0.11

Source: PSEO transcript records linked to the 2005-2019 ACS and the 2004 Barron's Guide; 2016 ACS 5-year public-use file.

Notes: ACS sample consists of individuals with at least one year of completed college education and with 2-20 years of potential experience. Earnings are expressed in thousands of US dollars at 2018 prices.

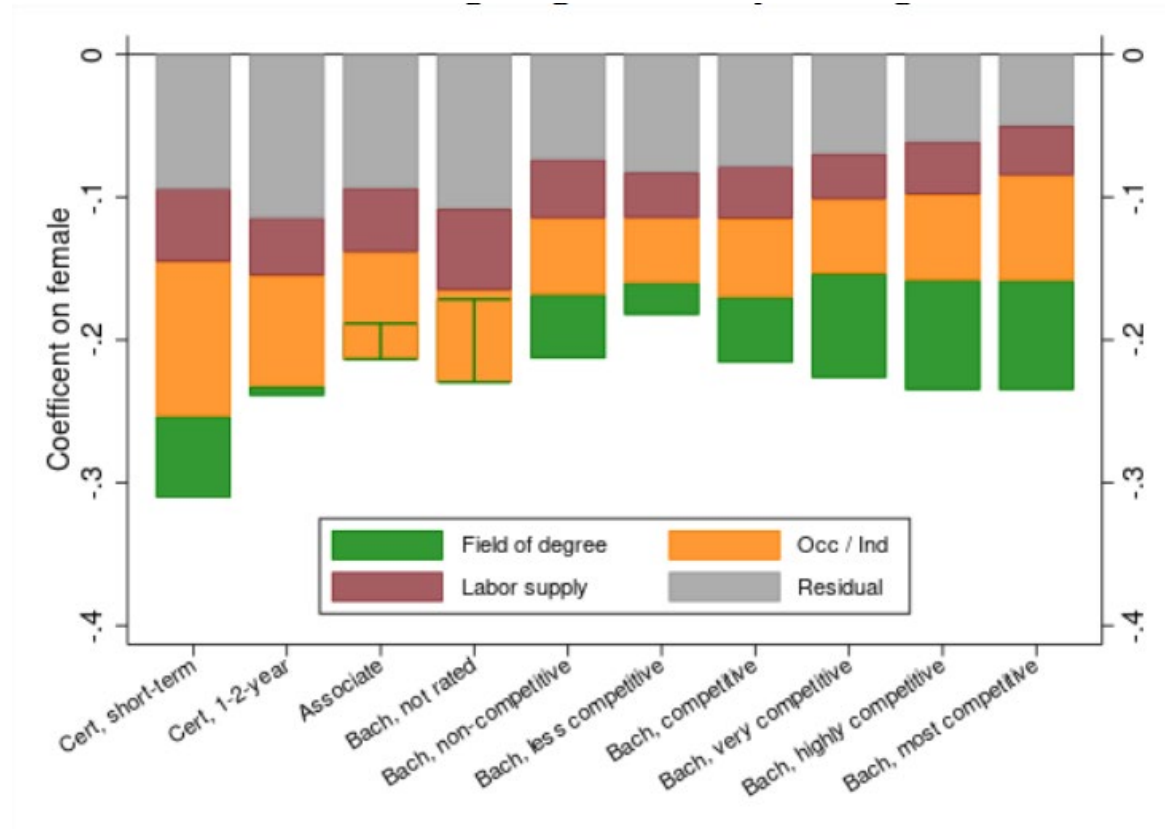
ACS attainment rates by degree level

Degree level	Share with Bachelor degree	Share with advanced degree
Short-term Certificate	0.185	0.031
1-2-year Certificate	0.228	0.042
Associate	0.441	0.080
Unrated Bachelor	0.931	0.215
Non-Competitive	0.933	0.239
Less Competitive	0.929	0.223
Competitive	0.941	0.255
Very Competitive	0.952	0.308
Highly Competitive	0.952	0.338
Most Competitive	0.984	0.454

Source: PSEO transcript records linked to the 2005-2019 ACS and the 2004 Barron's Guide.

Note: Sample restricted to ACS respondents observed at least two years after PSEO degree receipt, and with non-imputed ACS educational attainment information.

Decompositions by degree type: full-year workers only



Source: PSEO transcript records linked to the 2005-2019 ACS and the 2004 Barron's Guide.

Comparison to Brown and Corcoran (1997)

- BC sample: NLS72 respondents with a Bachelor degree, surveyed in 1986 (~8 years after graduation). We compare to sample of Bachelor graduates from rated programs observed 7-10 years after graduation.
- Outcome: $\ln(\text{hourly wage})$.

Statistic	BC	Our study	Difference
Total gap	-0.207	-0.178	-0.029
Explained by field of degree	-0.078	-0.049	-0.029
Share explained	37.7%	27.5%	10.2%

Source: Published estimates from Brown and Corcoran (1997); PSEO transcript records linked to the 2005-2019 ACS and the 2004 Barron's Guide.

Comparison to Bertrand et al. (2010)

- BGK sample: 1990-2006 graduating classes of Chicago Booth, surveyed in 2007. We compare to samples of “Top” and “Non-Top” Bachelor graduates.
- Focus on evolution of overall $\ln(\text{earnings})$ gap with time since graduation.

Time since graduation	Log earnings gap				
	BGK	Our study		Difference w/ BGK	
		Non-Top	Top	Non-Top	Top
0-3 years	-0.189	-0.069	-0.039	-0.120	-0.144
4-7 years	-0.257	-0.180	-0.098	-0.077	-0.167
8-11 years	-0.447	-0.301	-0.296	-0.146	-0.146
12-16 years	--	-0.368	-0.363	--	--

Source: Published estimates from Bertrand et al. (2010); PSEO transcript records linked to the 2005-2019 ACS and the 2004 Barron’s Guide.