Does the Gender Composition of an Occupation Affect its Compensation?

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Motivation

- Well-known negative correlation between female occupational shares and wages of men and women in cross-sections and time-series, even conditional on numerous controls
- Sociological literature uses specific term: “devaluation”
- No causal evidence yet even though question important in context of...
  - increasing female labor supply that has changed the female share in a large number of occupations
  - evidence that occupational segregation is an important driver of remaining gender pay gaps
  - the widespread political effort to encourage (young) women to enter male-dominated, high-paying occupations, e.g. in STEM fields

Motivation

- Causality is difficult to establish
- Changing occupational employment by gender is driven by both supply and demand forces
- Reverse causality also possible:
  - Women value certain amenities/non-pecuniary features more than men (e.g. flexibility)
  - Occupations that offer those amenities attract more women
  - In competitive markets, occupations that increase amenities lower wages in turn (compensating wage differentials)

What We Do

- We analyze the causal impact of the gender composition of an occupation on the wages of men and women in West German labor market
- Establish causality by leveraging the fall of the Berlin Wall in 1989, and the collapse of the German Democratic Republic (GDR)
  - Events triggered sudden, unexpected and gendered shock in potential labor supply to the West German labor market, spanning all occupations
  - Importantly for identification, distribution of women across occupations was very different in the GDR and FRG for reasons solely specific to the two parts of Germany before the Berlin Wall fell
  - We apply an IV approach, in which pre-1989 occupational fields of training of East German men and women serve as excluded instruments

What We Find

- Increase in the female share in an occupation causally leads to lower wages for both men and women working in that occupation
- Evidence is in line with the “devaluation hypothesis” developed in the sociological literature
- Quantitative importance of effects are larger for men than for women
- Because gender composition of occupations at the median evolved in opposite direction for men and women, it contributed to the closing of gender pay gap in recent decades

Literature

- Feminization and pay: MacPherson and Hirsch (1995), Levanon et al. (2009), England et al. (1988, 2007), Murphy and Oesch (2015), Harris (2020)
- “Pollution theory of discrimination” (Goldin, 2014)
- Occupational segregation and “tipping points”: Blau et al. (2013), Blau and Kahn (2017), Pan (2015)

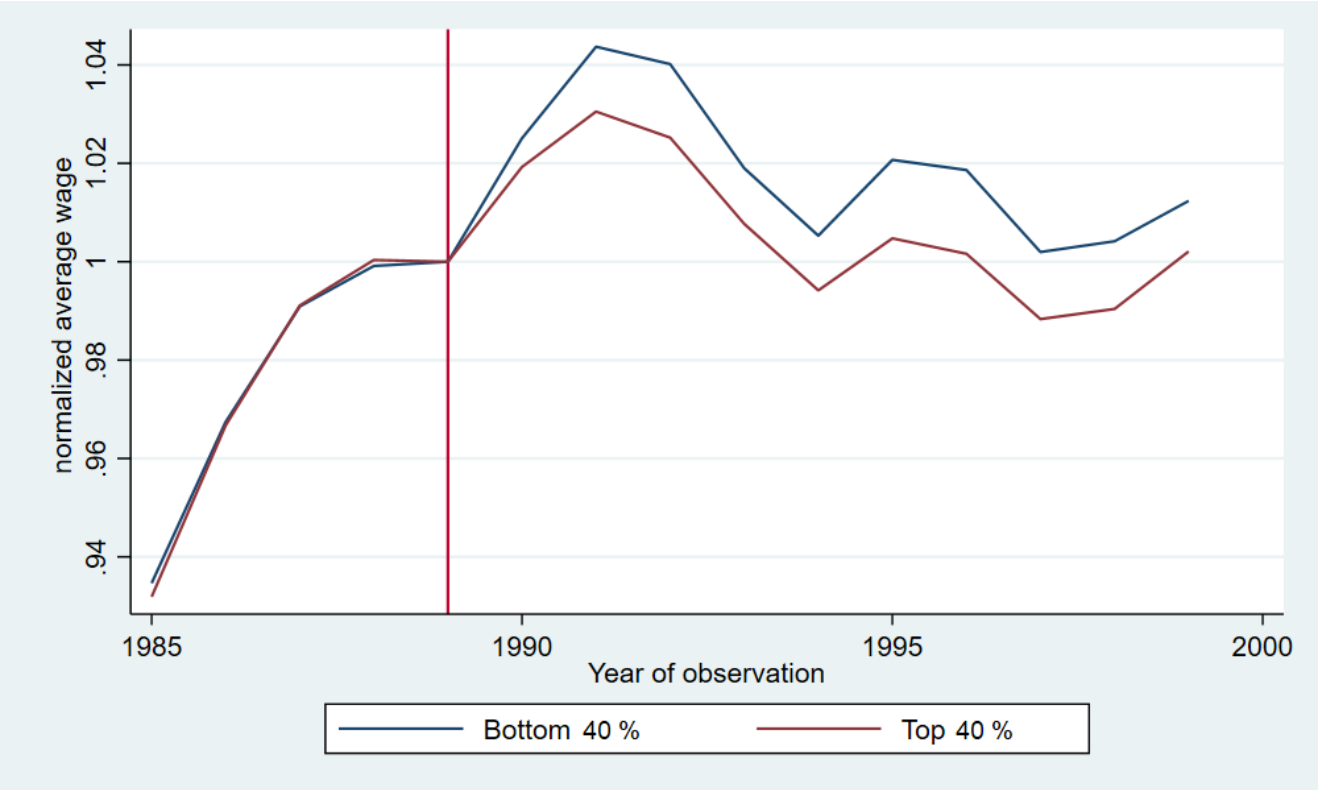
Sociology: Devaluation Hypothesis

- "Value of work" as social construct
- Historically conditioned patriarchal systems generated gender-bias in social construction of value of occupations
  - Society perceives female skills (e.g. "emotional" or "caring" work) as less valuable than male skills
  - Female-dominated occupations pay less for both men and women in the occupation
- Change in the gender composition of an occupation leads to a change in its pay, again for both genders
- Because the female-dominated occupations vary over time, "devaluation" requires that the definition of "female" skills is changing over time

Glance at the Raw Data

Evolution of Normalized Average Wages, West Germany, 1985–1999

Men



Data

1. Primary Data: German Social Security Record (so-called SIAB)
   - 2 percent sample of workers covered by social security
   - Daily wage information in main job as of June 30 each year
   - Detailed individual background information, e.g. gender, age, education, occupation, industry, and employer size
   - Main sample: medium-educated West German workers, employed full-time in West German labor market, aged 25 to 54
2. Data for Construction of IV: Qualification and Career Survey (waves 1991/92 and 1998/99)
   - Independent, representative cross-sections of labor force (including self-employed, unemployed)
   - Allows identification of East Germans as individuals who grew up in the GDR, independent of their current residence in East and West Germany
   - Detailed information on occupation in which East Germans were trained when they were young during GDR-times (i.e. pre-1989)

Conceptual Thoughts: Appropriate Level of Analysis

- "Devaluation" theory operates on occupation (-time) level
- We use age-occupation (-time) level:
  - valuation of amenities/flexibility may be age-specific, e.g. if firms want to attract young women into male-dominated tech occupations
  - methodological reasons:
    - ★ basic mechanism that fosters occupational gender integration is through entry of new cohorts of women (e.g. Blau, Brummund and Liu, 2013)
    - ★ evidence that people within the same occupation but with different age are imperfect substitutes in production (e.g. Prantl and Spitz-Oener, 2020)
    - ★ allows consideration of occupation-time fixed-effects (capture occupation-specific unobserved factors that may change over time, e.g. amenities)

Empirical Specification

$$\log w^{G}_{iaozt} = \beta_0 f_{aot} + \beta_1 L_{aot} + \Pi + \theta_i + \eta_z + \nu_{iaozt} \tag{1}$$

$$\Pi = \varrho_{ao} + \varsigma_{ot} + \tau_{at}$$

With:

f_{aot}: Share of women in each individual's age-occupation-time cell in West Germany

- $G = Men, Women$
- Subscripts indicate individual i, age group a, occupation o, employer z and time t
- Results we show for this specification are robust to the inclusion of individual and employer-related characteristics, e.g. tenure, tenure^2, employer-size

Empirical Specification

$$\log w^{G}_{iaozt} = \beta_0 f_{aot} + \beta_1 L_{aot} + \Pi + \theta_i + \eta_z + \nu_{iaozt}$$

$$\Pi = \varrho_{ao} + \varsigma_{ot} + \tau_{at}$$

With:

f_{aot} : Share of women in age-occupation-time cell in West Germany

β_0 : Coefficient of main interest

$\rightarrow$ identified by differential changes in female share across age-occupation cells over time

Empirical Specification

$$\log w^{G}_{iaozt} = \beta_0 f_{aot} + \beta_1 L_{aot} + \Pi + \theta_i + \eta_z + \nu_{iaozt}$$

$$\Pi = \varrho_{ao} + \varsigma_{ot} + \tau_{at}$$

$\rightarrow$ control for L_{aot}: size of each individual's age-occupation-time cell

Empirical Specification

$$\log w^{G}_{iaozt} = \beta_0 f_{aot} + \beta_1 L_{aot} + \Pi + \theta_i + \eta_z + \nu_{iaozt}$$

$$\Pi = \varrho_{ao} + \varsigma_{ot} + \tau_{at}$$

$\rightarrow$ Control for occupation-time fixed-effects ς_{ot}

$\rightarrow$ Control for individual fixed-effects θ_i

$\rightarrow$ Control for employer fixed-effects η_z

Feminization of Occupations and the Effect on Wages

OLS regressions, pooled data, 1985/86, 1991/92, 1998/99

Dependent variable: Log real daily wages of West Germans (w_{it}^W)								
	Male				Female			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Female Share$_{oat}^W$	-0.591***	-0.448***	-0.448***	-0.369***	-0.279***	-0.078	-0.077	-0.026
	(0.073)	(0.051)	(0.051)	(0.054)	(0.068)	(0.050)	(0.049)	(0.049)
OAT F.E. interactions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual F.E.	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Labour supply	No	No	Yes	Yes	No	No	Yes	Yes
Employer F.E	No	No	No	Yes	No	No	No	Yes
N	817,088				369,105			

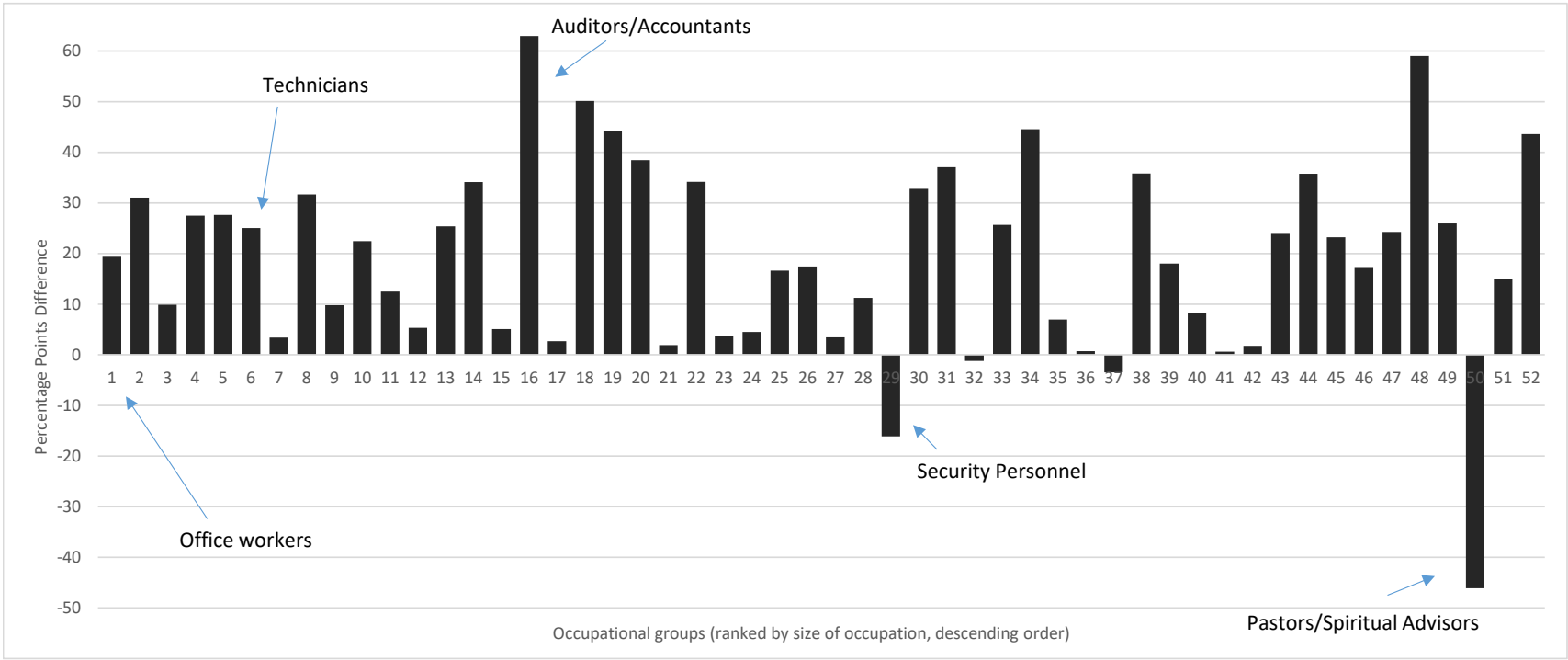
Instrumental Variable Approach

- There might still be age-occupation specific unobserved factors that change over time and that might drive the results, e.g. amenities provided only to the young
- Design an IV approach based on the gendered potential labor supply shock owing to the Fall of the Berlin Wall in 1989, and the associated merging of the East and West German labor market
- The instrumental variables use the pre-1989 occupational fields of training of East German men and women residing in East or West Germany in 1991/92

Validity of Instrumental Variables

- From 1949 to 1989, the GDR was a state socialist society and a centrally-planned economy, the FRG was a social-market economy: very different political and economic systems
- Differences in labor scarcity, gender ideology, family policy, industry structure, as well as educational and vocational training systems in the "two parts of Germany" produced stark differences in the gendered nature of work (e.g. larger labor market attachment of East German women than West German women)
- Importantly for this study, it also resulted in different pre-1989 distribution of men and women across occupations in the GDR and the FRG

East-West Difference in Occupational Female Shares



Main Instrumental Variable

$$f^{IV} = \begin{cases} \left(\frac{L_f^{pool} + L_{fpre}^{West}}{L_f^{pool} + L_m^{pool} + L_{pre}^{West}} \right)_{aot} & \text{if} \quad t = 1991/92, 1998/99 \\ \left(\frac{L_{fpre}^{West}}{L_{pre}^{West}} \right)_{aot} & \text{if} \quad t = 1985/86 \end{cases} \tag{2}$$

Gender-Specific Pool of East Germans

$$L_{gaot}^{pool} = \begin{cases} \sum_{k=1}^{K} \omega_{gaokt} L_{gakt} \quad \text{if} \quad t = 1991/92 \\ \\ \text{artificial ageing of 1991/92 values if t=1998/99} \end{cases} \tag{3}$$

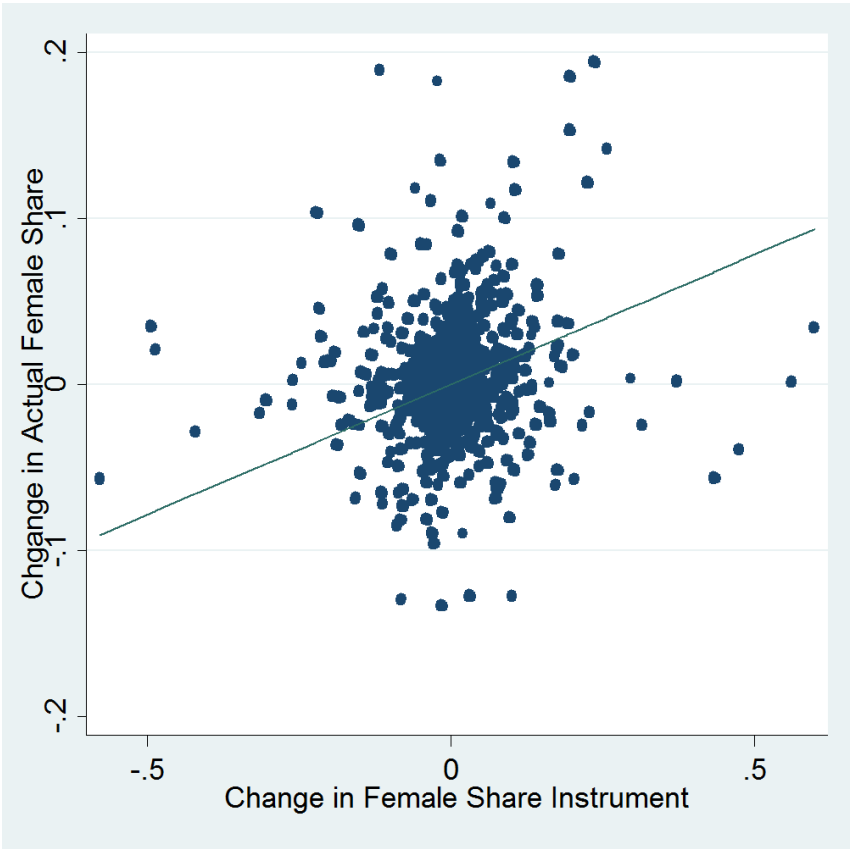
with

$$\omega_{gaokt} = \begin{cases} 1 \quad \text{if} \quad k = o \\ \\ \frac{L_{gaokt}}{L_{gaot}} \quad \text{if} \quad k \neq o \end{cases} \tag{4}$$

- $g :=$ gender (f or m); k indicates the training occupation
- Pool includes all East Germans those who migrated to West Germany and those who stayed in East Germany

Female Share: Graphical Illustration of First Stage

Men



Women



Instrumental Variable for L_{aot}

$$L_{aot}^{IV} = \begin{cases} \left(L_f^{pool} + L_m^{pool} + L_{pre}^{West} \right)_{aot} & \text{if} \quad t = 1991/92, 1998/99 \\ L_{ao,pre}^{West} & \text{if} \quad t = 1985/86 \end{cases} \tag{5}$$

Feminization of Occupations and the Effect on Wages

OLS and 2SLS regressions, pooled data, 1985/86, 1991/92, 1998/99

Dependent variable: Log real daily wages of West Germans (w_{it}^{W})				
	Male		Female	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Female Share$_{oat}^{W}$	-0.369***	-0.874***	-0.026	-0.225
	(0.054)	(0.174)	(0.049)	(0.161)
Full set of oat F.E. interactions	Yes	Yes	Yes	Yes
Individual F.E.	Yes	Yes	Yes	Yes
Labor supply	Yes	Yes	Yes	Yes
Employer F.E.	Yes	Yes	Yes	Yes
1st stage				
Female Share Instrument$_{oat}^{IV}$		0.109***		0.123***
		(0.025)		(0.032)
Labor supply instrumented		Yes		Yes
Control variables as in 2nd stage		Yes		Yes
SW F-test: $\beta^{excl.instr.} = 0$ (p-value)		20.39 (0.000)		15.58 (0.000)

Effect Size

- 1 percentage point increase in female share leads to 0.87 percent lower wages for men and 0.23 percent lower wages for women
- Change in female share between 1985/86 and 1998/99 contributed to closing of gender wage gap:
  - female share of men increased by 2.6 percentage points and declined by 0.55 percentage points for women
  - change in female share led to a 2.24 percent decrease in male wages and a 0.13 percent increase for females

Heterogeneity

2SLS regressions, pooled data, 1985/86, 1991/92, 1998/99

Dependent variable: Log real daily wages of West Germans (w_{it}^W)				
	Male		Female	
	(1)	(2)	(3)	(4)
Female Share $(FS)_{oat}^W$	-0.884***	-0.869***	-0.349***	-0.178
	(0.048)	(0.096)	(0.098)	(0.117)
FS_{oat}^W * 1(Older than 39 years)	-0.004		-0.007	
	(0.142)		(0.426)	
FS_{oat}^W * 1(medium tercile tenure)		0.067***		0.069***
		(0.004)		(0.004)
FS_{oat}^W * 1(upper tercile tenure)		0.097***		0.111***
		(0.006)		(0.007)

Heterogeneity/Robustness

2SLS regressions, pooled data, 1985/86, 1991/92, 1998/99

Dependent variable: Log real daily wages of West Germans (w_{it}^W)				
	Male		Female	
	(1)	(2)	(3)	(4)
Female Share $(FS)_{oat}^W$	-1.009***		-0.253	
	(0.112)		(0.162)	
FS_{oat}^W * 1(0.25-0.5 female share in base year)	0.140***		0.054	
	(0.020)		(0.035)	
FS_{oat}^W * 1(0.5-0.75 female share in base year)	0.117***		0.005	
	(0.029)		(0.043)	
FS_{oat}^W * 1($\geq$ 0.75 female share in base year)	0.074**		-0.023	
	(0.034)		(0.043)	
Female Share $(FS)_{ot}^W$		-0.774***		-2.314
		(0.391)		(1.683)

Ongoing Analyses

- Heterogeneity in effects for stayers and newcomers in occupations
- Occupational inflow and outflow analyses
- Organizational structure of occupation: share part-time/full-time workers, extent of overtime work etc.
- Event-study set-up

Conclusions

- We find strong causal evidence in support of “devaluation” hypothesis, and the notion that the value of work is a social construct
- Society seems to value jobs carried out by women less; this has repercussions on the wages of men
- Results are important in context of political goal to increase female labor supply in certain occupational fields
- Results have implications for the attractiveness of occupations and for the incentives of men to have women enter previously male dominated occupations

Thank You!

Additional Slides

Feminization of Occupations and the Effect on Wages

First stage and reduced form regressions, pooled data, 1985/86, 1991/92, 1998/99

		Male			Female	
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Female Share	Labor Supply	Log Real Daily Wages	Female Share	Labor Supply	Log Real Daily Wages
Female Share Instrument$^{E}_{oat}$	0.109***	-0.000***	-0.094***	0.123***	-0.000***	-0.027*
	(0.025)	(0.000)	(0.020)	(0.032)	(0.000)	(0.015)
Labor Supply Instrument$^{E}_{oat}$	-0.020***	0.004***		-0.026***	0.004***	
	(0.001)	(0.000)		(0.001)	(0.000)	
Full set of oat F.E. interactions	Yes	Yes	Yes	Yes	Yes	Yes
Individual F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Labour supply	No	No	Yes	No	No	Yes
Employer F.E.	Yes	Yes	Yes	Yes	Yes	Yes
SW F-test (oat SE cluster)	20.39	114.54		15.58	119.88	
R^2 adjusted			0.89			0.86