Is this really a man’s world?
The effect of vertical and horizontal segregation

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- Cultural explanations (Cejka and Eagly, 1999, Charles and Bradley, 2009)
- Psychological traits (Gneezy et al., 2003, Niederle and Vesterlund, 2007, Buser et al., 2014)
- Preference-based explanations (Hakim, 2000, Redmond and McGuinness, 2019)
Research question

- Analyse the entire spectrum of gender driven differences in wage distribution.
- Use the degree of female participation to explore the association between gender wage gap over the wage distribution and occupation types.
- Exploit difference in vocational versus general qualifications to explore the association between gender gap over the wage distribution and educational background.
Grade transformation analysis and relative distribution methods to compare the wage distributions of males and females.

Focus on multiple dimensions: gender wage gap across the wage spectrum, gender-driven occupational segregation, and disparities in educational background.

Explores the existence of any correlation between the type of educational background and gender differences throughout the wage distribution.
Summary of the results

- Women in FD and M occupations end up facing the toughest glass ceiling effect. Women in MD occupation perform on average as well as men.
- Vocational qualification: women face the wider wage gap in the upper part of the wage distribution in MD and M occupations.
- General qualification: women face the lowest glass in MD occupations.
Outline

- Methodology
- Data and Descriptive Statistics
- Results
- Robustness Checks
- Conclusion
Methodology

- $Y_0$: a random variable composed of male real hourly wages (reference population)
- $F_0(y)$, and $f_0(y)$: CDF and PDF - reference population.
- $Y$: a random variable composed of female real hourly wages (comparison population).
- $F(y)$ and $f(y)$: CDF and the PDF - comparison population.
- $F$ and $F_0$ are assumed to be continuous with common support.

The relative distribution of $Y$ (comparison) to $Y_0$ (reference) can be defined as the distribution of the random variable:

$$R = F_0(Y)$$

The PDF of $R$, known as the relative density:

$$g(r) = \frac{f(F_0^{-1}(r))}{f_0(F_0^{-1}(r))} = \frac{f(Q_0(r))}{f_0(Q_0(r))}$$

**Outcome of interest**: Rank of women’s wage relative to men’s wage

**Key variables:**
- Occupation type: Male-dominated (0-29.9 %) Mixed occupations (30-69.9 %) Female-dominated (70-100 %)
- Highest qualification achieved (Vocational Level 1-8, General level 1-8)
Figure 1: Mean Hourly wage by occupation
Figure 2: Violin plot of the wage distribution by gender and across occupation
Figure 3: Distribution of qualification among men and women

[Bar chart showing the distribution of qualifications between men and women across different levels, with bars for men in blue and for women in red.]

No Qual, Level 1 Vet, Level 1 Acad, Level 2 Vet, Level 2 Acad, Level 3 Vet, Level 3 Acad, Level 4 Vet, Level 4 Acad, Level 5 Vet, Level 5 Acad, Level 6 Vet, Level 6 Acad, Level 7/8 Vet, Level 7/8 Acad.

Percentage axis ranges from 0 to 25.

Legend: Men (blue) and Women (red).
Data

Figure: Distribution of qualification by field of specialization among men and women

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Figure 5: Age-hourly wage relationship for women/men across education types
Data

Control variables:

- Demographics: Gender, Ethnicity, Relationship status, Number of children, Geographic area
- Firm and Job characteristics: Firm size, Occupation, Public/Private company
Figure 6: Gender comparison of the adjusted mean of the logarithm of the hourly wage by education and occupation type
Figure 7: Relative CDF
Results

Figure 8: Relative PDF
Figure 9: Relative PDF across occupation type
Figure 10: Relative PDF across occupation and education type
Figure 11: Relative density balanced versus unbalanced data
Robustness checks

- Location and shape decomposition
- Composition of background characteristics

\[ R_{ijsq} = \beta_0 + \beta_1 \text{Background}_{ijsq} + \beta_2 \text{Family}_{ijsq} + \beta_3 \text{Job}_{ijsq} + \epsilon_{ijsq} \]

- Common Support
- Subject of the highest qualification achieved
- Weekly working hours
Robustness checks: Location and shape

Overall RD

Location shift

Shape shift

Proportion of male subsample
Robustness checks: Location and shape

| Log Hourly wage | Coef.  | Std. Err. | z   | P>|z| | [95% Conf. Interval] |
|-----------------|--------|-----------|-----|----|------------------|
| Location        | 61.019 | 2.390     | 25.53 | 0 | 56.334 - 65.703  |
| Shape           | 38.980 | 2.390     | 16.31 | 0 | 34.296 - 43.665  |

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only. The test implemented is based on the comparison of the entropy (Kullback-Leibler divergence) of the unadjusted and adjusted relative distributions (Bernhardt et al, 1999).
Conclusions

- Women in FD and M occupations end up facing the toughest glass ceiling effect. Women in MD occupation perform on average as well as men.
- Vocational qualification: women face the wider wage gap in the upper part of the wage distribution in MD and M occupations.
- General qualification: women face the lowest glass ceiling in MD.
### Table A.1: Occupation types

<table>
<thead>
<tr>
<th>Male-dominated Occupations</th>
<th>Mixed Occupations</th>
<th>Female-dominated Occupations</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOC21 Science, research, engineering and technology professionals</td>
<td>SOC11 Corporate managers and directors</td>
<td>SOC22 Health professionals</td>
</tr>
<tr>
<td>SOC31 Science, engineering and technology associate professionals</td>
<td>SOC12 Other managers and proprietors</td>
<td>SOC23 Teaching and educational professionals</td>
</tr>
<tr>
<td>SOC33 Protective service occupations</td>
<td>SOC24 Business, media and public service professionals</td>
<td>SOC32 Health and social care associate professionals</td>
</tr>
<tr>
<td>SOC51 Skilled agricultural and related trades</td>
<td>SOC34 Culture, media and sports occupations</td>
<td>SOC41 Administrative occupations</td>
</tr>
<tr>
<td>SOC52 Skilled metal, electrical and electrical trade</td>
<td>SOC35 Business and public service associate professions</td>
<td>SOC42 Secretarial and related occupations</td>
</tr>
<tr>
<td>SOC53 Skilled construction and building trade</td>
<td>SOC54 Textiles, printing and other skilled trades</td>
<td>SOC61 Caring personal service occupations</td>
</tr>
<tr>
<td>SOC81 Process, plant and machine operatives</td>
<td>SOC71 Sales occupations</td>
<td>SOC62 Leisure, travel and related personal service occupations</td>
</tr>
<tr>
<td>SOC82 Transport and mobile machine drivers and operatives</td>
<td>SOC72 Customer service occupations</td>
<td></td>
</tr>
<tr>
<td>SOC91 Elementary trades and related occupations</td>
<td>SOC92 Elementary administration and Service occupations</td>
<td></td>
</tr>
</tbody>
</table>
### Table A.2: Qualifications in the UK: General vs Vocational qualifications

<table>
<thead>
<tr>
<th>Level</th>
<th>Common qualifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Foundation Diploma, GCSE (grades D–G), Scottish National level below and equal to level 4, NVQ Level 1, City and Guilds foundation-part 1, GNVQ foundation level, BTEC first certification, RSA level 1, Entry level qualification, Level 1 Award, Basic Skill qualification, Key Skill qualification, YT/YTP Certificate</td>
</tr>
<tr>
<td>Level 2</td>
<td>Higher diploma, O-level - GCSE (grades A*–C), Scottish National level 5, intermediate Welsh Baccalaureate, NVQ Level 2, City and Guilds Craft- part 2, GNVQ intermediate, BTEC level 2, RSA Level 2, Level 2 Diploma/Certificate</td>
</tr>
<tr>
<td>Level 3</td>
<td>Advanced diploma, A-level, International Baccalaureate, SCE higher, Scottish Baccalaureate, Advanced Welsh Baccalaureate, NVQ Level 3, City and Guilds Advanced Craft, GNVQ Advanced, BTEC National, RSA level 3, Level 3 Award/Certificate</td>
</tr>
<tr>
<td>Level 4</td>
<td>Certificate of Higher Education, NVQ Level 4, Higher National Certificate (HNC), BTEC Professional award, certificate and diploma level 4, RSA Level 4, Level 4 Award/Certificate/Diploma, Nursing</td>
</tr>
<tr>
<td>Level 5</td>
<td>Diploma of Higher Education, Foundation degree, Teaching foundation stage/primary education/secondary education/further education. Higher National Diploma (HND), BTEC Professional Award, Level 5 Certificate/Diploma/Award</td>
</tr>
<tr>
<td>Level 6</td>
<td>First Degree/ Foundation degree, BTEC Advanced Professional Award, Level 6 Certificate/Diploma/Award</td>
</tr>
<tr>
<td>Level 7</td>
<td>Master's degree, Integrated master's degree, BTEC Advanced Professional award, Postgraduate certificate/diploma level 7</td>
</tr>
<tr>
<td>Level 8</td>
<td>NVQ Level 5, Doctorates</td>
</tr>
</tbody>
</table>
Figure A.1: Relative density balanced versus unbalanced data by education and occupation types
Appendix: Composition of background characteristics

\[ R_{ijsq} = \beta_0 + \beta_1 \text{Background}_{ijsq} + \beta_2 \text{Family}_{ijsq} + \beta_3 \text{Job}_{ijsq} + \epsilon_{ijsq} \]

- The human capital measures (qualification type and level) are found to be significant and to have the expected relationship with the relative wage: higher-educated women, on average, perform better in relative wage terms.

- Age also influences relative wages, particularly for women in male-dominated roles, with relative pay rising as women grow older, especially for those with a general qualification.

- Having children impacts relative pay for women in female-dominated or mixed occupations, leading to a decrease in relative wages, particularly pronounced for women with vocational backgrounds.

- Being married is negatively associated with relative wages in female-dominated occupations.
Appendix: Subject of the highest qualification achieved

\[ R_{ijsq} = \beta_0 + \beta_1 \text{Background}_{ijsq} + \beta_2 \text{Family}_{ijsq} + \beta_3 \text{Job}_{ijsq} + \alpha_0 \text{Vocational}_{ijsq} \times \text{MatchedSubject}_{ijsq} + \alpha_1 \text{Vocational}_{ijsq} + \alpha_2 \text{MatchedSubject}_{ijsq} + \epsilon_{ijsq} \]

- Women with vocational backgrounds, would benefit from obtaining qualifications focused on medicine or management, respectively.
- Acquiring a relevant qualification could assist women working in SOC61 ”Caring personal and service occupation,” SOC22 ”Health professionals,” SOC24 ”Business, media, and public service professionals,” and SOC35 ”Business and public service associate professionals” to achieve improved standings within the male wage distribution.
- Women with a vocational background are worse off than those with a general background in terms of relative wage.
Appendix: Weekly working hours

The distribution of weekly working hours across wage deciles for women and men within different occupation types, reveals that women in female-dominated fields consistently have the lowest average working hours, with the most significant gender gap in terms of monthly working hours occurring in the top percentile.