Te Pūnaha Matatini
Data ▪ Knowledge ▪ Insight

What drives the gender wage gap? Examining the roles of sorting, productivity differences, and discrimination

Isabelle Sin, Motu Economic and Public Policy Research and Te Pūnaha Matatini Centre of Research Excellence

Steven Stillman, Free University of Bozen-Bolzano

Richard Fabling, Independent Researcher

Australian Gender Economics Workshop
14 February 2019

Motivation and objectives

- Women earn less than men on average, controlling for observable characteristics (e.g. age, education, industry etc)

- But can't control for <u>unobservable</u> differences in men's and women's productivity (e.g. effort, motivation etc)

- Main objective:

  - Combine NZ firm production data with wage data

  - Estimate extent to which lower pay for women reflects lower productivity

- Additional objectives: Evaluate other popular explanations for gender pay gap

Possible explanations for the gender pay gap

1. Women work in industries and firms that pay everyone less

2. Women are less productive than men, e.g. because they've taken time off work to have children

3. Employers statistically discriminate

4. Women are less willing to negotiate for higher pay or promotions or are less successful at negotiation

5. Employers taste discriminate against women - they're more willing to hire or promote men than women or are willing to pay men more for work of the same value
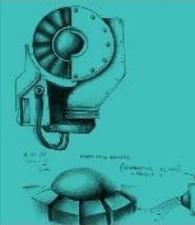
SNZ Data Confidentiality

Access to the data presented was managed by Statistics New Zealand under strict micro-data access protocols and in accordance with the security and confidentiality provisions of the Statistics Act 1975.

Our findings are not Official Statistics. The opinions, findings, recommendations, and conclusions expressed are those of the authors, not Statistics NZ, Motu Economic and Public Policy Research, or the Free University of Bozen-Bolzano.
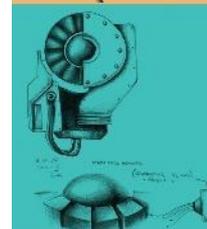
Data: Individual level

- From Linked Employer-Employee Data

- Individual-level data on monthly wages paid by each employer, based on tax data (PAYE)

- Aggregate to annual averages for financial years 2001-11

- For wage regressions use wages paid by main employer only

- Personal characteristics: gender, age, tenure with employer

- Linked to firm data
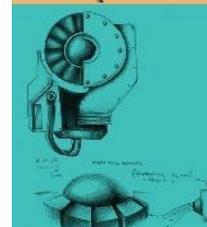
Data: Firm level

- From Longitudinal Business Database

- Comprehensive data on financial performance and other business characteristics (industry, multi-plant, working proprietors)

- Annual measures of:

  - Gross output

  - Capital services

  - Intermediate consumption

  - Construct labour input of different types, wage bill

- Only includes for-profit firms in the measured sector (83% of employing firms, 69% of overall employment)

- We limit to firms with 5+ employees

Empirical strategy: Sorting

- Objective: Estimate proportion of gender wage gap caused by women working in industries or firms that pay everyone less

- Individual-level wage regressions that include a female dummy

- Add detailed industry fixed effects (~500 industries) to see how much of gender wage gap remains within industries

- Add firm fixed effects
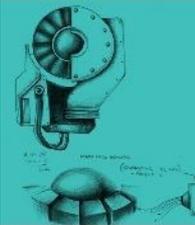
1. Sorting: Regular wage regressions

Table 2: Industry and Firm Sorting and the Gender Wage Gap

| Dep var: ln(earnings)	All Firms		Firms w/ 5+ head count and prody data		
Variable	(1)	(2)	(3)	(4)	(5)
Female	-0.222**	-0.207**	-0.235**	-0.203**	-0.192**
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Aged 25 to 39	0.346**	0.277**	0.387**	0.304**	0.283**
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Aged 40 to 54	0.393**	0.323**	0.446**	0.364**	0.356**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Aged 55+	0.288**	0.229**	0.318**	0.256**	0.266**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
FTEs (ln)	1.220**	1.172**	1.200**	1.135**	1.089**
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
4-Digit Industry FE		Yes		Yes	
Firm by Year FE					Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R-squared	0.802	0.829	0.798	0.833	0.864
Observations	11,265,400	11,265,400	5,425,400	5,425,400	5,425,400

Notes: Asterisks denote: * p<0.05, ** p<0.01. Standard errors, in parentheses, are robust and clustered at the individual level.
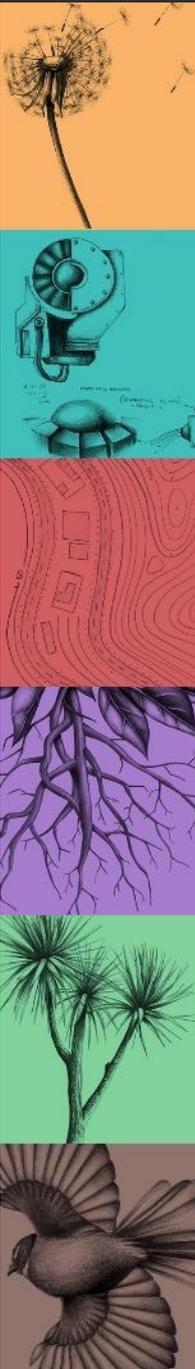
2. Productivity differences

Intuition

- Estimate relative earnings and relative marginal productivity of women compared with men by comparing total wage bills and output of similar firms with different gender mix of employees

- Compare relative earnings of females with their relative productivity

- Determine to what extent differences in the wages of men and women are explained by differences in the value they contribute to their employers
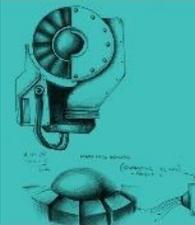
2. Productivity differences

At firm-year level, jointly estimate by NLSUR:

• Production function: Firm gross output as a translog function of total labour input and other inputs

• Wage bill equation: Firm total wage bill similarly

In both

$$TotalLabour = MaleLabour + \phi FemaleLabour$$

Says 1 unit of female labour has same effect on firm output (or wage bill) as φ units of male labour

Estimate φ in each equation
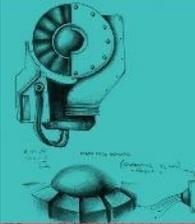
2. Productivity differences

- Production function:

  - $\phi_{pf} = 1$ implies men and women produce the same output with the same labour input

- Wage bill equation:

  - $\phi_{wb} = 1$ implies men and women are paid equally for the same labour input

- $\phi_{pf} = \phi_{wb}$ implies men and women are paid the same for producing the same output

- $1 - \dfrac{\phi_{wb}}{\phi_{pf}}$ is extent to which women are paid less for producing the same output (unexplained wage gap)
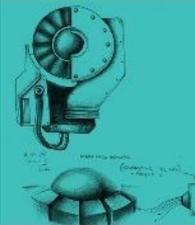
2. Productivity differences: Production Function & Wage Bill Equation

**Table 3: Joint NLSUR Estimation of Augmented Translog Production Function**

Measure of Labour Inputs	Head Count	FTEs	FT and PT as Separate Inputs	Head Count w/ FTE Adjustment
Prodn fn phi_female	0.688**	0.930	1.077	0.977
	(0.036)	(0.041)	(0.054)	(0.045)
Wage bill eqn phi_female	0.608**	0.773**	0.908**	0.817**
	(0.013)	(0.010)	(0.011)	(0.011)
Difference (1 - phi_wb/phi_pf)	11.6%**	16.9%**	15.7%**	16.4%**
	(0.041)	(0.036)	(0.042)	(0.038)
Number of Firms	290,490	290,490	290,490	290,490

Notes: Asterisks on phis indicate difference from 1, on phi difference theyindicate difference from 0: * p<0.05, ** p<0.01. Standard errors in parentheses account for clustering at the firm level. All regressions are weighted by either firm head count (cols 1 and 3) or firm FTE (cols 2 and 4).

# 2. Productivity differences

- We find that within industries:

  - Production has little relation to firm gender composition (holding other inputs constant)

  - But wage bill is significantly lower in firms with higher proportion of female employees

- Infer on average a woman is paid 84 cents for work for which a man would be paid $1

- Conclude productivity differences cannot explain majority of gender wage gap
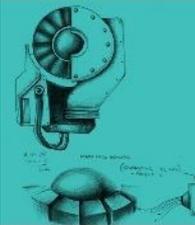
3. Statistical discrimination

Statistical discrimination:

- When workers can't signal true productivity, employers use aggregate information to estimate productivity

- Even when groups have same means, if one has more variation in productivity then employers will pay them less (Aigner & Cain, 1977)

- As workers have more chance to demonstrate their productivity, wages should come to reflect true productivity
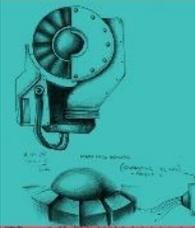
3. Statistical discrimination

- We find the unexplained wage gap is higher at greater age and tenure

- We conclude statistical discrimination is unlikely to be the main driver of the gender wage gap
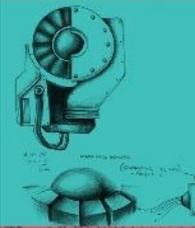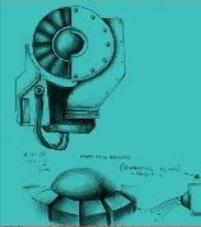
4. and 5. Bargaining or taste discrimination

Basic approach:

1. Estimate the extent to which women are paid less for work of the same value separately for each industry-year pair

2. Ask how industry unexplained wage gaps vary with:

   - competition faced by firms in output markets

   - worker skill

   - tightness of labour market

   - three-way interactions between these
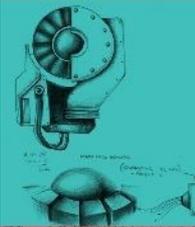
4. and 5. Bargaining or taste discrimination

3. Infer the characteristics of industry-years that have large unexplained gender wage gaps...

...and that have small or negative ones

4. Compare the patterns with what we'd expect if bargaining differences or taste discrimination were the main driver of the unexplained gender wage gap

Heterogeneity by industry in unexplained wage differences
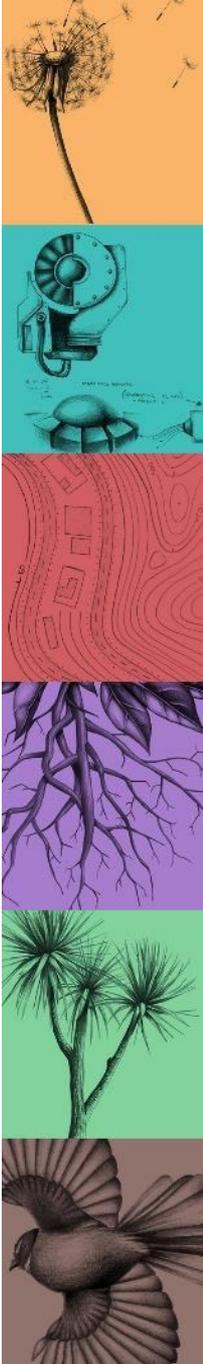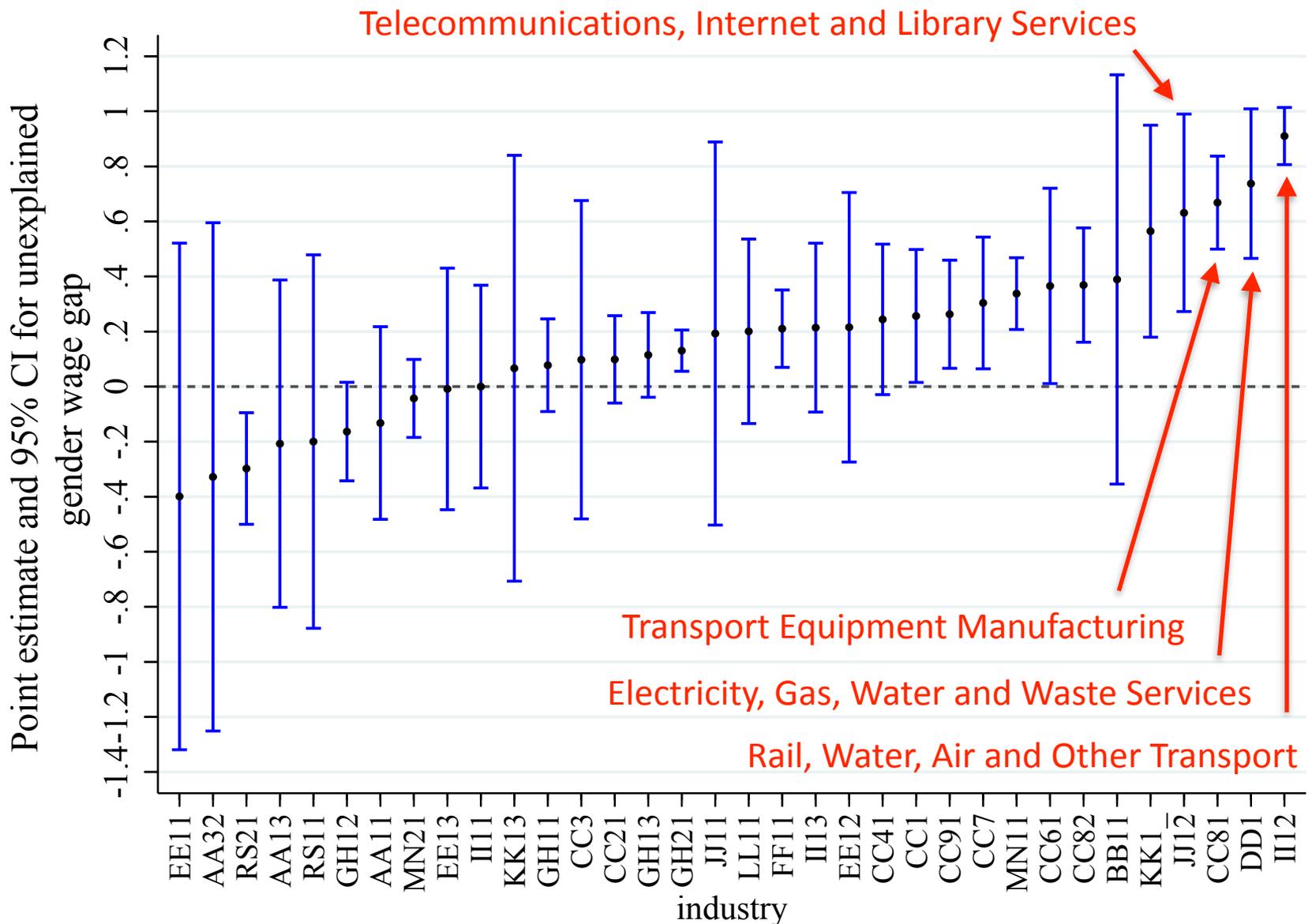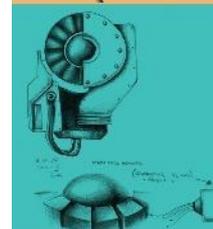
4. and 5. Bargaining or taste discrimination

Predictions from literature:

- If a firm in a competitive product market were to taste discriminate it would get driven out of the market by its competitors that didn't discriminate (Becker, 1957)

- Employers forego profit when a vacancy is unfilled, so taste discrimination is more costly in a tight labour market (Biddle and Hamermesh, 2013)

- Rent sharing is most likely when workers have specialised skills and search is costly (McLaughlin, 1994)

- Firms are more likely to bargain in tighter labour markets, when workers have higher reservation wages (Ellingsen and Rosén, 2003)

4. and 5. Bargaining or taste discrimination

- So for firms to have the potential to pay workers who contribute the same value different wages there must be rents to share from:

    - Low competition in the output market

    - High skilled employees - where the match between employee and firm matters

- And where there are rents to share:

    - Bargaining —> larger unexplained wage gaps when labour market is tight

   - Taste discrimination —> larger gap when labour market is slack

4. and 5. Bargaining or taste discrimination

- So for firms to have the potential to pay workers who contribute the same value different wages there must be rents to share from:

    - Low competition in the output market

    - High skilled employees - where the match between employee and firm matters

- And where there are rents to share:

    - Bargaining —> larger unexplained wage gaps when labour market is tight

    - Taste discrimination —> larger gap when labour market is slack

# Measuring conditions faced by firms

- Construct indexes that measure for each industry-year:

    - Employee skills

    - Product market competition

    - Tightness in skilled labour market

- Data-driven approach: principal component analysis for each concept, use first principal component, normalised to mean 0, sd 1
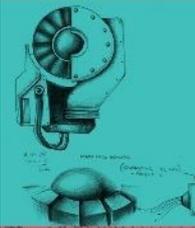
4. and 5. Bargaining or taste discrimination

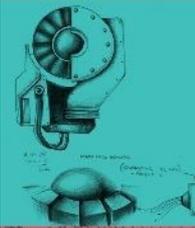| Dep var: Unexplained gender wage gap in industry-year	(1)	(2)	(3)
Higher skill (1st PCA component)	0.192***	0.192***	0.066
	(0.033)	(0.061)	(0.142)
Less competition (1st PCA Component)	0.059*	0.011	0.059
	(0.030)	(0.027)	(0.071)
More difficulty hiring (1st PCA component)	0.076*	0.063*	0.058
	(0.041)	(0.036)	(0.048)
Higher skill * Less competition	0.196***	0.148***	0.103
	(0.053)	(0.051)	(0.075)
Higher skills * More difficulty hiring	-0.009	-0.038	-0.017
	(0.032)	(0.028)	(0.035)
Less competition * More difficulty hiring	0.004	0.034	-0.001
	(0.030)	(0.030)	(0.054)
Higher skill * Less competition * More difficulty hiring	-0.139***	-0.118**	-0.079
	(0.045)	(0.045)	(0.061)
2-Digit Industry Fixed Effects	No	Yes	No
3-Digit Industry Fixed Effects	No	No	Yes
R-squared	0.076	0.129	0.136
Observations	266	266	266

Notes: * p<0.10, ** p<0.05, *** p<0.01. Standard errors, in parentheses, are clustered at the 3-digit industry level. Only data from 2005 to 2011 is included and all regressions are weighted by the inverse of the standard error of the estimated dependent variable. All regressions include year fixed effects as well as the listed variables.
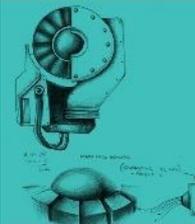
# 4. and 5. Bargaining or taste discrimination

Interpretation of results:

- 1 sd more skilled employees => wage gap 19.2 % pts higher at mean of other variables

- This gap is doubled if product market is 1 sd *less* competitive, or zero if product market is 1 sd *more* competitive

- This additional effect of lower product market competition is eliminated if 1 sd tighter labour market

- Gender wage-productivity gap is largest where high-skilled workers, low product market competition, slack labour market

4. and 5. Bargaining or taste discrimination

Interpretation of results:

- 1 sd more skilled employees => wage gap 19.2 % pts higher at mean of other variables

- This gap is doubled if product market is 1 sd *less* competitive, or zero if product market is 1 sd *more* competitive

- This additional effect of lower product market competition is eliminated if 1 sd tighter labour market

- Gender wage-productivity gap is largest where high-skilled workers, low product market competition, slack labour market

- More consistent with importance of taste discrimination
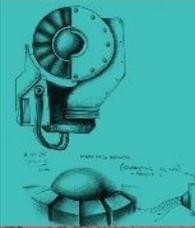
Gender wage gap takeaways

- The majority of the gender wage gap is not explained by:
    - Sorting by industry or firm
    - Differences in productivity between observably similar men and women
- The unexplained gender wage gap is:
    - Greater among older workers and those with longer tenure at their firm
    - High in industry-years with high-skill workers, low competition in firm product markets, and slack labour markets
- Suggest taste discrimination is more important driver of unexplained gender wage gap than differences in bargaining or statistical discrimination