You're the one that I want! Understanding the over-representation of women in the public sector

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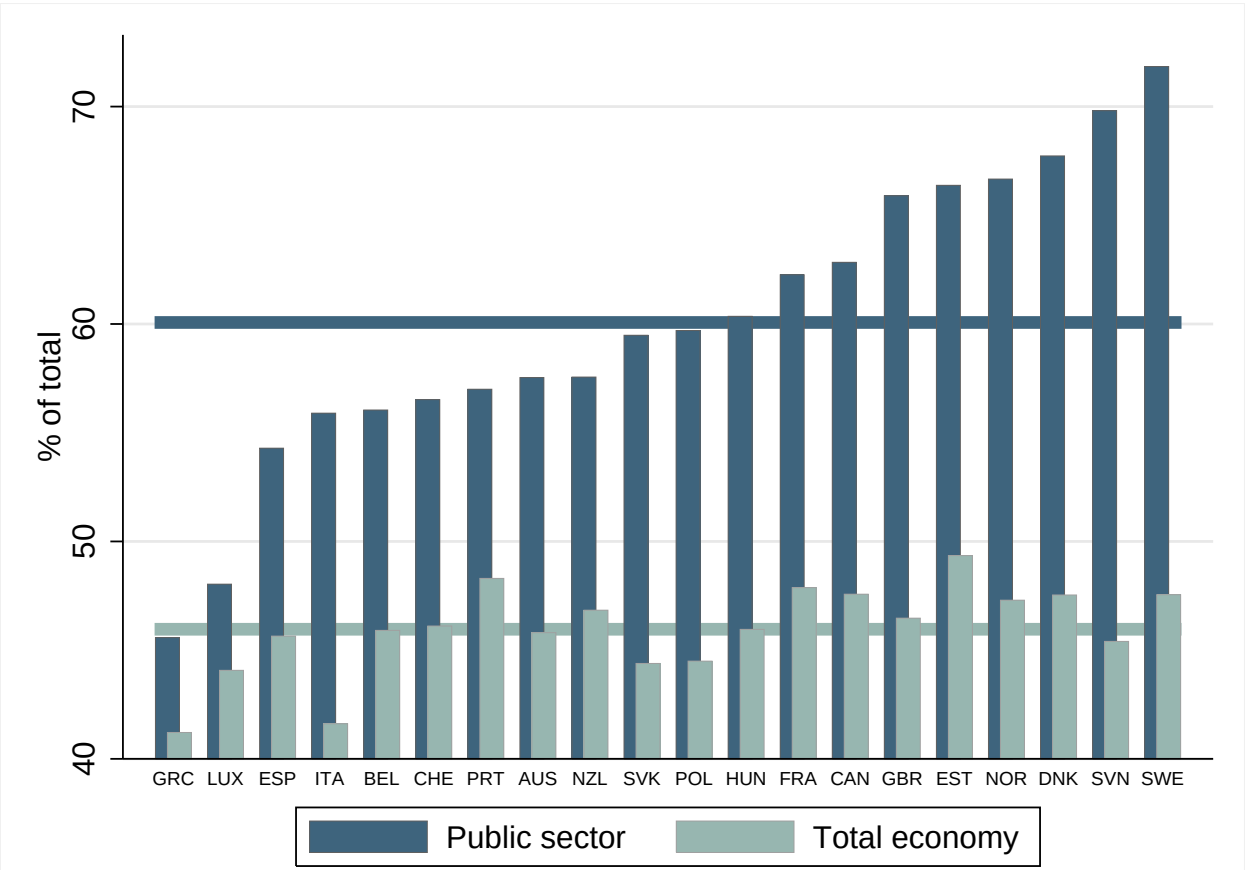
Public employment is more important for women



Source: OECD (2015); this data does not include the US; 56 percent of US public sector workers are women compared to 48 of workers, see Hammouya (1999).

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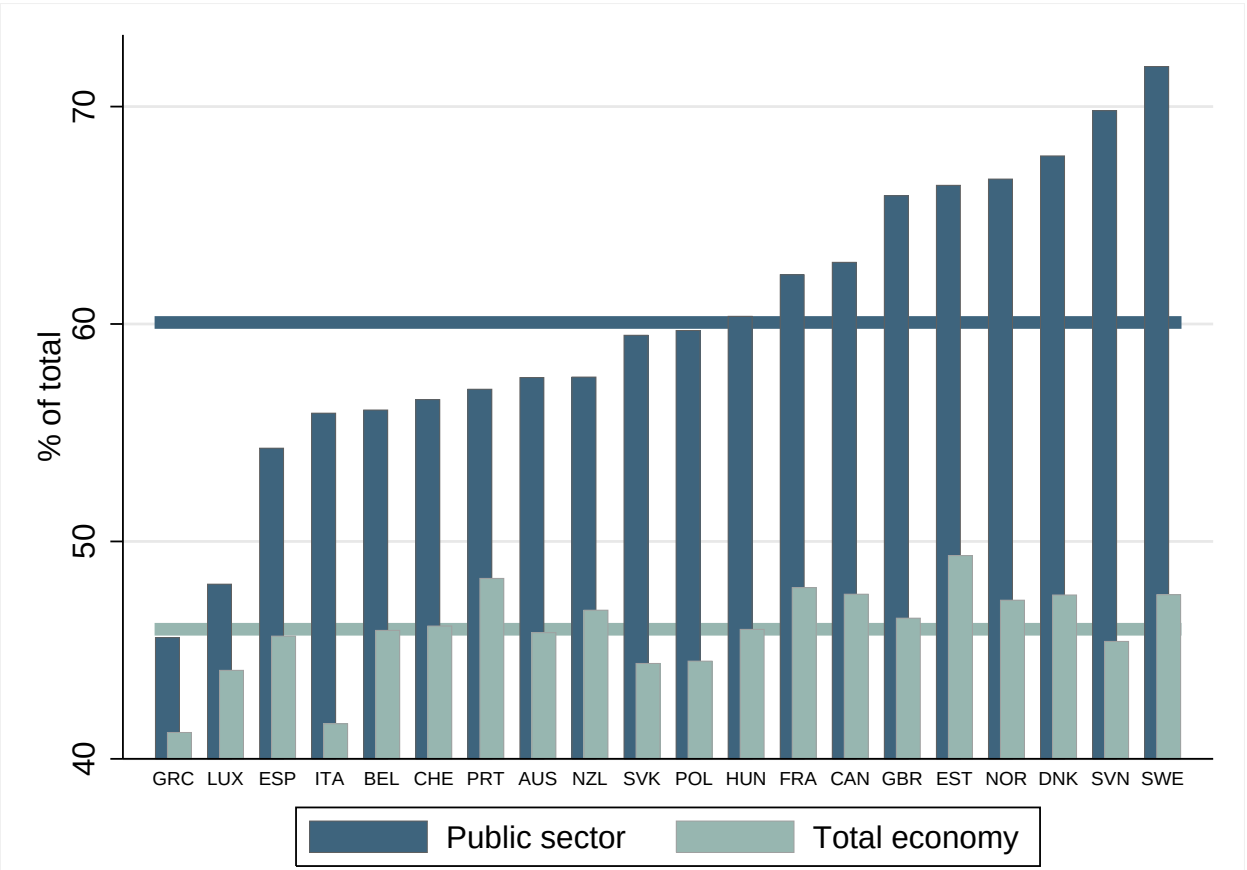

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→ Robust to measurement, over time, age, education, industries, occupations..

Main research question:

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2. lower gender wage gaps;
3. better work-life balance;
4. higher job-security.

Lower gender wage gaps in the public sector

$$log(y_i^a) = \beta_0 + \beta_1 f + \beta_2 X_i + \beta_3 m \times pub + \beta_4 f \times pub + \beta_5 C_i + d_r + d_y + \epsilon_i$$

Note: CPS for 1996-2018, Structure of Earnings Survey from 2002, 2006, 2010, and 2014.

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	US		Spain	
	(1)	(2)	(1)	(2)
Public-sector wage premium				
Men	-0.0198***	-0.0289***	0.0015	0.0082***
	(-6.26)	(-9.48)	(0.62)	(3.68)
Women	0.0547***	0.0530***	0.0688***	0.0732***
	(19.67)	(18.63)	(28.65)	(32.43)
Gender wage gap				
Private	-0.2888***	-0.2861***	-0.2145***	-0.2472***
	(-158.68)	(-156.20)	(-163.18)	(-196.78)
Controls				
Age	X	X	X	X
Education	X	X	X	X
Reg., year	X	X	X	X
Tenure ^{2}			X	X
Occupat.	X	X	X	X
Part time dummy	X		X	
Only fll time wkr		X		X
Obs.	1,037,822	796,920	876,274	747,228
R-squared	0.5090	0.3975	0.5989	0.5383

Note: CPS for 1996-2018, Structure of Earnings Survey from 2002, 2006, 2010, and 2014.

Fewer annual working hours in the public sector

$$log(hours_i) = \alpha_0 + \alpha_1 f + \alpha_2 X_i + \alpha_3 pub + \alpha_4 C_i + d_r + d_y + \epsilon_i$$

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Panel B: hours regressions				
Public sector hours premium				
Public	-0.0109***	-0.0286***	-0.0419***	-0.0365***
	(-10.15)	(-37.00)	(-38.11)	(-74.59)
Controls				
Age	X	X	X	X
Education	X	X	X	X
Reg., year	X	X	X	X
Tenure ^{2}			X	X
Occupat.	X	X	X	X
Part time dummy	X		X	
Only fll time wkr		X		X
Obs.	1,008,225	777,538	876,274	747,228
R-squared	0.3799	0.0685	0.5478	0.3031

Note: CPS for 1996-2018, Structure of Earnings Survey from 2002, 2006, 2010, and 2014

Higher job security

Hazard rates by sector and gender

	US			**Spain**		
	All	Men	Women	All	Men	Women
$P \to U$	**0.015**	0.016	0.012	**0.043**	0.042	0.044
$P \to I$	0.023	0.019	0.027	0.033	0.025	0.045
$G \to U$	**0.007**	0.006	0.008	**0.022**	0.020	0.023
$G \to I$	0.018	0.015	0.020	0.024	0.019	0.027

▸ Conditional probabilities

- P = Private sector
- G = Public sector

Ingredients for a model

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3. Job security:
   - Flows from public (private) employment to unemployment
4. Preferences:
   - Residual needed to explain female over-representation.

Model: General setting

- Search and matching model with .
  - Men and women $j = [m, f]$.
  - Private and public sector $i = [g, p]$,
- Continuous time.
- Risk neutral agents with discount rate $r > 0$.

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  - Men and women $j = [m, f]$.
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- Continuous time.
- Risk neutral agents with discount rate $r > 0$.
- At each instant, τ individuals die and a new generation is born.
- Draw a preference for public sector ϵ_j, distributed $\Xi^j(\cdot)$ on $[-\infty, \infty]$.
  - Join the public-sector labor market if ϵ is high enough.
  - Join the private sector otherwise.
- In each market, people can be employed (e) or non-employed (ne).

Labor market - agent j

- At rate λ, they draw x, value of home production
  - Men draw from $F_m(\cdot)$,
  - Women draw from $F_f(\cdot)$ [different by gender].
- Flow utilities:

$$v_{i,j}^{E} = (1 - \xi_i)x + w_{i,j},$$
$$v_{i,j}^{NE} = x,$$

- Time costs of work ξ_i [different across sectors].

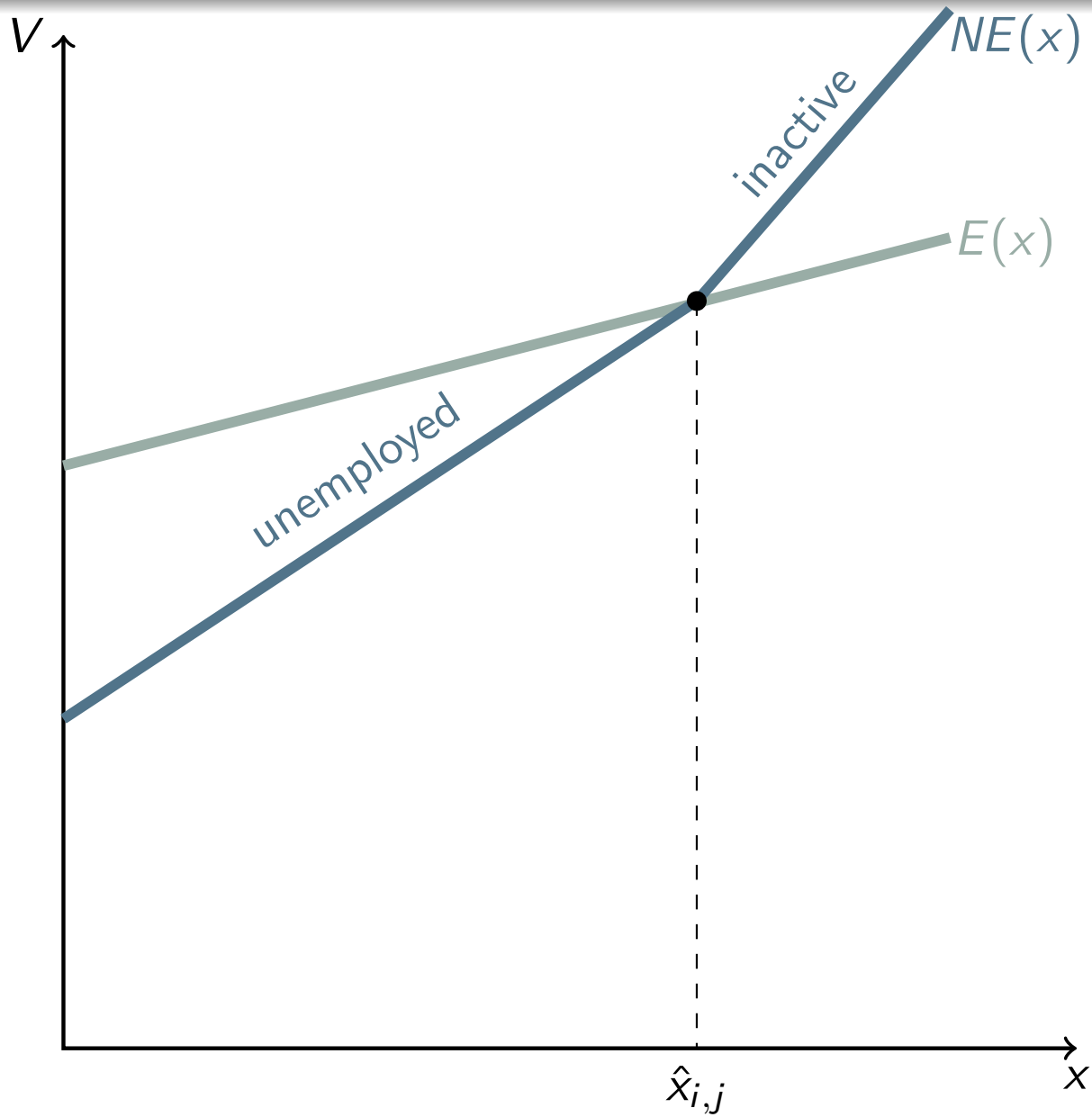
Value functions

$$(r+\tau+\lambda)E_{i,j} = v_{i,j}^{E} + \delta_i[NE_{i,j} - E_{i,j}] + \lambda \int_0^{\infty} \max(E_{i,j}(x'), NE_{i,j}(x'))dF_j(x')$$

$$(r+\tau+\lambda)NE_{i,j} = v_{i,j}^{NE} + m(\theta_i)[\max(E_{i,j}, NE_{i,j}) - NE_{i,j}] + \lambda \int_0^{\infty} NE_{i,j}(x')dF_j(x')$$

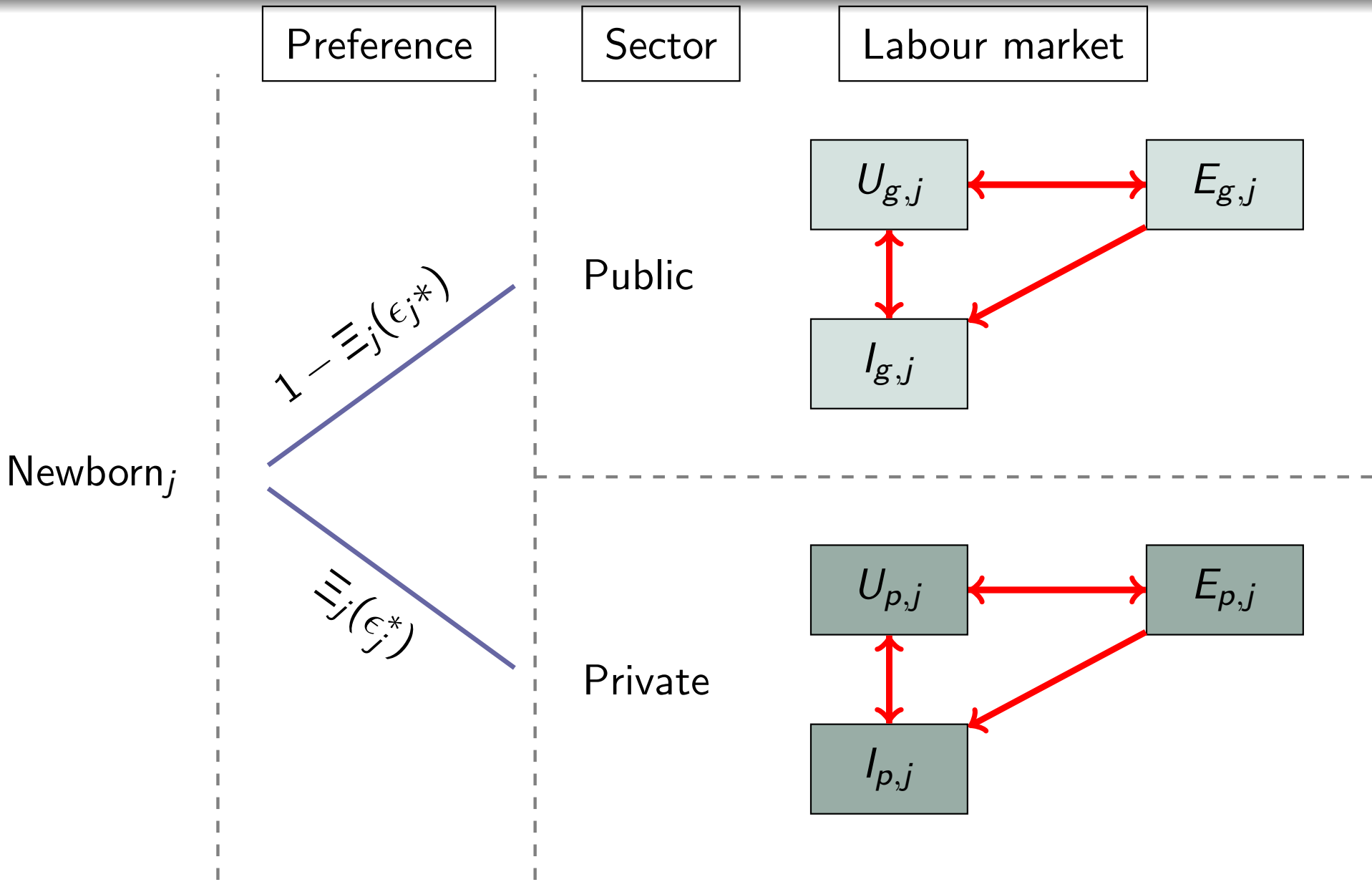
- Exogenous separations at rate δ_i [different across sectors].

Decision Threshold



▸ Threshold

Decision of newborn - Segmented markets



▸ Flows between States

Closing the model

- Private sector:
  - Male wage: $w_m = \beta y$
  - Value of a job same for male and female workers: $J_m = J_f$
  - Endogenous gender wage gap: Women are more likely to quit.
  - To target observed gap: Assume a "wedge" on women's wages
  - Free-entry condition pins down θ_p and hence $m(\theta_p) = \zeta \theta_p^{\eta}$.

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  - Hires workers to compensate for the ones who retire, or separate into unemployment or inactivity.
  - **Does not react to market tightness.**

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- Government:
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  - Hires workers to compensate for the ones who retire, or separate into unemployment or inactivity.
  - **Does not react to market tightness.**
- Initial choice of sector:
  - Comparing expected values of inactivity and unemployment in the private and the public sector, including preferences ϵ_j:
  - $\max\left\{(1 - F_j(\hat{x}_{p,j}))I_{p,j} + F_j(\hat{x}_{p,j})U_{p,j}; (1 - F_j(\hat{x}_{g,j}))I_{g,j} + F_j(\hat{x}_{g,j})U_{g,j} + \epsilon_j\right\}$

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Summarizing the model

Differences between men and women:

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Interaction P & G : Public-sector employment and wages affect:

$\rightarrow$ expected values for searching in the public sector.

$\rightarrow$ decision to join each sector.

$\rightarrow$ tightness and job creation in the private sector.

Mechanisms behind over-representation

- Lower gender wage gap public sector, higher premium π_f
  - Value for women's employment in public sector increases.
  - On the margin, men prefer a "less crowded" private sector.
  - Magnitude of effect depends on preference distribution.

Mechanisms behind over-representation

- Better conciliation, less working time (lower ξ_g)
  - Value for employment in public sector increases for both genders.
  - If women have on average higher opportunity costs of working, effect will be stronger for them.
  - Again, in that case men would prefer a "less crowded" private sector.

Mechanisms behind over-representation

- Higher job security, lower job separation rate δ_g
  - Value for employment and non-employment in public sector increases.
  - If women have higher opportunity costs of working and lower wages, might benefit less from safer jobs.
  - In that case, women might prefer "less crowded" private sector.

Mechanisms behind over-representation

- Different preferences
  - Different means affect gender composition across sectors on top of job characteristics; variance determines magnitude of crowding out effect.

Calibration strategy

- France, UK, Spain, US separately.
- Fix 11 parameters.
- Calibrate 9 parameters.
- 9 targets

Drivers for women's over-representation

	Benchmark	No sector differences no preference differences $\pi_j = 1$ $\xi_g = \xi_p$ $\delta_g = \delta_p$ $\bar{\epsilon}_f = \bar{\epsilon}_m$	No wage difference $\pi_j = 1$	No hours diff. $\xi_g = \xi_p$	No job security diff $\delta_g = \delta_p$	No sector diff. $\pi_j = 1$ $\xi_g = \xi_p$ $\delta_g = \delta_p$
Public-sector employment shares ratio						
US	1.36	0.99	1.15(**57.1%**)	1.35(1.9%)	1.36(-1.2%)	1.16(56.4%)
UK	1.86	1.00	1.86(-0.9%)	1.83(2.4%)	1.87(-1.3%)	1.87(-2.3%)
FR	1.59	1.01	1.53(10.5%)	1.55(6.9%)	1.60(-2.2%)	1.48(**18.3%**)
ES	1.56	0.93	1.33(40.1%)	1.52(6.7%)	1.58(-4.2%)	1.33(**41.2%**)
US						
College	1.41	0.89	0.90(**124.6%**)	1.45(-9.6%)	1.41(-0.8%)	1.02(96.2%)
Non-college	1.19	1.00	1.19(2.3%)	1.19(1.6%)	1.19(-1.6%)	1.19(2.1%)

Alternative decomposition:

Work life balance and job-security premia

Percentage of wage private sector workers would sacrifice for public sector hours

Country	$[\xi_p = \xi_g]$	
	Women	Men
US	0.84	0.81
UK	1.46	0.93
France	3.52	2.82
Spain	2.23	1.78

Details

Work life balance and job-security premia

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Percentage of wage private sector workers would sacrifice for public sector separation rates

Country	$[\delta_p = \delta_g]$	
	Women	Men
US	0.98	1.02
UK	0.92	1.17
France	1.43	1.66
Spain	2.88	3.39

▸ Details

Effects of public-sector policies for Spain

Policy	**Spain**
Increase of wages by 1 percent	
Δ unemployment rate male	0.07 pp.
Δ unemployment rate female	0.15 pp.
Δ inactivity rate male	-0.06 pp.
Δ inactivity rate female	-0.09 pp.
Δ aggregate wage gap	-0.05 pp.
Increase of employment by 1 percent	
Δ unemployment rate male	-0.03 pp.
Δ unemployment rate female	-0.06 pp.
Δ inactivity rate male	0.01 pp.
Δ inactivity rate female	0.01 pp.
Δ aggregate wage gap	-0.01 pp.

▸ Other countries

Conclusion

1. Selection of women into the public sector is driven by:
   - an intrinsic preference for public-sector occupations (mainly in the UK).
   - lower gender wage gaps (57% in US, 40% Spain, 11% in France);
   - better work-life balance (7% in France and Spain);
   - no role for job security;
   - stark differences across educational groups.

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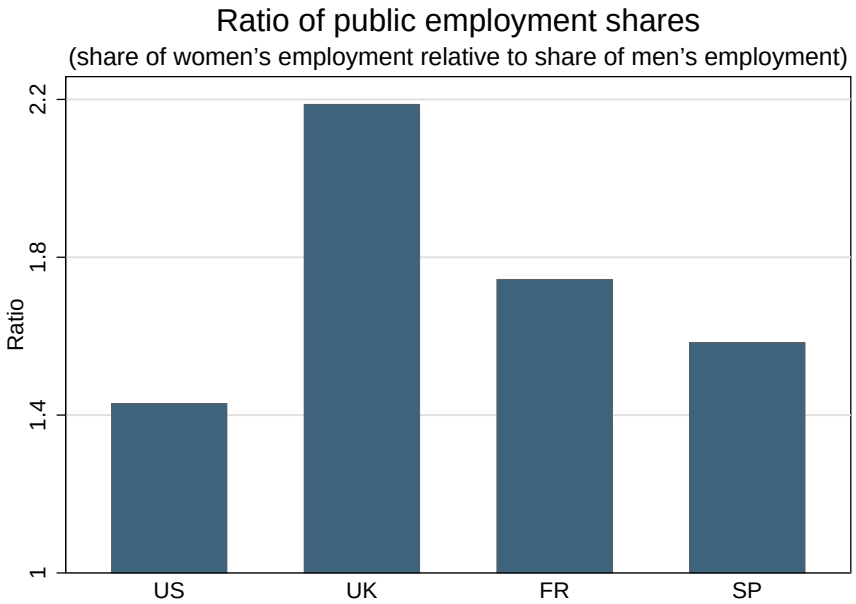
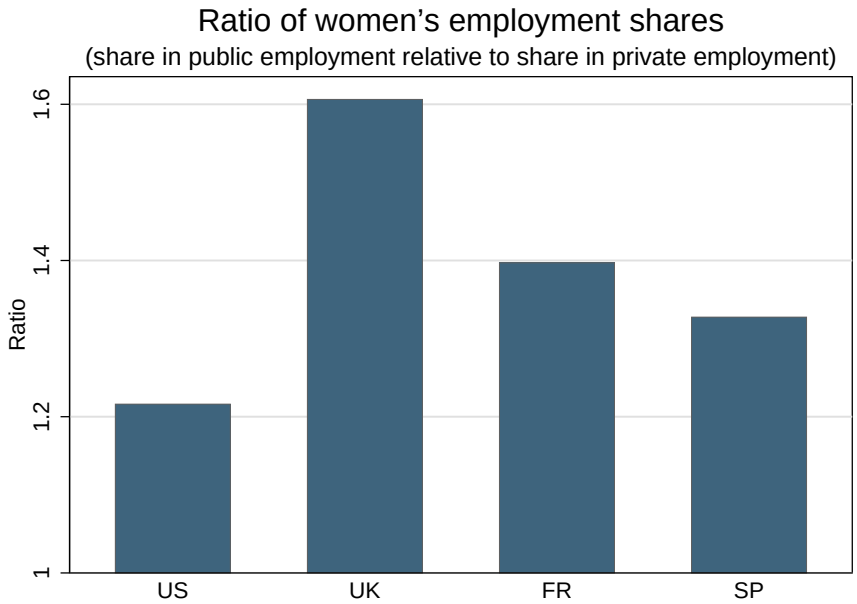
3. Policies regarding public sector wages and employment affect women's unemployment 2-3 times as much as men's.

Gender bias in public employment

.. is robust to measurement





Public-sector employment, by gender

	Public sector	Private sector	Total
Women	$e_{g,f}$	$e_{p,f}$	e_f
Men	$e_{g,m}$	$e_{p,m}$	e_m
Total	e_g	e_p	e

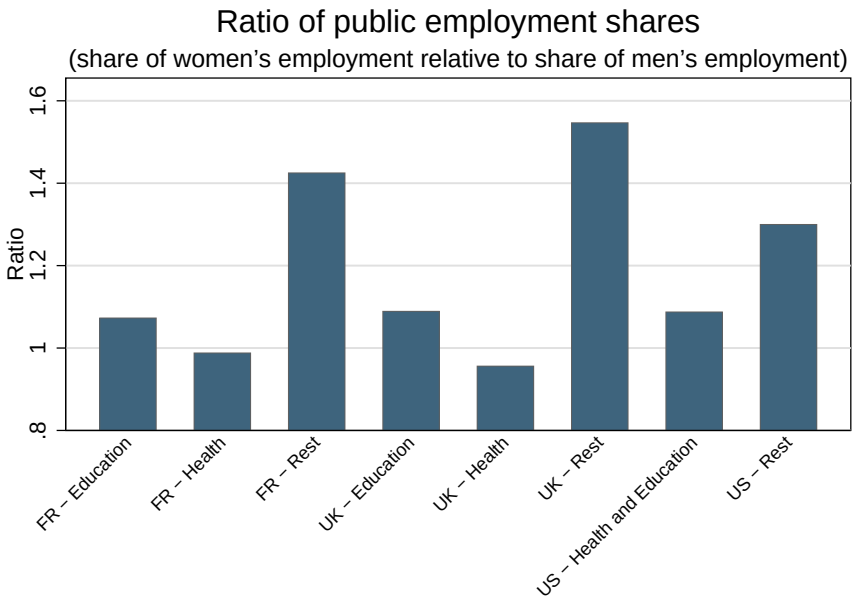
Note: Government (g), private (p), women (f), men (m).

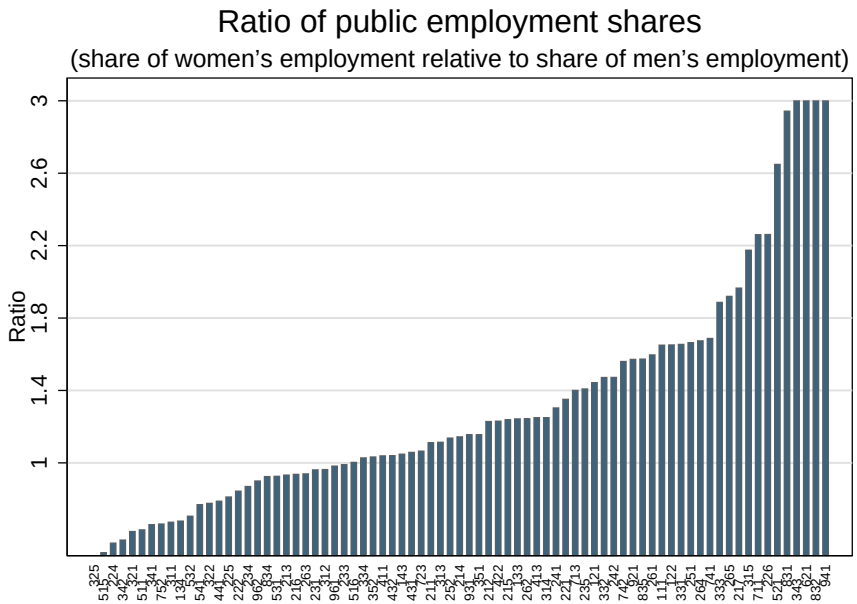
Two statistics:

- **Ratio of public employment share**: $rg = \frac{\frac{e_{g,f}}{e_f}}{\frac{e_{g,m}}{e_m}}$,
- **Ratio of women employment shares** : $rf = \frac{\frac{e_{g,f}}{e_g}}{\frac{e_{p,f}}{e_p}}$,

Gender bias in public employment

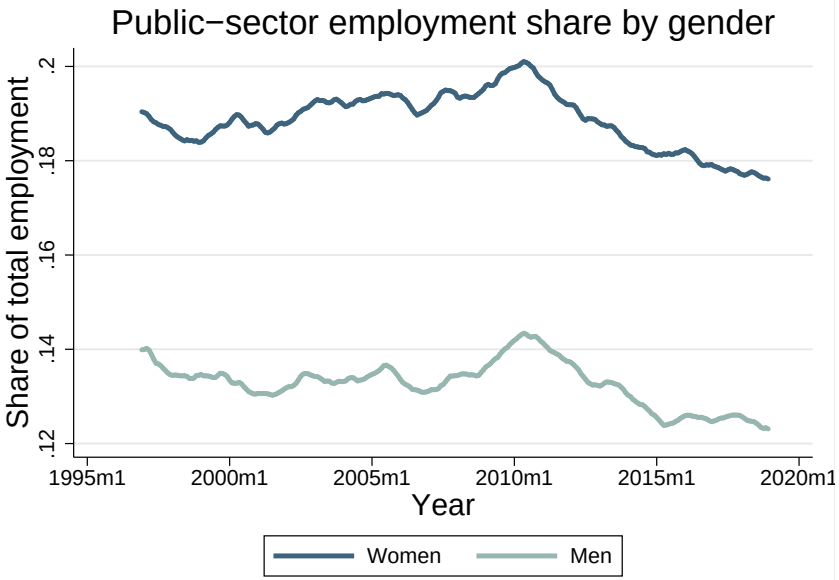
...across industries and occupations..

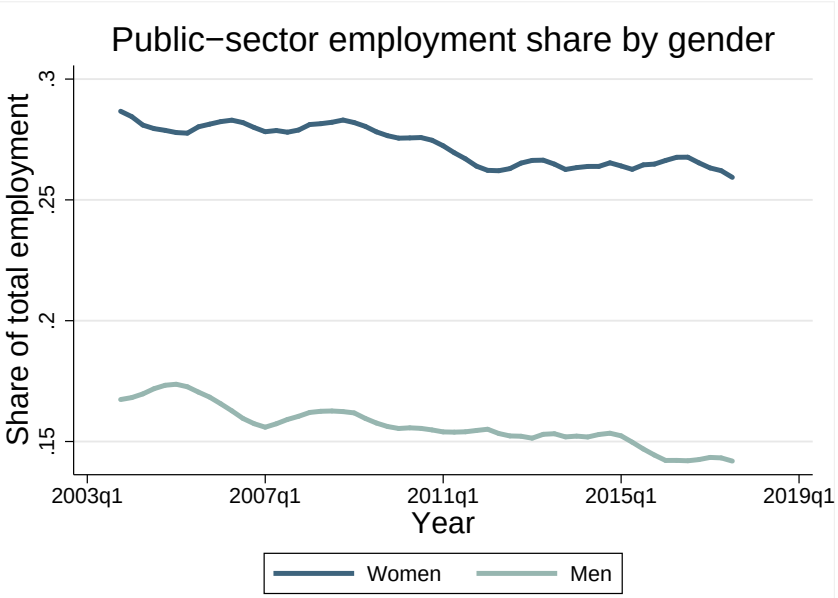




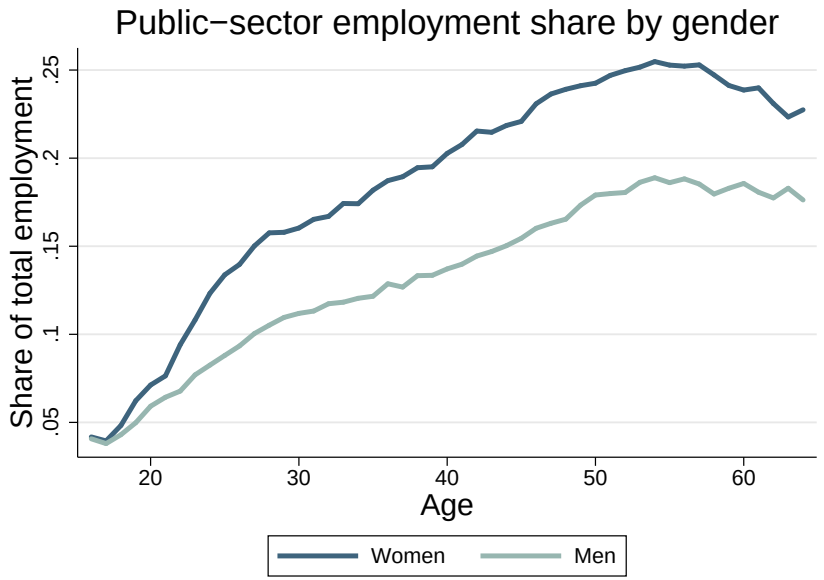
Note: French, UK Labour Force Surveys, CPS. For occupations: CPS data, average between 1996 and 2017. 3-digit occupations that have an overall share of public-sector employment between 0.05 and 0.95.

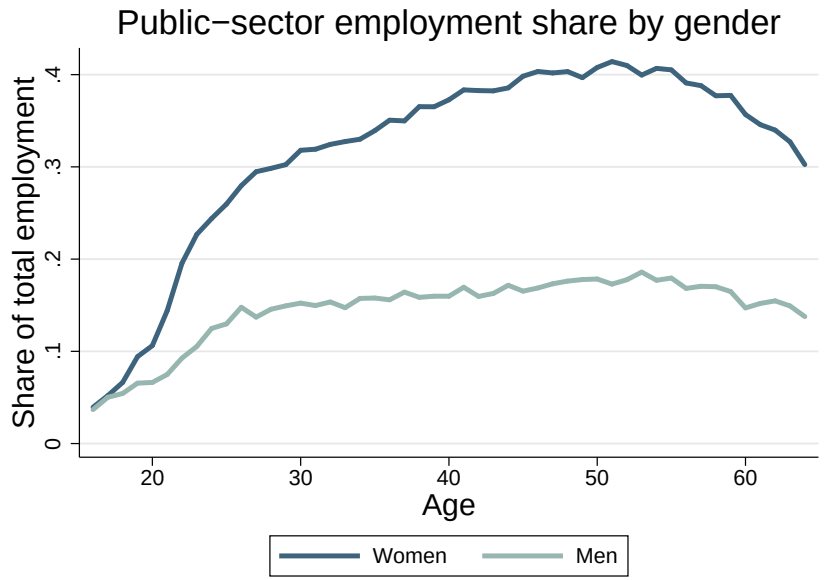
Public-sector employment by gender over time

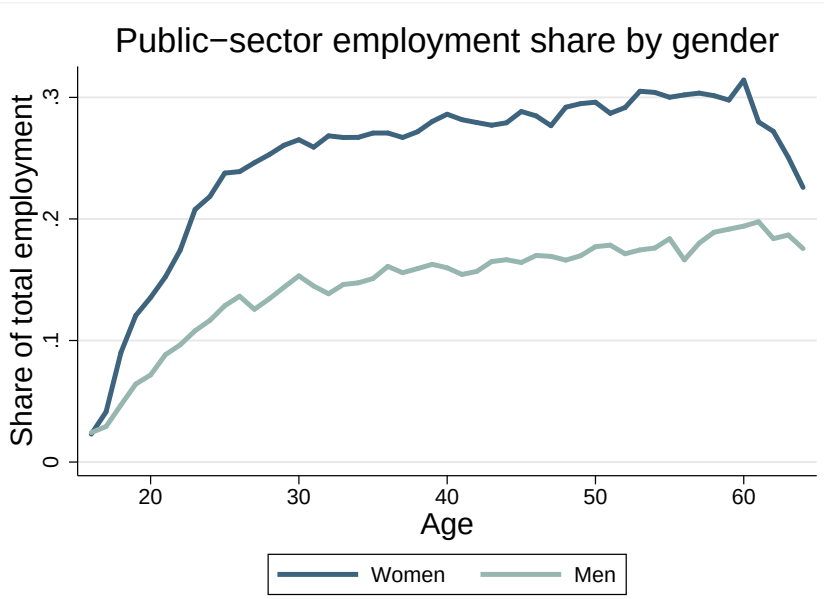


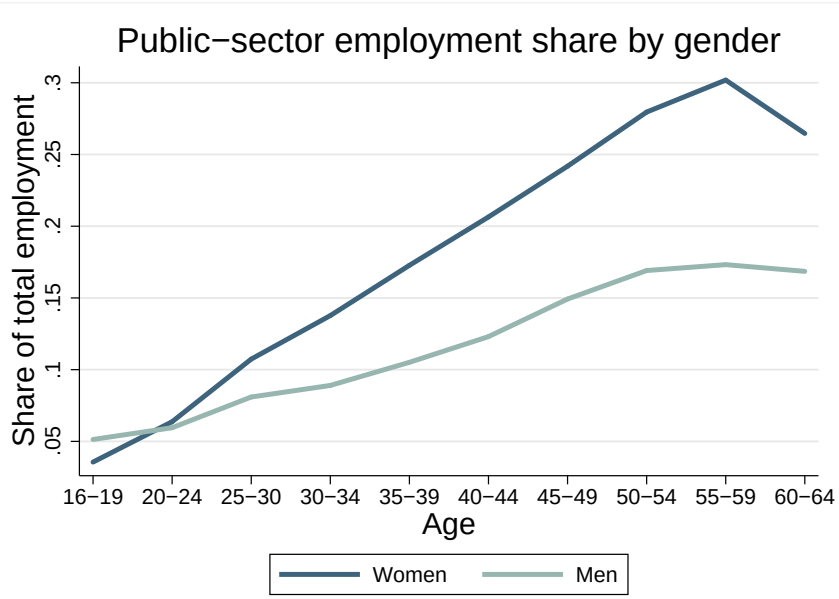


Public-sector employment by gender, different age groups

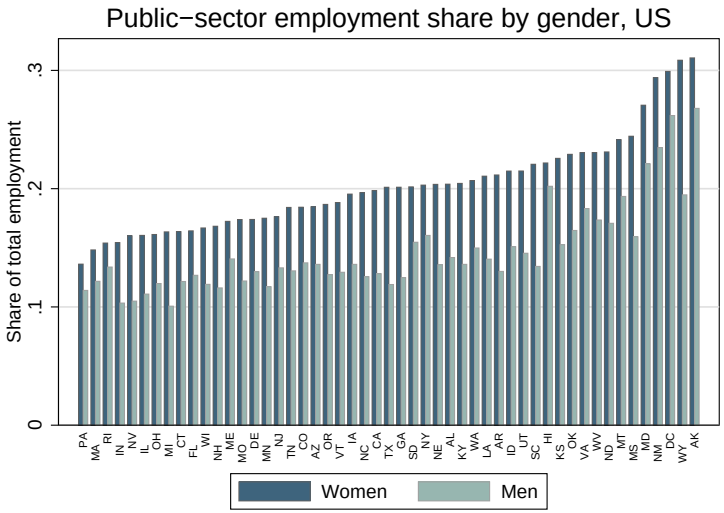


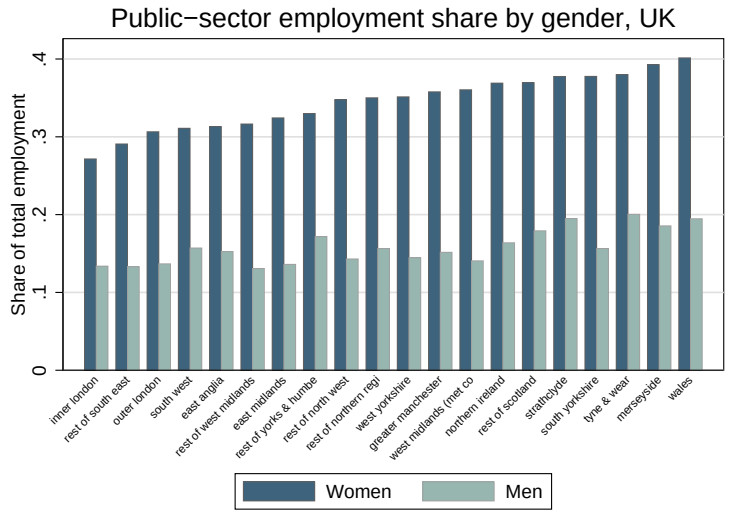


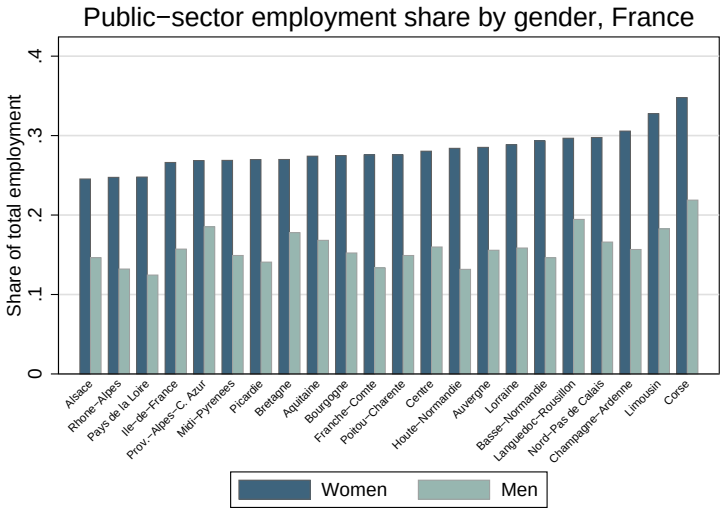


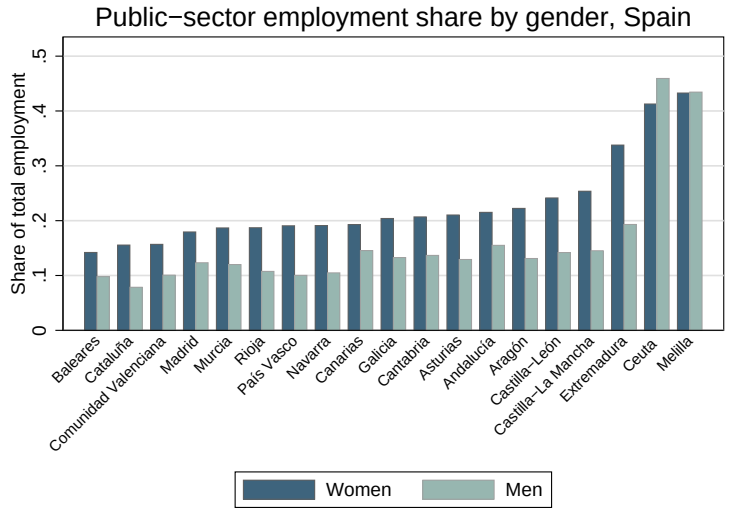


Public-sector employment by gender and regions



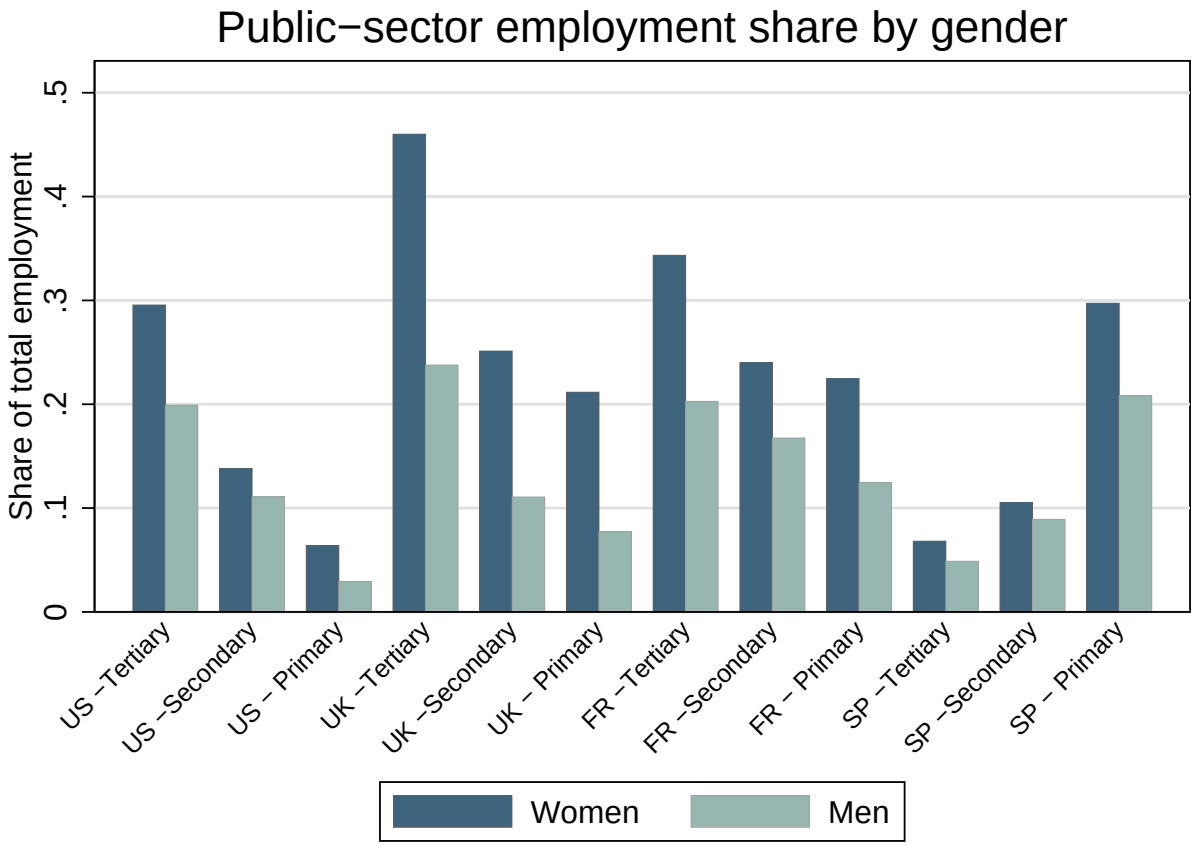






Note: French, Spanish, and UK Labour Force Surveys and CPS (2003-2018).

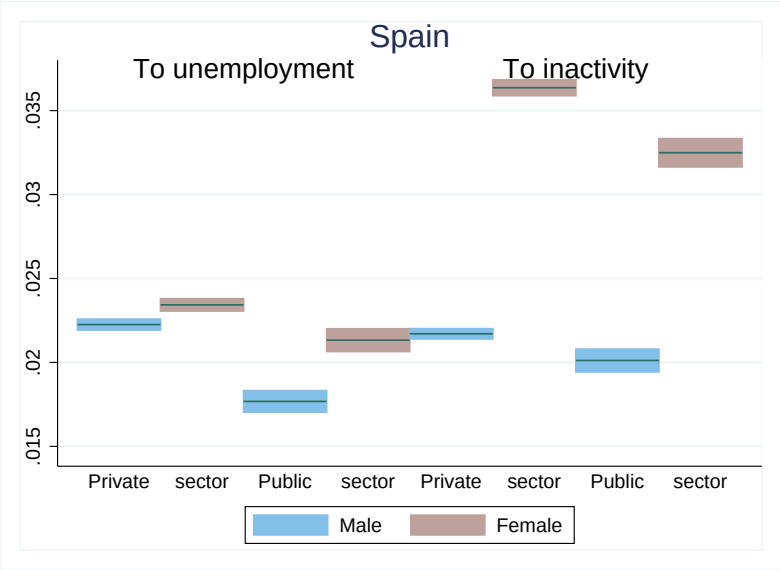
Public-sector employment by gender, educational groups

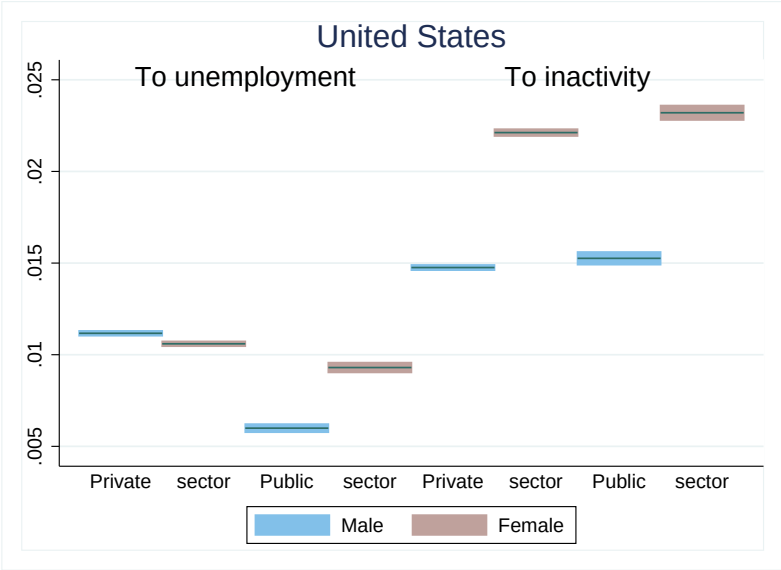


Note: For the United States the data is taken from the CPS (2003-2018), for the United K Force Survey (2003-2018), for France from the French Labour Force Survey (2003-2017) a Labour Force Survey (2003-2018).

Return

Conditional job-separations: US and Spain





Conditional job-separations

Multinomial logit model: estimate the probabilities of transitioning out of employment conditional on observable characteristics.

$$\lambda_i^U = \frac{\exp(x_i\beta_U)}{1 + \exp(x_i\beta_U) + \exp(x_i\beta_I)}, \tag{1}$$

$$\lambda_i^I = \frac{\exp(x_i\beta_I)}{1 + \exp(x_i\beta_U) + \exp(x_i\beta_I)}, \tag{2}$$

x_i includes age, age squared, and dummies for education, region, year, public sector, occupation, age between 60-64, gender and gender dummies interacted with being employed in the public sector. ◂ Return

Steady-state equilibrium

A set of thresholds $\{\bar{\epsilon}_f, \bar{\epsilon}_m, \hat{x}_{g,m}, \hat{x}_{p,m}, \hat{x}_{g,f}, \hat{x}_{p,f}\}$, job-finding probabilities $\{m(\theta_p), p_g\}$, stocks of inactive $\{i_{p,m}, i_{p,f}, i_{g,m}, i_{g,f}\}$, unemployed $\{u_{p,m}, u_{p,f}, u_{g,m}, u_{g,f}\}$, employed $\{e_{p,m}, e_{p,f}, e_{g,m}, e_{g,f}\}$, and private and public sector wages $\{w_{p,f}, w_{g,f}, w_{p,m}, w_{g,m}\}$, such that, $\{\pi_m, \pi_f, \bar{e}_g\}$ and an exogenous "wedge" for female private sector wages $\{\alpha\}$:

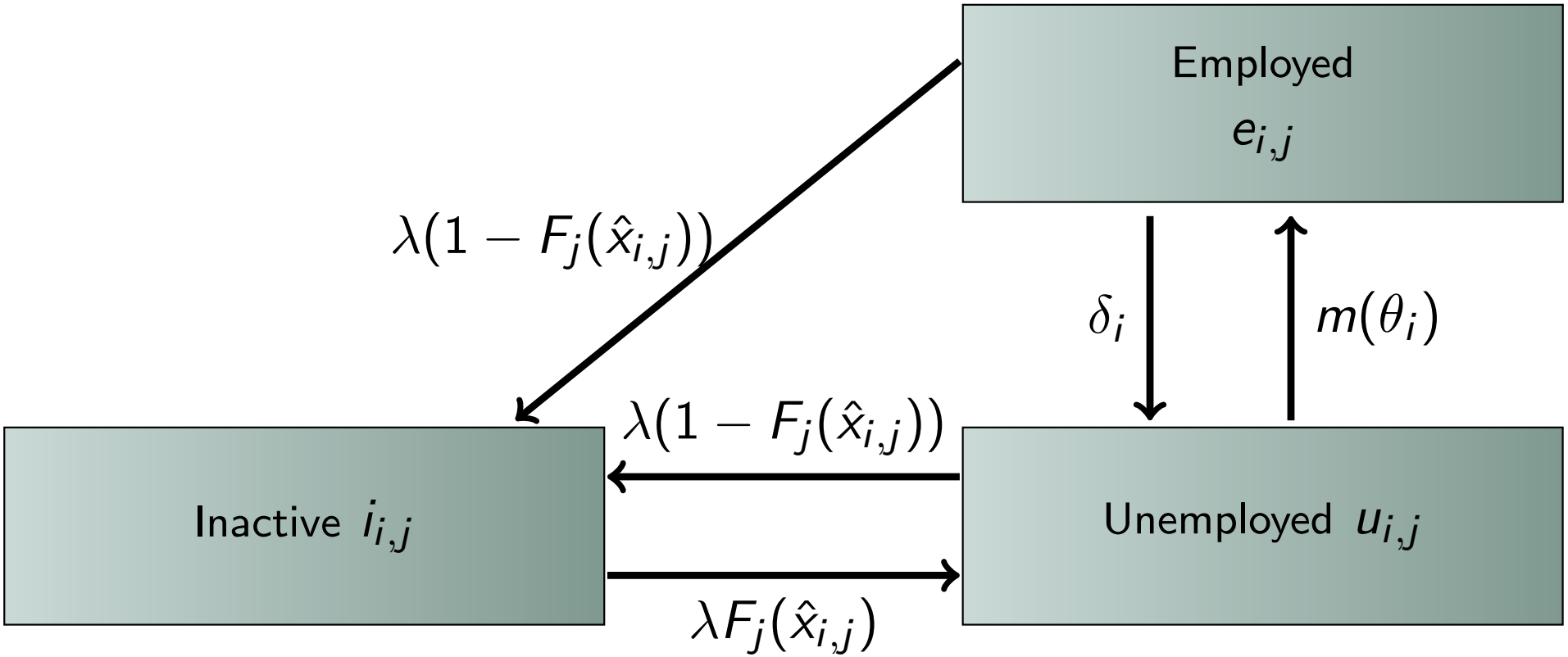
1. Private sector firms satisfy the free-entry condition.
2. **Male private sector wages are a constant fraction of workers' productivity.**
3. **Female private sector wages prior to applying a "wedge" are such that the value of a job for a firm is the same when hiring a man or a woman.**
4. Newborns decide optimally which sector to join.
5. **Workers decide optimally the threshold values of x for quitting their job or to stop searching.**
6. Worker flows in and out of the four stocks are constant.
7. The total population adds up to 1 (0.5 men, 0.5, women):
   - $\frac{1}{2}(1 - \Xi_m(\bar{\epsilon}_m)) = i_{g,m} + u_{g,m} + e^a_{g,m} + e^{na}_{g,m}$
   - $\frac{1}{2}\Xi_m(\bar{\epsilon}_m)) = i_{p,m} + u_{p,m} + e^a_{p,m} + e^{na}_{p,m}$
   - $\frac{1}{2}(1 - \Xi_f(\bar{\epsilon}_f)) = i_{g,f} + u_{g,f} + e^a_{g,f} + e^{na}_{g,f}$
   - $\frac{1}{2}\Xi_f(\bar{\epsilon}_f)) = i_{p,f} + u_{p,f} + e^a_{p,f} + e^{na}_{p,f}$.

Steady-state flows

Exits
$i_{i,j}(\lambda F_j(\hat{x}_{i,j}) + \tau)$
$u_{i,j}(\lambda(1 - F_j(\hat{x}_{i,j})) + \tau + m(\theta_i))$
$e_{i,j}(\lambda(1 - F_j(\hat{x}_{i,j})) + \tau + \delta_i)$
Entries
$\lambda(1 - F_j(\hat{x}_{i,j}))[e_{i,j} + u_{i,j}] + \tau(1 - F_j(\hat{x}_{i,j}))$
$\delta_i e_{i,j} + \lambda F_j(\hat{x}_{i,j}) i_{i,j} + \tau F_j(\hat{x}_{i,j})$
$m(\theta_i) u_{i,j}$

◂ Return

Labor market - agent j



Return

Calibration - fixed parameters

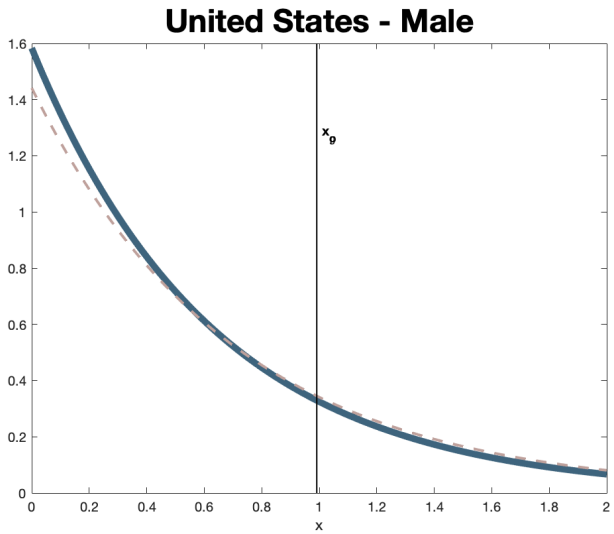
	US (monthly)	UK (qt)	France (qt)	Spain (qt)
Parameters set exogenously				
Discounting				
Interest rate (r)	0.004	0.012	0.012	0.012
Death rate (τ)	0.002	0.006	0.006	0.006
Public sector policies				
Wage premium (men) (π_m)	0.971	1.049	0.897	1.008
Wage premium (women) (π_f)	1.053	1.062	0.905	1.073
Employment (e_g)	0.120	0.170	0.137	0.074
Labor market parameters				
Matching efficiency (ζ)	1	1	1	1
Matching elasticity (η)	0.5	0.5	0.5	0.5
Time cost of labor force				
Private (ξ_p)	1	1	1	1
Public (ξ_g)	0.971	0.964	0.915	0.944
Arrival rate of shocks				
Job separation - private (δ_p)	0.018	0.019	0.021	0.055
Job separation - public (δ_g)	0.009	0.007	0.008	0.027

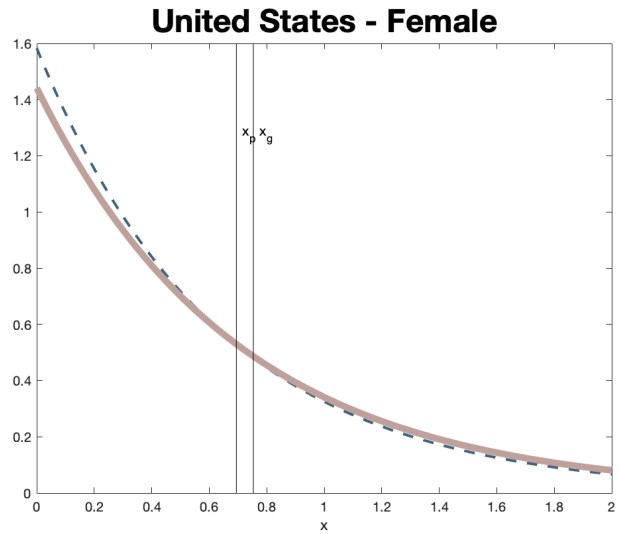
Calibration - calibrated parameters

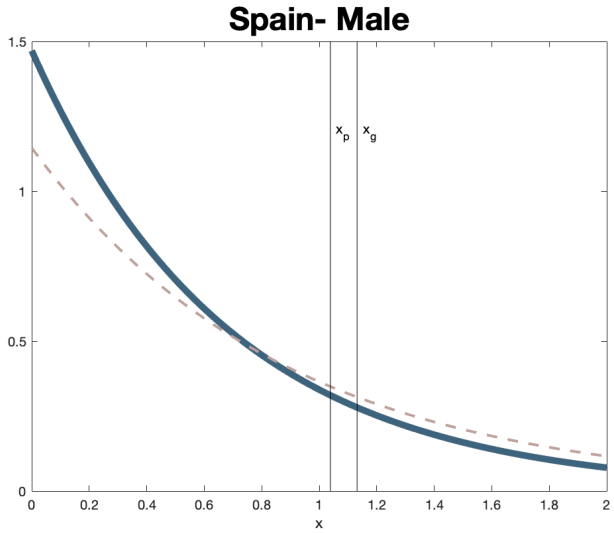
	US (monthly)	UK (qt)	France (qt)	Spain (qt)
Calibrated parameters				
Labor market parameters				
Bargaining power of men (β)	0.925	0.968	0.964	0.940
Cost of posting vacancies (κ)	3.158	0.914	1.398	1.411
"Wedge" female-male wage prv. sector (α)	0.270	0.201	0.177	0.237
Outside option distribution: Exponential				
Mean - men ($\mu_{x,m}$)	0.632	0.570	0.743	0.681
Mean - women ($\mu_{x,f}$)	0.694	0.906	0.927	0.873
Arrival rate of shocks				
Outside option (λ)	0.081	0.079	0.065	0.106
Preference distribution: Normal				
Mean - men ($\tilde{\epsilon}_m$)	-85.792	-49.673	-9.959	-30.000
Mean -women ($\tilde{\epsilon}_f$)	-76.941	-24.377	-6.402	-25.326
Std. - men and women ($\sigma_{\epsilon,m}$)	84.670	51.889	13.598	21.910

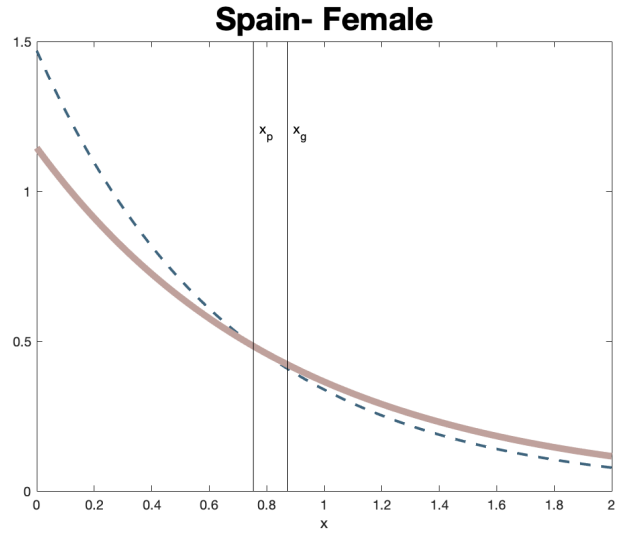
Calibration-distributions $F(\mu_x^j)$, $j = [m, f]$

Return









Note: Means of these distributions for men (women) in each country are 0.632 (0.694) for the US and 0.681(0.873) for Spain. Thresholds for the public and private sector for men (women) are 0.990 (0.754) and 0.992 (0.695) in the US and 1.132 (0.872) and 1.039(0.754) for Spain.

Calibration - targets

Targets	US		UK		France		Spain	
	Data	Model	Data	Model	Data	Model	Data	Model
Unemployment rate								
$((u_m + u_f)/((1 - i_m) + (1 - i_f)))$	0.064	0.064	0.060	0.060	0.093	0.093	0.168	0.168
Non-employment rates (full time equivalent)								
Male $(i_m + u_m)$	0.252	0.253	0.200	0.200	0.315	0.315	0.338	0.337
Female $(i_f + u_f)$	0.418	0.409	0.450	0.450	0.473	0.473	0.522	0.523
Private sector wage gap								
$w_f^p / w_m^p - 1$	-0.286	-0.289	-0.212	-0.212	-0.183	-0.183	-0.247	-0.248
Nr. of weekly wages- exp. cost vacancy								
$\kappa\Theta^(1 - \eta)/(W_{mp}/4)$	8.000	7.997	8.000	8.000	8.000	8.000	8.000	7.998
Flows rates								
$E \rightarrow I$	0.022	0.022	0.020	0.020	0.021	0.012	0.032	0.032
Public sector employment shares ratio; full-time equivalent								
$(e_f^g/(e_f^p + e_f^g))/(e_m^g/(e_m^p + e_m^g))$	1.358	1.359	1.855	1.855	1.587	1.587	1.558	1.558
Ratio probability job finding private/public								
$p_g / m(\theta_p)$	1.066	1.066	0.743	0.743	0.809	0.809	0.878	0.878
Regional variation: Public sector size & over-representation								
ϵ_{u_g / w_g}	0.004	0.004	0.002	0.002	0.007	0.007	0.011	0.011

Return

Drivers for women's over-representation: alternative decomposition

Country	Benchmark	No sector differences & no preference differences $\pi_j = 1$ $\xi_g = \xi_p$ $\bar{\epsilon}_f = \bar{\epsilon}_m$ $\delta_g = \delta_p$	Only wage differences $\xi_g = \xi_p$ $\bar{\epsilon}_f = \bar{\epsilon}_m$ $\delta_g = \delta_p$	Only hours differences $\pi_j = 1$ $\bar{\epsilon}_f = \bar{\epsilon}_m$ $\delta_g = \delta_p$	Only job security differences $\pi_j = 1$ $\xi_g = \xi_p$ $\bar{\epsilon}_f = \bar{\epsilon}_m$	Only sector differences $\bar{\epsilon}_f = \bar{\epsilon}_m$
Public-sector employment shares ratio						
US	1.359	0.991	1.171	0.993	0.985	1.166
UK	1.855	0.998	1.000	1.008	0.992	1.005
France	1.587	1.007	1.115	1.049	0.996	1.086
Spain	1.558	0.931	1.069	0.934	0.906	1.058

◂ Return

Work life balance premia

Percentage of wage private sector workers would sacrifice for public sector

$$PremiumH_i^p = \frac{(1-\xi_g)\int_0^{\hat{x}_{p,j}} x f_j(x)dx}{F_j(\hat{x}_{p,j})}\frac{1}{w_{p,j}} \times 100$$

Country	Private sector worker $[\xi_p = \xi_g]$		Public sector worker $[\xi_g = \xi_p]$	
	Women	Men	Women	Men
US	0.84	0.81	0.87	0.83
UK	1.46	0.93	1.53	1.02
France	3.52	2.82	1.70	1.99
Spain	2.23	1.78	3.20	3.75

Job-security premia

Consider a private sector worker, with

- wage $w_1 = w_{p,j}$
- job-separation rate δ_p
- outside option $x < \hat{x}_{p,j}$.
- If offered a job-separation rate of δ_g, what wage w_2 would make him indifferent between the two options?
- $w_2 = w_1 + \delta_p(U_{p,j}(x|\delta_g) - E_{p,j}(x|\delta_p)) - \delta_g(U_{p,j}(x|\delta_g) - E_{p,j}(x|\delta_g))$
- where $E_{p,j}(x|\delta_i) - U_{p,j}(x|\delta_i) = \frac{\xi_{p,j}(\hat{x}_{p,j}-x)}{r+\tau+\lambda+\delta_p+m(\theta_i)}$.
- Integrating over x we calculate the conditional expected value:

Country	**Private sector worker** $[\delta_p = \delta_g]$		**Public sector worker** $[\delta_p = \delta_g]$	
	Women	Men	Women	Men
US	0.98	1.02	0.94	0.98
UK	0.92	1.17	1.20	1.52
France	1.43	1.66	1.70	1.99
Spain	2.88	3.39	3.20	3.75

Return

Effects of public sector employment and wage policies

Policy	US	UK	France	Spain
Increase of wages by 1 percent				
Δ unemployment rate male	0.15pp.	0.11pp.	0.15pp.	0.07pp.
Δ unemployment rate female	0.27pp.	0.37pp.	0.31pp.	0.15pp.
Δ inactivity rate male	-0.13pp.	-0.11pp.	-0.12pp.	-0.06pp.
Δ inactivity rate female	-0.17pp.	-0.21pp.	-0.17pp.	-0.09pp.
Δ aggregate wage gap	-0.05pp.	-0.13pp.	-0.09pp.	-0.05pp.
Increase of employment by 1 percent				
Δ unemployment rate male	-0.07pp.	-0.09pp.	-0.05pp.	-0.03pp.
Δ unemployment rate female	-0.14pp.	-0.29pp.	-0.11pp.	-0.06pp.
Δ inactivity rate male	0.04pp.	0.04pp.	0.02pp.	0.01pp.
Δ inactivity rate female	0.04pp.	0.06pp.	0.02pp.	0.01pp.
Δ aggregate wage gap	-0.01pp.	-0.01pp.	-0.001pp.	-0.01pp.

◂ Return

Threshold

$$E_{i,j}(\hat{x}_{i,j}) = NE_{i,j}(\hat{x}_{i,j}). \tag{3}$$

$$\hat{x}_{i,j} = \frac{w_{i,j}}{\xi_i} + \frac{\lambda}{\xi_i}[A_{i,j} - B_{i,j}], \tag{4}$$

$$\tag{5}$$

Establishes first link between wages and inactivity: lower wages $\Rightarrow$ higher inactivity

Value functions

We define two values functions for non-employed, one for unemployed and another one for inactive individuals.

$$
\begin{aligned}
(r+\tau+\lambda)E_{i,j} &= (1-\xi_i)x + w_{i,j} + \delta_i[U_{i,j} - E_{i,j}] + \lambda[A^1_{i,j} + A^2_{i,j}], \\
(r+\tau+\lambda)U_{i,j} &= x + m(\theta_i)[E_{i,j} - U_{i,j}] + \lambda[B^1_{i,j} + A^2_{i,j}], \quad \text{if } x \leq \hat{x}_{i,j} \\
(r+\tau+\lambda)I_{i,j} &= x + \lambda[B^1_{i,j} + A^2_{i,j}], \quad \text{if } x > \hat{x}_{i,j}
\end{aligned}
$$

where $A^1_{i,j} = \int_0^{\hat{x}_{i,j}} E_{i,j}(x')dF_j(x')$, $A^2_{i,j} = \int_{\hat{x}_{i,j}}^{\infty} I_{i,j}(x')dF_j(x')$,
$A_{i,j} = A^1_{i,j} + A^2_{i,j}$, $B^1_{i,j} = \int_0^{\hat{x}_{i,j}} U_{i,j}(x')dF_j(x')$ and $B_{i,j} = B^1_{i,j} + A^2_{i,j}$.

◂ Return