Family-Friendly Policies and Fertility: What Firms Got to Do With It?

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Macro-Labor-Family Literature

- During recent decades, a macro-labor-family literature has emerged
- Inspiration by Mortensen (1988), "Matching: Finding a Partner for Life or Otherwise", American Journal of Sociology
- "The analysis follows the view of Becker (1991) that marriage is a partnership for joint production and consumption..... The inquiry here treads in the steps of Mortensen's (1988) search-theoretic model of marriage and divorce." (Aiyagari, Greenwood, Guner 2000)

- Wide range of family-friendly policies in high-income countries
  - Childcare subsidies, parental leave, work hours flexibility, etc.

- Why? Low total fertility rates
  - 1.8 in the US, 1.6 in Germany, 1.4 in Japan, 1.3 in Spain

- Barriers to combine labor market participation and family life
  - Feyrer, Sacerdote, and Stern (2008)

- Long-lasting scarring effects of children on women earnings
  - Kleven et al (2019), De Quinto, Hospido and Sanz (2020)

- A growing literature in the effects of such policies on female labor supply and fertility – Petrongolo and Olivetti (2017)

- What is the role of firms?
- Goldin (2014): *"As women have increased their productivity enhancing characteristics and as they "look" more like men, the human capital part of the wage difference has been squeezed out. What remains is largely how firms reward individuals who differ in their desire for various amenities."*
- Olivetti and Petrongolo (2017): *"family policies may feed into labor demand decisions. [...] insofar as part of the costs of these arrangements directly or indirectly trickles down on employers, the demand for female labor (and especially for women of child-bearing age) would be negatively affected."*
- Yet, firms are mostly missing in the literature!

- **Build a search and matching model to study the effects of family-friendly policies on fertility**
  - Economy has temporary and permanent jobs.
  - Jobs also differ in how costly they are for women to have children – flexible vs. non-flexible jobs
  - Firms post vacancies, hire and fire workers, and decide on promotions from temporary to permanent contracts
  - Women build human capital as they work, but human capital depreciates when they don't
  - Women decide how many children to have and when to have them

- **Focus on Spain**
  - Low fertility
  - Strong labor market duality:
    - more than one third of employed women (ages 25-54) has a temporary contract (more than 50% around age 25)
    - women account for 86% of all temporary contracts
  - Rich administrative data, social security records (MCVL)

Law 39/1999: Work and Family Reconciliation Act

- Work and Family Reconciliation Act (Law 39/1999)
  - Passed on November 5, 1999
  - Every parent with a child up to 6 years old has the right to ask for work-week reduction (WWWR), to 1/2
  - During WWR, parents cannot be dismissed or laid off
  - In 2007 the maximum age of child increased to 8, in 2012 to 12
  - Analyzed by Fernandez-Kranz and Rodrigues-Planas (2020)
    - Strong negative effects on promotions

- Model as a laboratory to evaluate family-friendly policies

Preview of findings

- Effect of work-week reduction:
  - Induce higher fertility for women in permanent contracts, but decrease fertility for non-employed and in temporary contracts
  - Strong firm reaction:
    - Lower hiring rate
    - Lower promotion rate
  - Evidence from an event study support the trade-off
  - Despite firm's reaction, welfare for women increased after the reform

- Study other reforms on duality, employment protection, hiring subsidies

- Trade-off between women's wages (and employment rate) versus fertility

Literature

- Large literature that studies how policies affect fertility decisions, but abstracts from firms
  - Adda, Dustmann and Stevens (2017)
  - Guner, Kaya and Sanchez-Marcos (2021)

- Search and matching models to study gender wage and employment gaps, but abstract from fertility
  - Flabbi and Moro (2010)
  - Morchio and Moser (2019)
  - Xiao (2020)

- Fertility decisions within search and matching models, but abstract from labor market duality
  - Erosa, Fuster and Restuccia (2010)

- Interactions between households and firm decisions:
  - Albanesi and Olivetti (2009)
  - Fernandez-Kranz and Rodrigues-Planas (2020)

Four model building blocks:

- Search and matching frictions in the labor market (Mortensen and Pissarides 1994)
- Dual labor market: temporary and permanent contracts (Bentolila, Cahuc, Dolado, Le Barbanchon 2012)
- Fertility decision (Erosa, Fuster and Restuccia 2010)
- Job flexibility and gender gap (Flabbi and Moro, 2010)

- Stochastic life-cycle with constant probability of death, ρ^d
- Individuals differ by gender g, men (m) or women (w)
- Women differ by their fecundity, fertile (w_1) or infertile (w_0).
- Men and infertile women care about consumption (no saving/borrowing)
- Fertile women receive utility from having children, staying home, d
- Men are all identical

- Women are heterogeneous
- number of children $n \in [0, 1, 2, ...]$
- human capital, $h \in \mathcal{H}$, drawn at entry from $\Gamma^e(h)$
- evolves according to a Markov process, $\Gamma(h'|h)$
- Human capital accumulation:
  - Restrict the space for human capital h to be defined in discrete set $h \in \mathcal{H} := \{\underline{h}, .., h_i, .., \bar{h}\}$
  - Let π^c for $c = \{t, p, r, u\}$ be the probability of a one-step jump (drop) in human capital, i.e.

$$h' = \begin{cases} h + \Delta_h, & \text{with probability} \quad \pi^c \\ h, & \text{otherwise} \end{cases}$$

  - The level of jump (drop) depends on the current h,

$$\Delta_h = \Delta^0 + \Delta^1 h$$

Fertility

- If unemployed, women enjoy utility of children $d(1+n)$
- If employed, women enjoy utility of children $\nu d(1+n)$, $\nu \in (0,1)$
- If fertile, women with n children have an opportunity to have another child with probability $\sigma(n)$
- Stochastic childhood with probability of becoming a teenager ρ^c: teenagers do not give any utility to parents
- Stochastic fecundity with probability of becoming infertile ρ^i

Labor market

- Workers can be in one of three labor market states: *employed with a temporary job*, (t) *employed with a permanent job* (p), *unemployed* (u)

- Only unemployed individuals get job offers. No on-the-job search
- All new jobs start as temporary
- Each period a temporary contract can be converted into a permanent
  - conversion by law after 4 years (on average)
- Job separation: exogenously (δ_g) + endogenously
- Destruction of a temporary job comes at no cost. Destruction of a permanent job implies firing cost c_f
- Workers can quit their job at no cost for the firm
- Unemployed individuals get an unemployment benefit b_g

- The number of new contacts between searchers u and vacancy v equal to:

$$m(u,v) = \frac{uv}{\left(u^{\eta} + v^{\eta}\right)^{\frac{1}{\eta}}}, \quad \eta > 0$$

- Contact rate for workers:

$$\phi_u = \frac{m(u,v)}{u}$$

- Contact rate for firms:

$$\phi_v = \frac{m(u,v)}{v}$$

- Once in contact, workers and firm draw a flexibility degree $j \in \mathcal{J}$ from the distribution $\Upsilon(j)$ and a productivity level z from $\Lambda(z)$ and decide whether to form a match.
- Per period cost of keeping vacancies for the firm $c_v > 0$

- Output is produced by worker-firm pairs
- Each worker-firm pair is characterized by
  - a match-specific time-varying productivity $z \sim \Lambda(z'|z)$
  - flexibility degree $j = 1, 2$
- Match productivity process $z \in \mathcal{Z} = [0, 1]$

$$\Lambda(z'|z) = \begin{cases} z & \text{with probability} \quad \varphi_z \\ z' \sim \mathcal{B}(\alpha_z, \beta_z) & \text{otherwise} \end{cases}$$

- Probability of a type-j occupation:

$$\Upsilon(j) = \begin{cases} \chi & \text{if} \quad j = 1 \\ 1 - \chi & \text{if} \quad j = 2 \end{cases}$$

Production

- Output is produced by worker-firm pairs
- Production of match (z, j) with men

$$y_m = A$$

- Production of match (z, j) with infertile women h

$$y_{w_0}(z, h, j) = (1 - \omega_g)Azh - c_o,$$

where ω_g is a gender wage penalty and c_o is a fixed production cost

- Production of match (z, j) with fertile women (h, n)

$$y_{w_1}(z, h, n, j) = (1 - \omega_g)(1 - \omega_j(n))Azh - c_o$$

where $\omega_j(n)$ denotes inflexibility wage penalty

- The inflexibility penalty

$$\omega_j(n) = \begin{cases} 0 & \text{if} \quad j = 1 \\ \omega_{j0} + \omega_{j1} n & \text{if} \quad j = 2 \end{cases}$$

Workweek reduction

- Women with permanent contracts and children can take a work-week reduction (i.e. they can work lower number of hours)
- Workers under workweek reductions can not be fired
- Production function for a worker who is in reduced hours is given by

$$y_g^r(z, h, n, j) = (1 - \omega_g)(\omega_r - \omega_j(n))Azh - c_o,$$

  where ω_r determines the amount of forgone production
- WWR provides extra utility from children: $\xi d(1 + n)$

- Wages are the solution of bargaining problem as in Binmore et al. (1986) with zero payoff for firms in case of match breakdown
- Employee bargaining power $\beta \in (0, 1)$
- Wages for men

$$w_m = (1 - \beta)b_m + \beta A$$

- Wages for infertile women

$$w_{w_0}(z, h, j) = (1 - \beta)[b_w + d] + \beta(1 - \omega_g)Azh$$

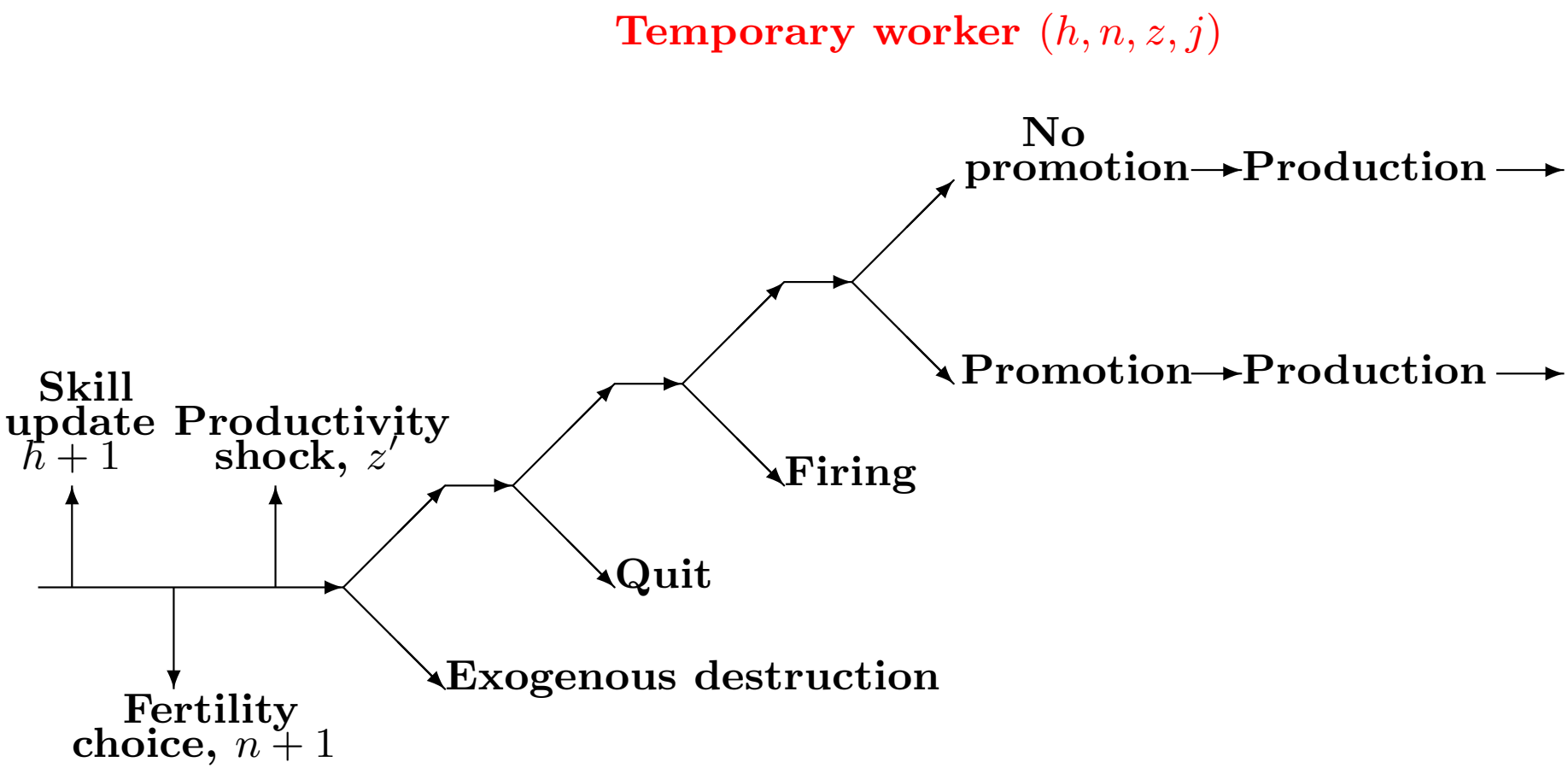
- Wages for fertile women

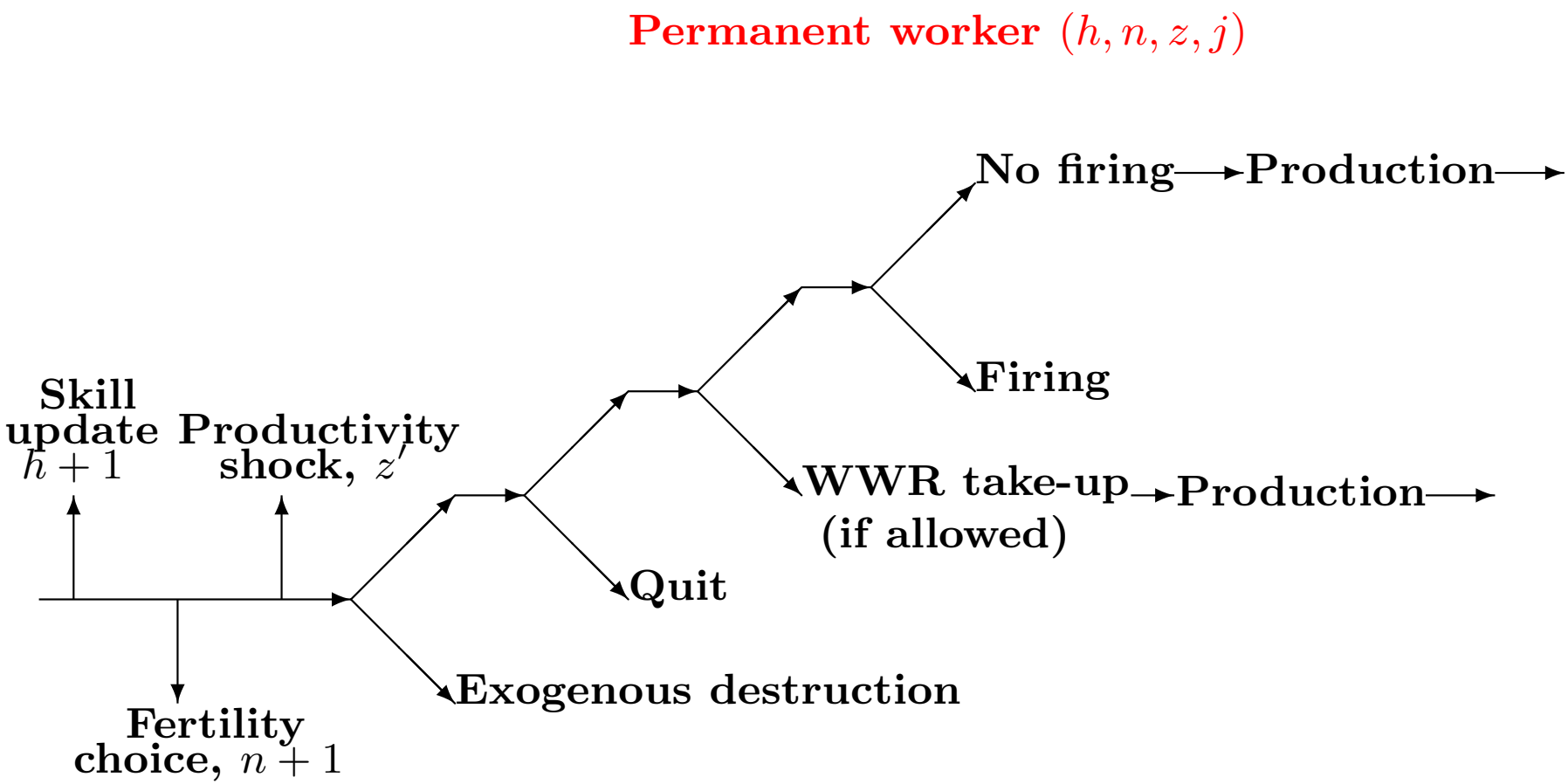
$$w_{w_1}(z, h, n, j) = (1-\beta)[b_w+(1-\nu)d(1+n)]+\beta[(1-\omega_g)(1-\omega_j(n))Azh]$$

- Wages for fertile women in WWR

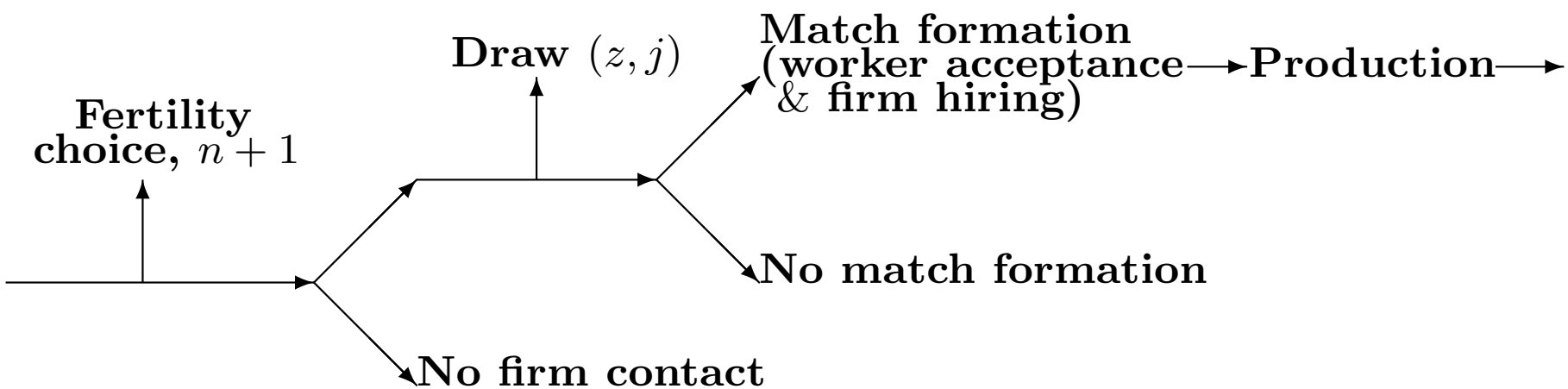
$$w^r_{w_1}(z, h, n, j) = \bar{\omega}_r w_{w_1}(z, h, n, j)$$

with $\bar{\omega}_r \neq \omega_r$


Temporary worker (h, n, z, j)
No promotion
Production
Promotion
Production
Skill update $h+1$
Productivity shock, z'
Firing
Quit
Exogenous destruction
Fertility choice, $n+1$


Permanent worker (h, n, z, j)
No firing
Production
Firing
Skill update $h+1$
Productivity shock, z'
WWR take-up (if allowed)
Production
Quit
Exogenous destruction
Fertility choice, $n+1$

Unemployed worker (h, n)



Recursive stationary competitive equilibrium:

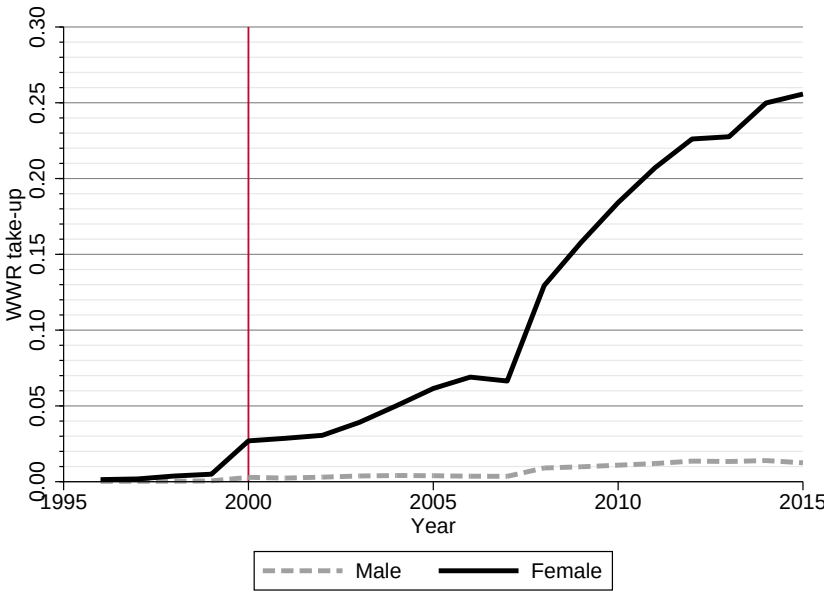
- *optimality 1*: policy functions for hiring, promotion and firing are determined non-cooperatively by the firm, i.e. are the solution to the firm value functions
- *optimality 2*: policy functions for fertility, job acceptance and quit and reduced work-time decisions are determined non-cooperatively by fertile women, i.e. are the solution to the workers value functions
- *bargaining*: wages are determined as the solution of a bargaining problem
- *free entry*: jobs are created until the expected value of entry net cost of posting a vacancy equals zero
- *consistency*: distributions of workers and jobs replicate themselves over time through the policy functions, exogenous labor market flows, human capital accumulation and productivity shocks

numerical solution

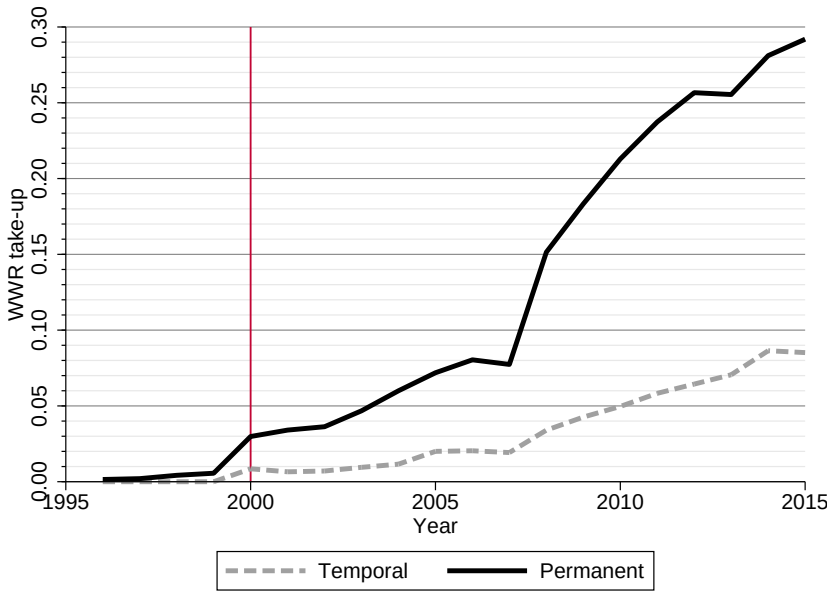
Continuous Sample of Employment Histories

- Spanish administrative data set (4%), 2005-2015 years of extraction
- Complete working histories of individuals that are employed or receive SS benefits in the year of extraction (traceable back to 1980 or to their first employment)
- Data: demography (age, sex, province), employment information (contract type, dates of each employment spell, work-week reduction coefficient, industry, wages, sector, firm size, skill level)
- Municipal Registry (Padrón): nationality, education, household composition (birth dates of children)
- Sample:
  - 1996-2015 (before 1996 contract type is not reliable)
  - Construct a quarterly panel
  - Age 25-45
  - Natives born in Spain
  - Drop self-employed and others in not-SS regimes

Work-Week Reduction Take-Up



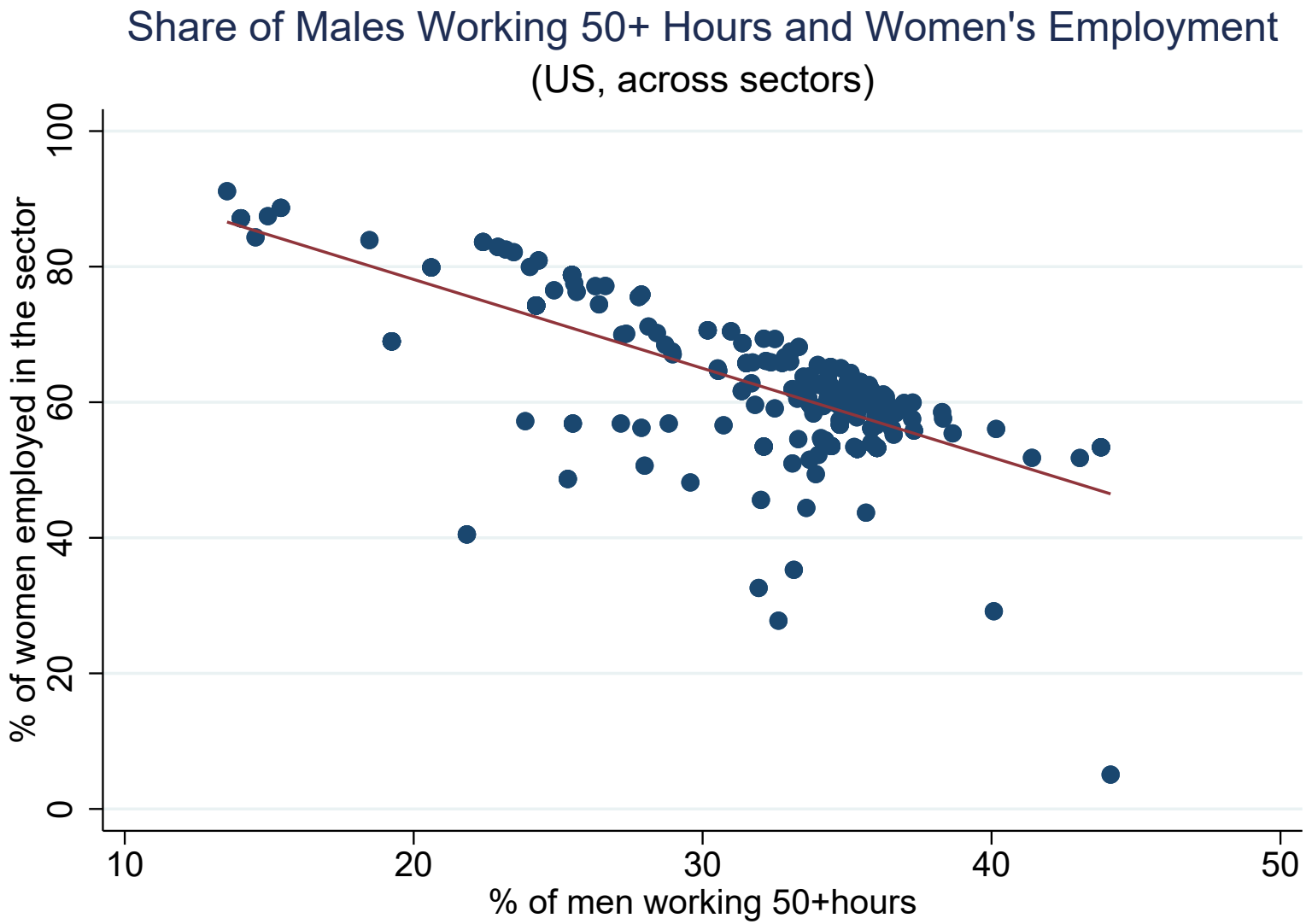
By gender

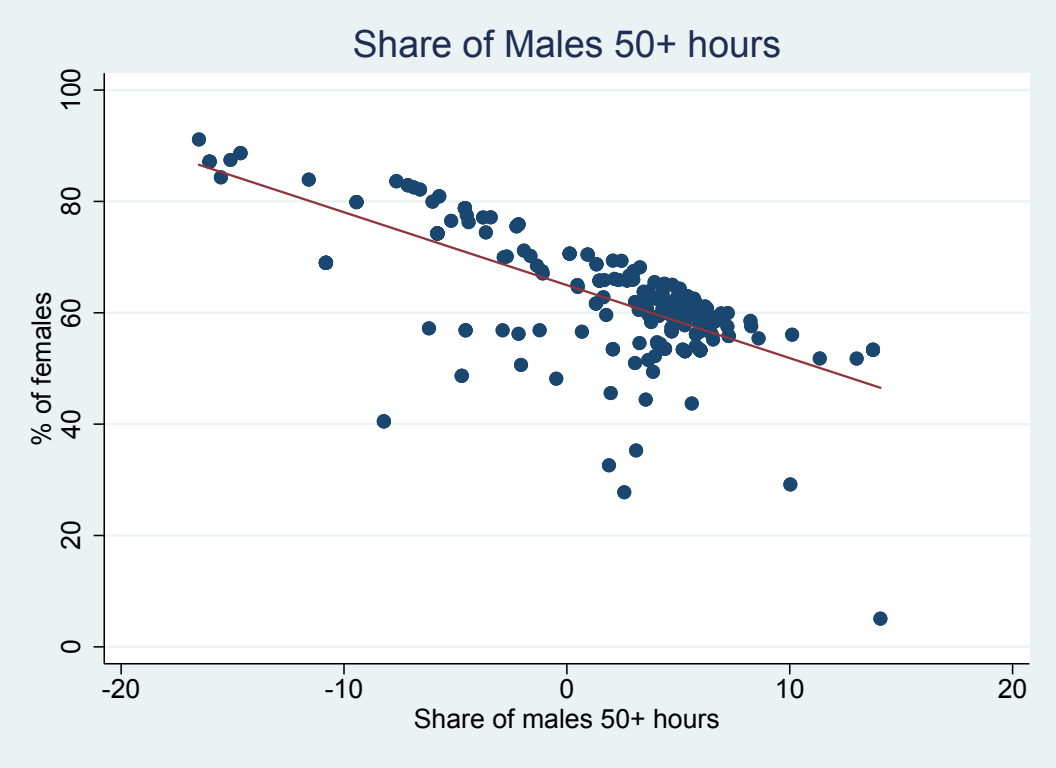


By contract type (women)

Job Flexibility

- We follow Cortes and Pan 2019 (JLE) to build a measure flexibility for each industry
- Flexibility=share of males in the occupation that work more than 50 hours
- BLS data for industry-occupation matrix. We calculate flexibility at industry level as $\sum_i flexibility_i * share_{ij}$, where i is occupation and j is industry
- We use the crosswalk of industry classification in the US and Spain
- We get a measure of job flexibility for each industry in Spain


Share of Males Working 50+ Hours and Women's Employment
(US, across sectors)
% of women employed in the sector
0
20
40
60
80
100
10
20
30
40
50
% of men working 50+hours


Share of Males 50+ hours
% of females
0
20
40
60
80
100
-20
-10
0
10
20
Share of males 50+ hours

Calibration

- Model set up:
  - Baseline period: 2001-2015
  - Occupations: 2 (flexible, non-flexible)
- Functional forms:
  - matching functions
  - productivity shocks
  - distribution of occupations
  - human capital accumulation
- 8 parameters calibrated outside the model
- 30 parameters calibrated to match a list of 122 worker-level targets

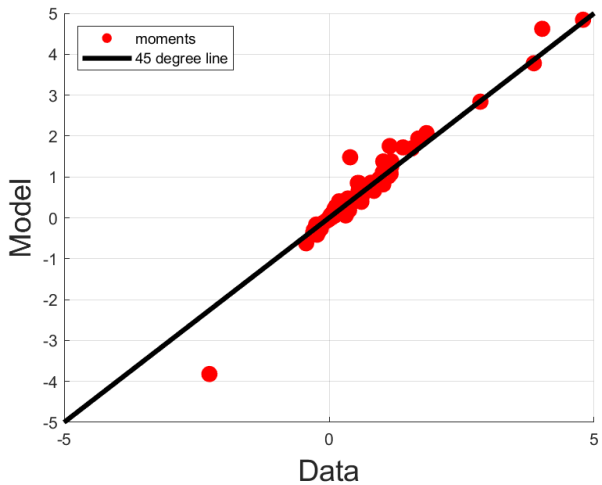
parameters moments

Some calibrated parameters

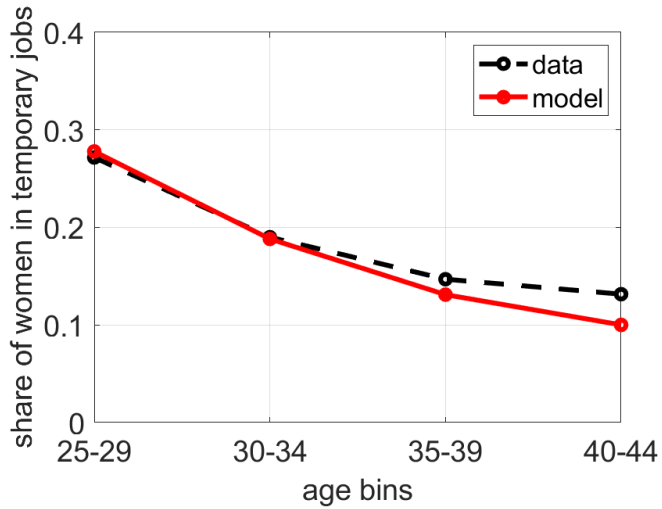
Parameter	Description	Value
	Wage/production penalties	
ω_g	Gender wage penalty	0.0866
ω_r	WWR production penalty	0.1708
	Fertility/utility	
$\sigma(n=0)$	Fertility opportunity if $n=0$	1.5390%
$\sigma(n=1)$	Fertility opportunity if $n=1$	1.4173%
$\sigma(n=2)=\sigma(n=3)$	Fertility opportunity if $n \in \{2,3\}$	0.2047%
d	Value staying home if unemployed (euros)	1381.51
νd	Value staying home if employed (euros)	696.79
ξd	Extra value staying home under WWR (euros)	236.02

Targeted moments

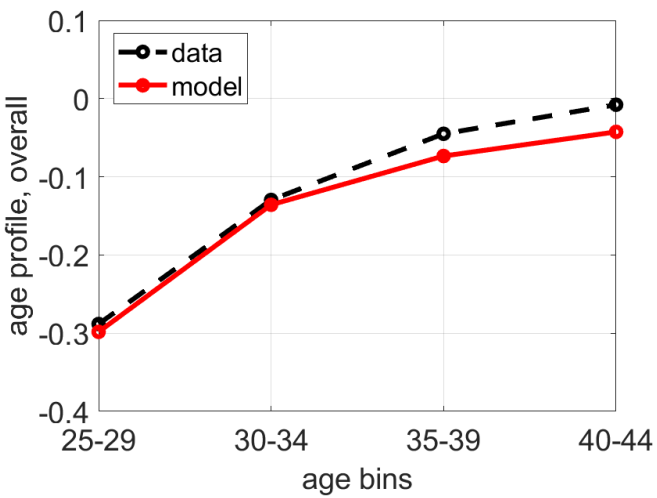
Estimation fit

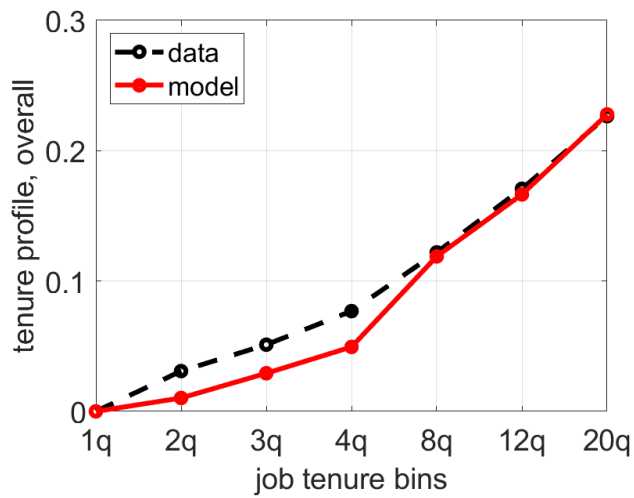


Employment shares



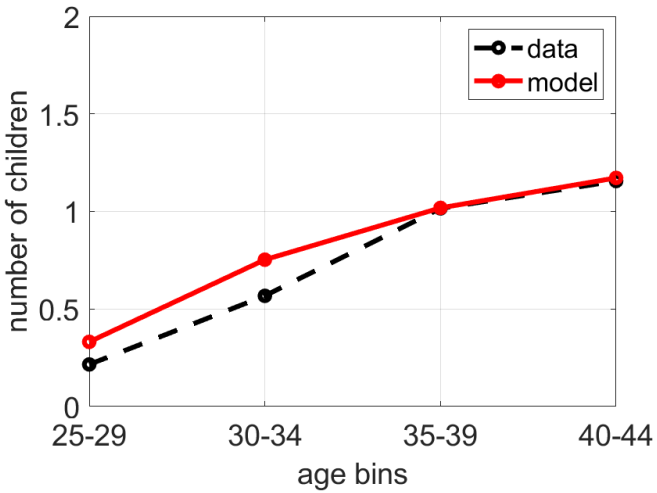
Wage profiles



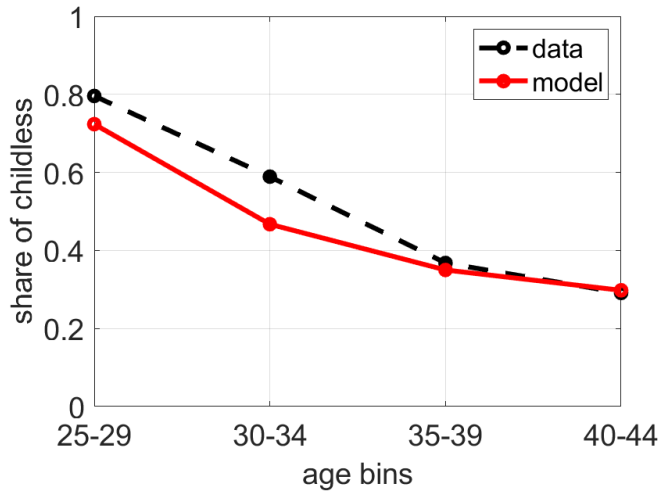


Targeted moments

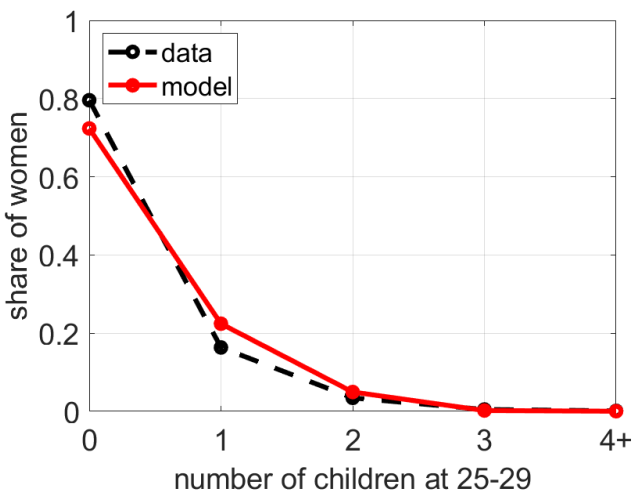
Completed fertility

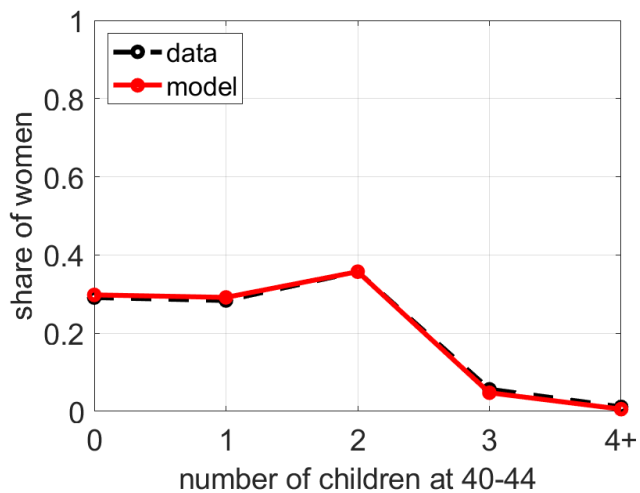


Childless women



Women distribution across number of children





- Remove job protection under WWR
- Effects of labor market duality:
  - Reduction of period for temporary contract (2 years)
  - Extension of period for temporary contract (6 years)
  - No duality (all contracts are permanent with possibility of dismissal at 1/2 cost)
- Effect of employment protection
  - Cost of dismissal = 0
  - Cost of dismissal = *2
- Effect of subsidies:
  - Child benefits 50 euros monthly
  - Women hiring subsidies 5% of wage bill

Counterfactuals. Allow Worker Dismissal under WWR

	Counterfactual	Baseline	Change
Cost of dismissal during WWR (euros)	5165.69	Not allowed	-
Labor Market Outcomes			
Women in permanent contracts under WWR, 25-44 y.o. %	0	14.64	-
Temporary to permanent contract, rate 25-44 y.o. %	12.55	11.40	-1.16 p.p.
Non-employed women, 25-44 y.o. %	40.50	42.30	-1.80 p.p.
Women in temporary contracts, 25-44 y.o. %	17.54	18.27	0.73 p.p.
Women in permanent contracts, 25-44 y.o. %	41.95	39.43	-2.52 p.p.
Women in flexible occupations, 25-44 y.o. %	69.46	68.38	-1.08 p.p.
Avg. wage, 25-44 y.o.	63.19	60.79	-3.81%
Avg. wage growth, 25-44 y.o. %	5.04	4.84	-3.99%

- Decline in promotion rate
  empirical evidence

Counterfactuals. Allow Worker Dismissal under WWR

	Counterfactual	Baseline	Change
Cost of dismissal during WWR (euros)	5165.69	Not allowed	-
Fertility Outcomes			
Prob. of newborn non-employed women 25-44 y.o. %	1.26	1.20	-4.47%
Prob. of newborn, employed women 25-44 y.o. %	0.85	0.88	+2.87%
Prob. of newborn, women in temporary contracts 25-44 y.o. %	2.90	2.78	-4.22%
Prob. of newborn, women in permanent contracts 25-44 y.o. %	1.21	1.29	+6.16%

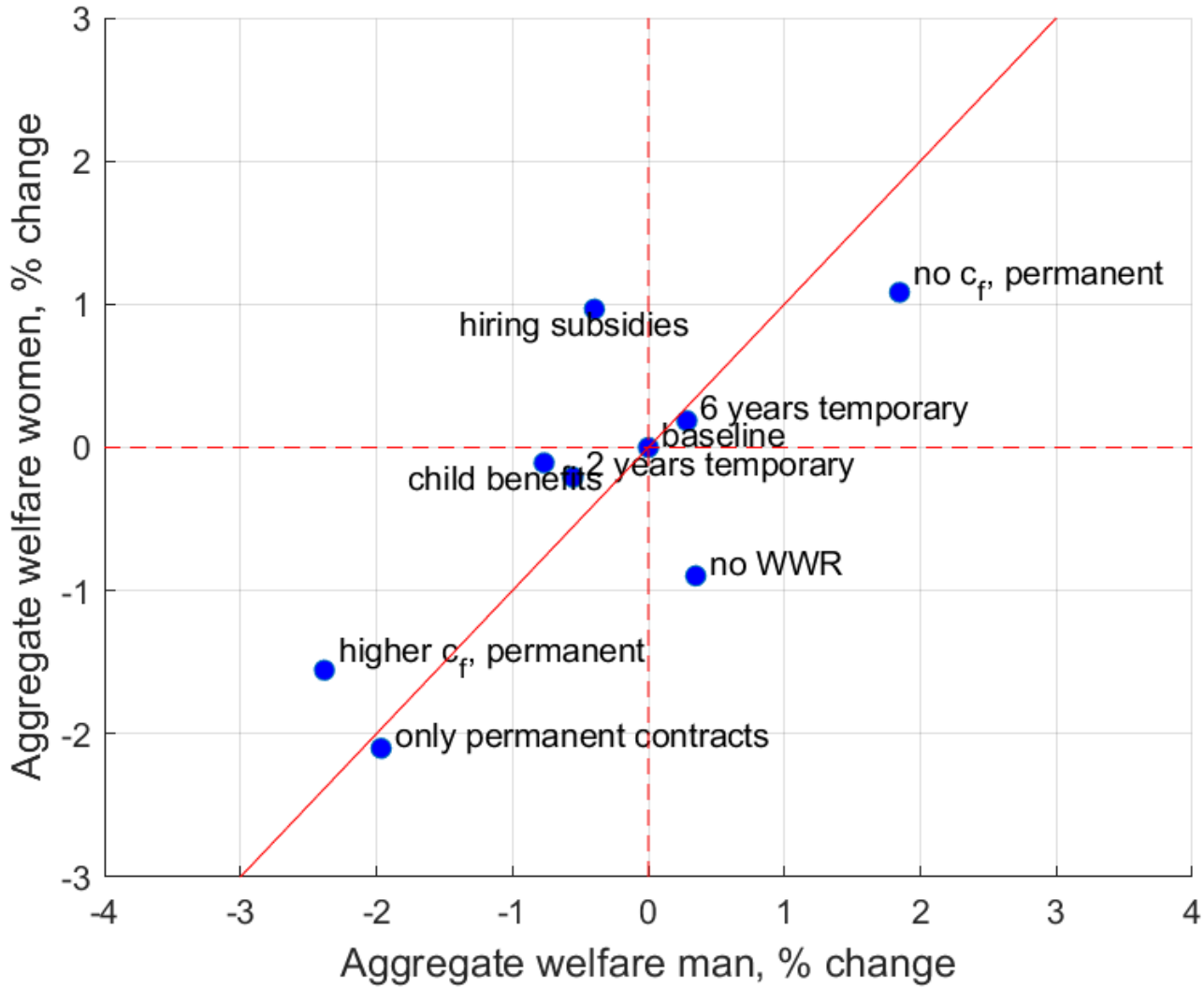
- Probability of having a newborn:
  - increases for women in permanent contracts
  - declines for women in temporary contracts

empirical evidence

Policy possibility frontier

outcomes

Welfare trade-off: men vs. women

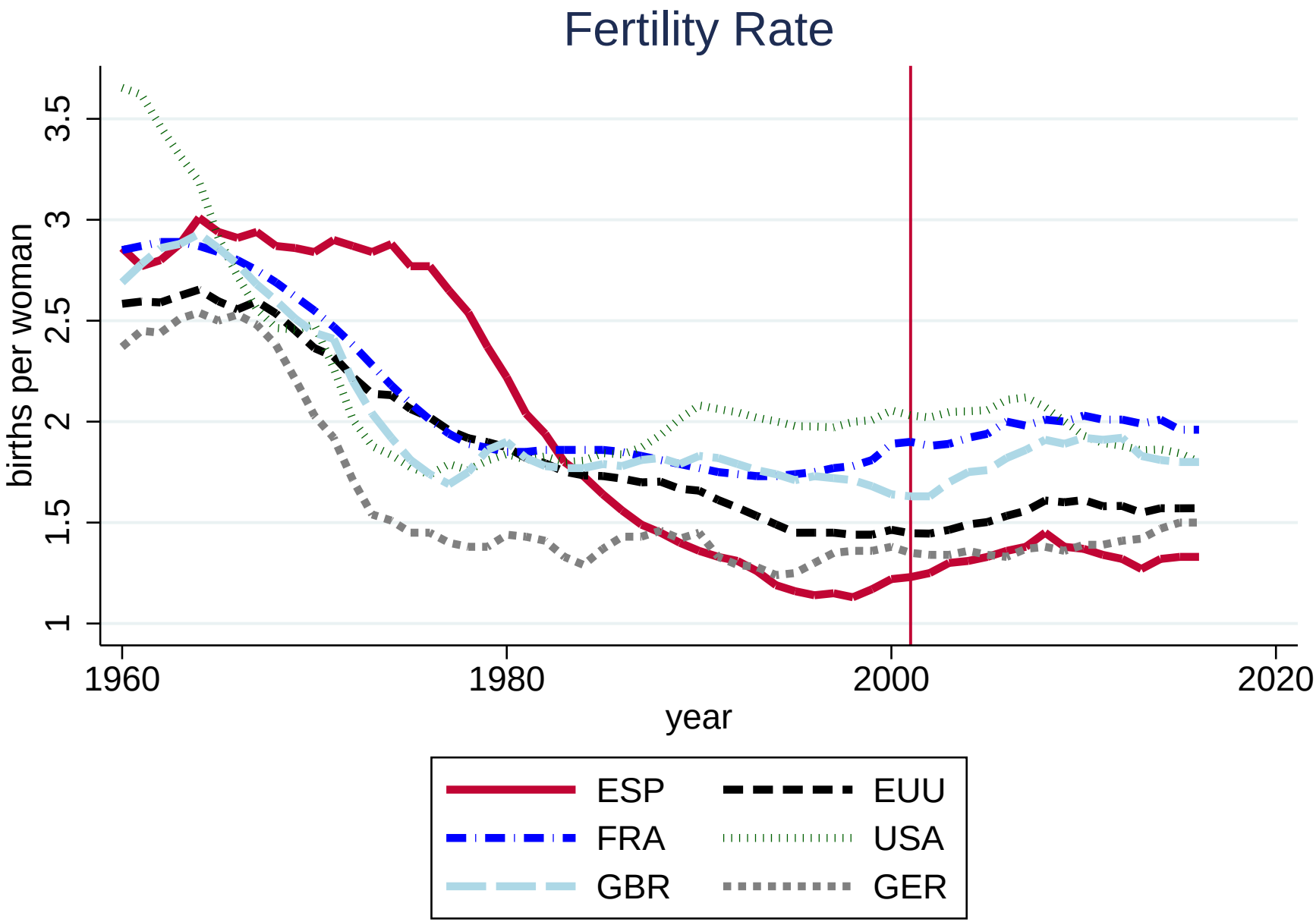


young vs old

Conclusion

- Job protection under work-week reduction induce higher fertility for women in permanent contracts, but decrease fertility for non-employed and in temporal contracts.
- Strong firm reaction:
  - lower promotion rate
  - lower hiring rate
- Despite firm's reaction, welfare for women increased after the reform

- Trade-off between wage rate and probability of having a newborn across policies
  - Hiring subsidies: largest positive effect on earnings, with largest negative effects on fertility
  - Only permanent contracts: largest positive effect on fertility, with largest negative effect on earnings
- Can we move the frontier towards positive wage and positive fertility effects?


Fertility Rate
births per woman
1
1.5
2
2.5
3
3.5
1960
1980
2000
2020
year
ESP
EUU
FRA
USA
GBR
GER

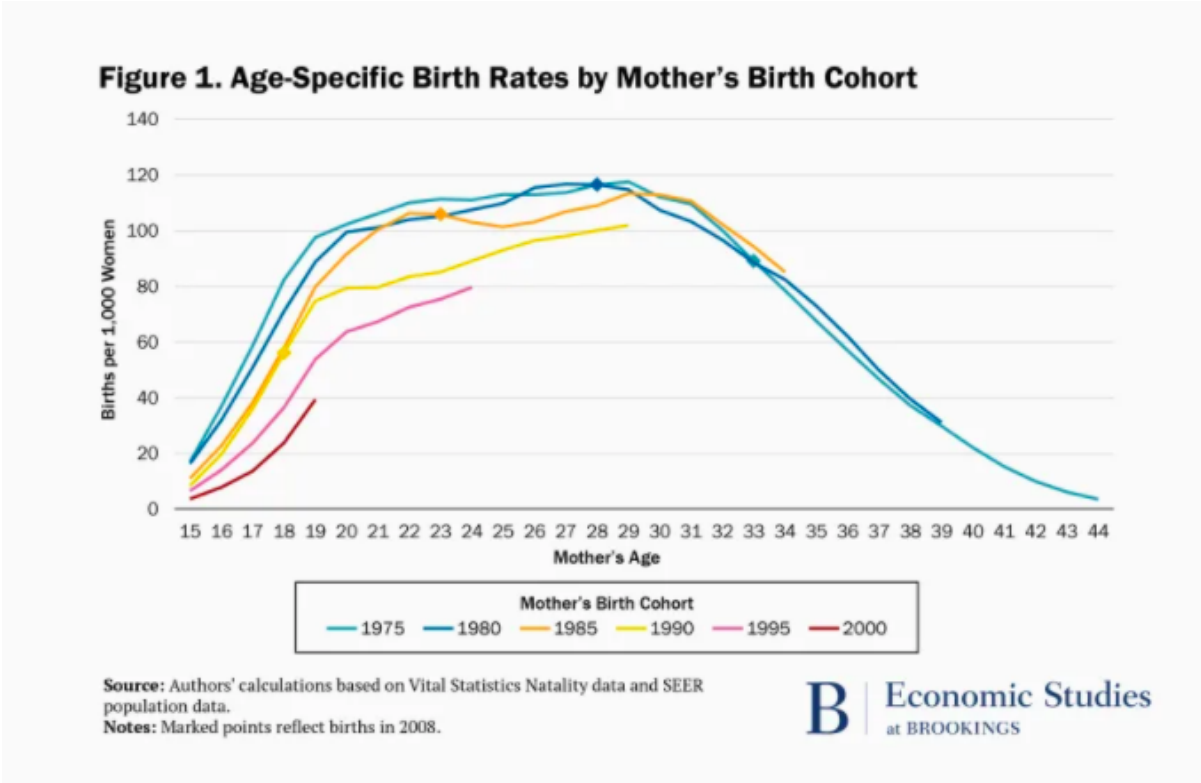


Figure 1. Age-Specific Birth Rates by Mother's Birth Cohort
Births per 1,000 Women
140
120
100
80
60
40
20
0
15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44
Mother's Age
Mother's Birth Cohort
1975 1980 1985 1990 1995 2000
Source: Authors' calculations based on Vital Statistics Natality data and SEER population data.
Notes: Marked points reflect births in 2008.
B | Economic Studies at BROOKINGS

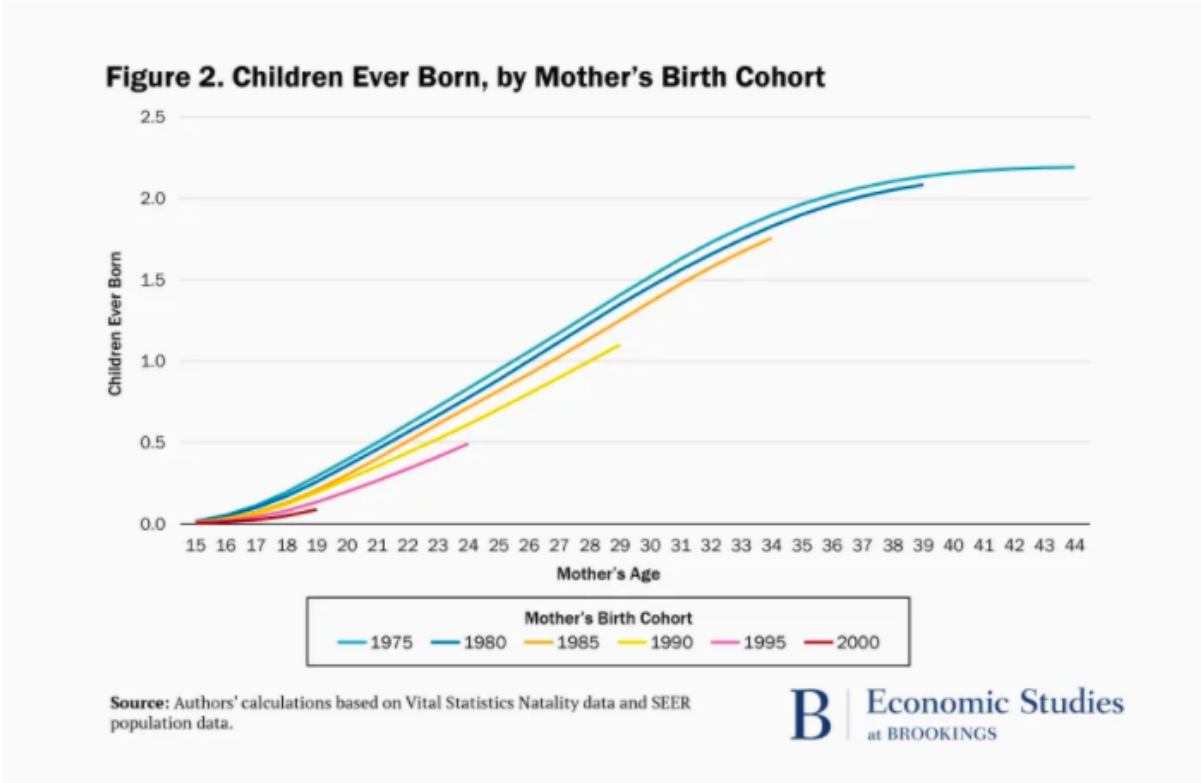


Figure 2. Children Ever Born, by Mother's Birth Cohort
2.5
2.0
1.5
1.0
0.5
0.0
Children Ever Born
15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44
Mother's Age
Mother's Birth Cohort
1975 1980 1985 1990 1995 2000
Source: Authors' calculations based on Vital Statistics Natality data and SEER population data.
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Descriptive Statistics

back

Variable	Mean	Std. Dev.	Min.	Max.	N
Age	37.177	4.344	30	45	3812587
Females	0.443	0.497	0	1	3812587
Real daily earnings (in 2010 euros)	31.859	126.994	0	62293.305	2077390
Top- and bottom-coded real daily earnings (in 2010 euros)	27.912	130.293	0	49672.84	3799228
Full-time	0.847	0.36	0	1	3390134
Work-week reduction	0.052	0.222	0	1	905904
Newborn dummy	0.06	0.237	0	1	3812587
Promotions	0.177	0.382	0	1	814111
Reform	0.806	0.395	0	1	3812587
College+	0.229	0.42	0	1	3809120
High skill	0.22	0.415	0	1	3807470
Public	0.173	0.378	0	1	3806663
Permanent	0.695	0.46	0	1	3511585
High Flexibility Industry ($\leq$p50 O*NET score)	0.625	0.484	0	1	3704151
High Flexibility Industry (p25 vs p75)	0.662	0.473	0	1	2453530
Children below 6 until 2007 an below 8 after 2007	0.315	0.465	0	1	3812587

High Flexibility Sectors (low % of men working 50+h)

back

- Activities of households as employees of domestic personnel [13.54%, women 91.14%]
- Assistance in residential establishments with health care, residential establishments for people with intellectual disabilities, mental illness and drug dependence, residential establishments for the elderly and physically disabled and other residential establishments [14.02, 87.14]
- Social services activities without accommodation for the elderly and disabled [14.53, 84.33]
- Hospital activities [14.96, 87.45]
- Medical and dental activities and other health activities [15.41, 88.68]
- Other social services activities without accommodation [18.47, 83.92]
- Education and activities auxiliary to education [19.24 68.98]
- Activities of business, professional and employers' organizations, trade union activities, other associative activities [20.61 79.88]

Low Flexibility Sectors (high % of men working 50+h)

back

- Manufacture of knitwear [38.29%, women 58.55%]
- Retail trade of other articles in specialized establishments [38.32, 57.60]
- Retail trade in stalls and markets [38.65, 55.41]
- Fishing [40.08, 29.17]
- Retail trade of food products, beverages and tobacco in specialized establishments [40.16, 56.07]
- Retail sale of automotive fuel in specialized establishments [41.40, 51.80]
- Retail trade in non-specialized establishments [43.06, 51.78]
- Restaurants and food stands [43.79, 53.36]
- Provision of prepared meals for events and other catering services [43.79, 53.36]

- Random-effect probit model for the likelihood of being in a permanent contract for women (Card and Hyslop 2005)

$$p_{it} = \Phi(\mu_r \mathbf{1}_t^{WWR} + \phi_p p_{it-1} + \beta_p \mathbf{1}_t^{WWR} p_{it-1} + x_{it}\delta_p + \eta_i + \varepsilon_{it})$$

- The structure of unobserved heterogeneity (Wooldridge 2005):

$$\eta_i = \theta_p B_{i0} + \theta_p P_{i0} + \psi p_{i0} + \zeta_{it}$$

where $\mathbf{1}_t^{WWR}$ – indicator of the reform, p_{it-1} –permanent status in previous period, x_{it}–set of controls (skill level, dummies for children of different age, age, sector, quadrature of the trend), B_{i0} – initial number of children, P_{i0} – initial number of years/share of years in permanent contracts, p_{i0} – initial permanent status.

Changes in likelihood of permanent contract

back

	(1)	(2)
Temporary*Before	0.3531***	0.3734***
	(0.0038)	(0.0039)
Temporary*After	0.3287***^{d}	0.3458***^{d}
	(0.0019)	(0.0019)
Permanent*Before	0.8970***	0.8837***
	(0.0019)	(0.0021)
Permanent*After	0.9567***^{d}	0.9549***^{d}
	(0.00042)	(0.0004)

- Temporary workers are 2.4 p.p. less likely to be promoted
- ^{d} –difference after-before is significant at 1%

gender differences

- Random-effect probit model for the likelihood of having a newborn for women (Card and Hyslop 2005)

$$b_{it} = \Phi(\mu_b \mathbf{1}_t^{WWR} + \phi_b p_{it-1} + \beta_b \mathbf{1}_t^{WWR} p_{it-1} + x_{it}\delta_b + \alpha_i + \epsilon_{it})$$

- The structure of unobserved heterogeneity (Wooldridge 2005):

$$\alpha_i = \theta_b B_{i0} + \theta_b P_{i0} + \xi_{it},$$

where $\mathbf{1}_t^{WWR}$ – indicator of the reform, p_{it-1} –permanent status in previous period, x_{it}–set of controls (skill level, dummies for children of different age, age, sector, quadrature of the trend), B_{i0} – initial number of children, P_{i0} – initial number of years/share of years in permanent contracts

Changes in likelihood of having a newborn

back

	(1)	(2)
Temporary*Before	0.0319***	0.0300***
	(0.0011)	(0.0011)
Temporary*After	0.0307***	0.0299***
	(0.0004)	(0.0003)
Permanent*Before	0.0481***	0.0495***
	(0.0013)	(0.0013)
Permanent*After	0.0514^{***d}	0.0517^{***d}
	(0.00028)	(0.00028)

- Fertility of temporary workers declines by 3.7%
- Fertility of permanent workers increased by 6.8%
- ^{d} –difference after-before is significant at 1%

gender differences

- We include gender in previous equations ($\mathbf{1}_i^w$ - woman):

$$\begin{aligned} p_{it} \quad &= \Phi(x_{it}\delta_p + \mu_p \mathbf{1}_t^{WWR} + \phi_p p_{it-1} + \beta_p \mathbf{1}_t^{WWR} p_{it-1} + \delta_p \mathbf{1}_i^w + \\ &\quad \xi_p \mathbf{1}_i^w \mathbf{1}_t^{WWR} + \pi_p \mathbf{1}_i^w p_{it-1} + \nu_p \mathbf{1}_i^w \mathbf{1}_t^{WWR} p_{it-1} + \eta_i + \varepsilon_{it}) \end{aligned}$$

- Unobserved heterogeneity as before:

$$\eta_i = \theta_p B_{i0} + \theta_p P_{i0} + \psi p_{i0} + \zeta_{it}$$

where $\mathbf{1}_t^{WWR}$ – indicator of the reform, p_{it-1} –permanent status in previous period, x_{it}–set of controls (skill level, dummies for children of different age, age, sector, quadrature of the trend), B_{i0} – initial number of children, P_{i0} – initial number of years/share of years in permanent contracts, p_{i0} – initial permanent status.

Changes in likelihood of a permanent contract

back

	Men	Women
Temporary*Before	0.3544***	0.3768***
	(0.0024)	(0.0032)
Temporary*After	0.3503***^{d}	0.3382***^{d}
	(0.0014)	(0.0016)
Permanent*Before	0.8612***	0.8897***
	(0.0014)	(0.0014)
Permanent*After	0.9489***^{d}	0.9535***^{d}
	(0.0004)	(0.0004)

- Both, men and women are more likely to stay in permanent contracts after the reform
- Promotion rate of men decreases by 0.6 p.p, of women - by 3.86 p.p.

- We include gender in previous equations ($\mathbf{1}_i^w$ - woman):

$$\begin{aligned} b_{it} \quad &= \Phi(x_{it}\delta_b + \mu_b \mathbf{1}_t^{WWR} + \phi_b p_{it-1} + \beta_b \mathbf{1}_t^{WWR} p_{it-1} + \delta_b \mathbf{1}_i^w + \\ &\quad \xi_b \mathbf{1}_i^w \mathbf{1}_t^{WWR} + \pi_b \mathbf{1}_i^w p_{it-1} + \nu_b \mathbf{1}_i^w \mathbf{1}_t^{WWR} p_{it-1} + \alpha_i + \epsilon_{it}) \end{aligned}$$

- Unobserved heterogeneity as before:

$$\alpha_i = \theta_b B_{i0} + \theta_b P_{i0} + \xi_{it},$$

where $\mathbf{1}_t^{WWR}$ – indicator of the reform, p_{it-1} –permanent status in previous period, x_{it}–set of controls (skill level, dummies for children of different age, age, sector, quadrature of the trend), B_{i0} – initial number of children, P_{i0} – initial number of years/share of years in permanent contracts

Changes in likelihood of having a newborn

back

	Men	Women
Temporary*Before	0.0401***	0.0294***
	(0.0008)	(0.0009)
Temporary*After	0.0388***	0.0306***^{d}
	(0.0003)	(0.0003)
Permanent*Before	0.0498***	0.0435***
	(0.0007)	(0.0008)
Permanent*After	0.0487***	0.0505***^{d}
	(0.0002)	(0.0002)

- Fertility of men is not affected by the reform
- Fertility of women in permanent contracts increases by 0.007 p.p with respect to men's

Bargaining problem

- Protocol as in Binmore et al. (1986) and Hall and Milgrom (2008)
- Threats of permanent suspension of negotiations are not credible
  - even with breakdown, the firm will wish to resume negotiations with the same worker in the subsequent period
- Breakdown is credibly associated only with a temporary disruption of production due to delayed agreement
- Since wages are renegotiated every period, effective surplus is the marginal flow surplus
- Sharing rule

$$\beta[y - w - \omega_f] = (1 - \beta)[w - \omega_w]$$

where ω_f and ω_w are payoffs for firms and workers in case of breakdown

back

Value of being employed in a temporary contract back

$$V^{e,t}_{w_1}(z,h,n,j) = w^t_{w_1}(z,h,n,j) + \nu d(1+n)$$
$$+ \rho(1-\rho^d)\rho^c \sum_{h' \in \mathcal{H}} \bar{V}^{e,t}_{w_0}(z,h',j)\Gamma^{e,p}_{w_1}(h'|h)$$
$$+ \rho(1-\rho^d)(1-\rho^c)(1-\sigma(n)) \sum_{h' \in \mathcal{H}} \bar{V}^{e,t}_{w_1}(z,h',n,j)\Gamma^{e,p}_{w_1}(h'|h)$$
$$+ \rho(1-\rho^d)(1-\rho^c)\sigma(n) \sum_{h' \in \mathcal{H}} \max\{\bar{V}^{e,t}_{w_1}(z,h',n,j), \bar{V}^{e,t}_{w_1}(z,h',n+1,j)\}\Gamma^{e,p}_{w_1}(h'|h)$$

$$\bar{V}^{e,t}_{w_1}(h,n,j) = \mathbf{1}^{f,t}_{w_1}(z,h,n,j)V^u_{w_1}(h,n)$$
$$+ (1 - \mathbf{1}^{f,t}_{w_1}(z,h,n,j)) \max\{\mathrm{E}V^{e,t}_{w_1}(z,h,n,j), V^u_{w_1}(h,n)\}$$

$$\mathrm{E}V^{e,t}_{w_1}(z,h,n,j) = p^t \mathbf{1}^{c,t}_{w_1}(z,h,n,j) \sum_{z' \in \mathcal{Z}} V^{e,p}_{w_1}(z',h,n,j)\Lambda(z'|z)$$
$$+ p^t(1 - \mathbf{1}^{c,t}_{w_1}(z,h,n,j))V^u_{w_1}(h,n)$$
$$+ (1-p^t)\mathbf{1}^{p,t}_{w_1}(z,h,n,j) \sum_{z' \in \mathcal{Z}} V^{e,p}_{w_1}(z',h,n,j)\Lambda(z'|z)$$
$$+ (1-p^t)(1 - \mathbf{1}^{p,t}_{w_1}(z,h,n,j)) \sum_{z' \in \mathcal{Z}} V^{e,t}_{w_1}(z',h,n,j)\Lambda(z'|z)$$

Value of being employed in a permanent contract back

$$
\begin{aligned}
V^{e,p}_{w_1}(z,h,0,j) &= w^p_{w_1}(z,h,0,j) + \nu d \\
&+\rho(1-\rho^d)\rho^c \sum_{h'\in\mathcal{H}} \bar{V}^{e,p}_{w_0}(z,h',j)\Gamma^{e,p}_w(h'|h) \\
&+\rho(1-\rho^d)(1-\rho^c)(1-\sigma(0)) \sum_{h'\in\mathcal{H}} \bar{V}^{e,p}_{w_1}(z,h',0,j)\Gamma^{e,p}_w(h'|h) \\
&+\rho(1-\rho^d)(1-\rho^c)\sigma(0) \sum_{h'\in\mathcal{H}} \max\{\bar{V}^{e,p}_{w_1}(z,h',0,j), \bar{V}^{e,p}_{w_1}(z,h',1,j)\}\Gamma^{e,p}_w(h'|h)
\end{aligned}
$$

and

$$
\begin{aligned}
V^{e,p}_{w_1}(z,h,n,j) &= w^p_{w_1}(z,h,n,j) + \nu d(1+n) \\
&+\rho(1-\rho^d)\rho^c \sum_{h'\in\mathcal{H}} \bar{V}^{e,p}_{w_0}(z,h',j)\Gamma^{e,p}_w(h'|h) \\
&+\rho(1-\rho^d)(1-\rho^c)(1-\sigma(n)) \sum_{h'\in\mathcal{H}} \bar{V}^{e,o}_{w_1}(z,h',n,j)\Gamma^{e,p}_w(h'|h) \\
&+\rho(1-\rho^d)(1-\rho^c)\sigma(n) \sum_{h'\in\mathcal{H}} \max\{\bar{V}^{e,o}_{w_1}(z,h',n,j), \bar{V}^{e,o}_{w_1}(z,h',n+1,j)\}\Gamma^{e,p}_w(h'|h)
\end{aligned}
$$

where

$$
\bar{V}^{e,o}_{w_1}(z,h,n,j) = \max\{\bar{V}^{e,r}_{w_1}(z,h,n,j), \bar{V}^{e,p}_{w_1}(z,h,n,j)\}
$$

Value of being employed in a permanent contract

back

$$\bar{V}^{e,p}_{w_1}(z,h,n,j) = \mathbf{1}^{f,p}_{w_1}(z,h,d,n,j)V^{u}_{w_1}(h,n) + (1-\mathbf{1}^{f,p}_{w_1}(z,h,n,j))\max\{\mathrm{E}V^{e,p}_{w_1}(z,h,n,j), V^{u}_{w_1}(h,n)\}$$

and

$$\mathrm{E}V^{e,p}_{w_1}(z,h,n,j) = \sum_{z'\in\mathcal{Z}} V^{e,p}_{w_1}(z',h',n,j)\Lambda(z'|z)$$

$$\bar{V}^{e,r}_{w_1}(z,h,n,j) = \max\{\mathrm{E}V^{e,r}_{w_1}(z,h,n,j), V^{u}_{w_1}(h,n)\}$$

where

$$\mathrm{E}V^{e,r}_{w_1}(z,h,n,j) = \sum_{z'\in\mathcal{Z}} V^{e,r}_{w_1}(z',h',n,j)\Lambda(z'|z)$$

$$\begin{aligned}
V^{e,r}_{w_1}(z,h,n,j) &= w^{r}_{w_1}(z,h,n,j) + (\nu+\xi)d(1+n) \\
&+\rho(1-\rho^d)\rho^c \sum_{h'\in\mathcal{H}} \bar{V}^{e,p}_{w_0}(z,h',j)\Gamma^{e,p}_{w}(h'|h) \\
&+\rho(1-\rho^d)(1-\rho^c)(1-\sigma(n)) \sum_{h'\in\mathcal{H}} \tilde{V}^{e,o}_{w_1}(z,h',n,j)\Gamma^{e,p}_{w}(h'|h) \\
&+\rho(1-\rho^d)(1-\rho^c)\sigma(n) \sum_{h'\in\mathcal{H}} \max\{\bar{V}^{e,o}_{w_1}(z,h',n,j), \bar{V}^{e,o}_{w_1}(z,h',n+1,j)\}\Gamma^{e,p}_{w}(h'|h)
\end{aligned}$$

Value of being non-employed

back

$$
\begin{aligned}
V^u_{w_1}(h,n) &= b_w + d(1+n) \\
&\quad + \rho(1-\rho^d)\rho^c \sum_{h' \in \mathcal{H}} \bar{V}^u_{w_0}(h)\Gamma^u_w(h'|h) \\
&\quad + \rho(1-\rho^d)(1-\rho^c)(1-\sigma(n)) \sum_{h' \in \mathcal{H}} \bar{V}^u_{w_1}(h,n)\Gamma^u_w(h'|h) \\
&\quad + \rho(1-\rho^d)(1-\rho^c)\sigma(n) \sum_{h' \in \mathcal{H}} \max\{\bar{V}^u_{w_1}(h,n), \bar{V}^u_{w_1}(h,n+1)\}]\Gamma^u_w(h'|h)
\end{aligned}
$$

where

$$
\begin{aligned}
\bar{V}^u_{w_1}(h,n) &= V^u_{w_1}(h,n) \\
&\quad + \phi_u \sum_{z \in \mathcal{Z}} \sum_{j \in \mathcal{J}} \mathbf{1}^{h,t}_{w_1}(z,h,n,j) \max\{0, V^{e,t}_{w_1}(z,h,n,j) - V^u_{w_1}(h,n)\}\Upsilon(j)\Lambda(z)
\end{aligned}
$$

Solution algorithm

- Use the solution to the bargaining problem to determine the wage schedules under temporary contracts for men, fertile and infertile women, permanent full-time contracts for men, fertile and infertile women, and permanent contract with reduced working schedule for fertile women
- Make or update the guess for the job contact probability for firms, ϕ_v
- Use the definition of matching functions to compute the job contact probability for unemployed workers, i.e.

$$\phi_u = (1 - \phi_v^{\eta})^{\frac{1}{\eta}}$$

- Use ϕ_u and the wage solutions to jointly solve the problem of unemployed workers, the problem of the employed workers, and the problem of an active jobs. Store value functions and policy functions.

back

Solution algorithm

- Use the policy functions to simulate a large panel of individuals and construct the distribution of unemployed workers across individual states, the measure of unemployed workers, and the shares of fertile and infertile women
- Use the distribution of unemployed individuals, the value function for temporary job and the policy function for hiring to construct the value of a vacant job
- Update guesses:
    - Use the free entry condition for firms to update ϕ_v. If the value of entry is larger than zero, increase ϕ_v, decrease it otherwise
- Iterate until convergence

back

- Matching function b/w job seekers u, and vacancies, v:

$$m(u,v) = \frac{uv}{\left(u^{\eta} + v^{\eta}\right)^{\frac{1}{\eta}}}$$

- Degenerate distribution of home values:

$$\Omega(d) = d \quad \text{with probability} \quad 1$$

- Match productivity process $z \in \mathcal{Z} = [0,1]$

$$\Lambda(z'|z) = \begin{cases} z & \text{with probability} \quad \varphi_z \\ z' \sim \mathcal{B}(\alpha_z, \beta_z) & \text{otherwise} \end{cases}$$

- Non-parametric distribution of occupation:

$$\Upsilon(j) = \begin{cases} \chi & \text{if} \quad j = 1 \\ 1 - \chi & \text{if} \quad j = 2 \end{cases}$$

back

- The inflexibility penalty is modelled as follows:

$$\omega_j(n) = \begin{cases} 0 & \text{if} \quad j = 1 \\ \omega_{j0} + \omega_{j1} n & \text{if} \quad j = 2 \end{cases}$$

- Human capital accumulation:
  - We restrict the space for human capital h to be defined in discrete set $h \in \mathcal{H} := \{\underline{h}, .., h_i, .., \bar{h}\}$
  - Let π_g^c for $c = \{t, p, r\}$ be the probability of a one step-jump in human capital, i.e.

$$h' = \begin{cases} h + \Delta_h, & \text{with probability} \quad \pi_g^c \\ h, & \text{otherwise} \end{cases}$$

  - The level of jump depends on the current h,

$$\Delta_h = \Delta_g^0 + \Delta_g^1 h$$

back

Calibration. Parameters calibrated outside the model

Parameter	Description	Value	Targets/Notes
	Demographics parameters		
ρ	Discount Factor	0.9967	4% yearly return
ρ^d	Survival Probability	0.0021	# of years in labor market (25-64)
ρ^c	Prob. child leaves home	0.0069	# of years for children (0-12)
	Labor market parameters		
β	Bargaining power	0.5	Taken from the literature
b_m	Net unemployment benefit, men (euros)	122.6776	Measured directly from data (EPA)
b_w	Net unemployment benefit, women (euros)	107.8751	Measured directly from data (EPA)
p^t	Exogenous promotion rate	0.020833	Average temporary contract length: 4 years
	Wage parameters		
ω_r	WWR wage penalty	0.7152	Measured directly from data (MCVL)

back

Estimated parameters I

Parameter	Description	Value
A	Aggregate shifter (euros)	4014.4784
	Wage/production penalties	
ω_w	Gender wage penalty	0.0866
ω_{j0}	Children wage penalty, scalar	0.7650
ω_{j1}	Children wage penalty, linear	0.0655
ω_r	WWR production penalty	0.1708
	Human capital	
α_w^h	Initial distribution human capital	2.6573
β_w^h	Initial distribution human capital	4.6558
Δ_w^0	Human capital step size, constant	0.1568
Δ_w^1	Human capital step size, linear	-0.0491
π_w^t	Human capital jump, temporary	0.3556
π_w^p	Human capital jump, permanent	0.2256
π_w^r	Human capital jump, WWR	0.1801
π_w^u	Human capital jump, unemployed	0.0547
	Match-specific shocks	
φ_z	Shock persistency	0.6025
α_z	Shock distribution	4.8512
β_z	Shock distribution	9.8050

back

Estimated parameters II

Parameter	Description	Value
	Fertility/utility	
$\sigma(n=0)$	Fertility opportunity if $n=0$	1.5390%
$\sigma(n=1)$	Fertility opportunity if $n=1$	1.4173%
$\sigma(n=2)=\sigma(n=3)$	Fertility opportunity if $n \in \{2,3\}$	0.2047%
d	Value staying home if unemployed (euros)	1381.51
νd	Value staying home if employed (euros)	696.79
ξd	Extra value staying home under WWR (euros)	236.02
	Costs	
c_o	Cost of operation (euros)	310.15
c_v	Cost of posting vacancy (euros)	63252.88
c_f	Firing costs (euros)	5165.69
	Labor market	
χ	Share of potential flexible jobs	0.5881
η	Elasticity of matching function	0.6214
δ_f^t	Exogenous separation from temporary contract, women	1.2162%
δ_f^p	Exogenous separation from permanent contract, women	1.0162%
δ_m	Exogenous separation, men	1.0392%

back

Other targeted moments

Description	Data	Model
Employment shares		
Employment share of pop., 25-44	0.4589	0.3943
Temporary share of emp., 25-44	0.1811	0.1827
Flexible share of emp., 25-44	0.6826	0.6838
WWR share of permanent emp., 25-44	0.1354	0.1464
Rates		
Temporary to permanent contract, 25-44	0.0920	0.1140
Permanent to permanent contract, 25-44	0.9446	0.9534
Wages (relative to men)		
Avg.wage, 25-44 y.o.	-0.1104	-0.1261
Avg.wage flexible job, 25-44 y.o.	-0.0563	-0.0734
Avg.wage inflexible job, 25-44 y.o.	-0.2444	-0.2505
Wage dispersion at entry		
St.dev.log wage, 25-29 y.o.	0.4200	0.3997
p90/p10 wage, 25-29 y.o.	2.8543	2.8396
p50/p10 wage, 25-29 y.o.	1.5605	1.6980
Wage growth		
Avg. wage growth, 25-44 y.o.	4.7908	4.8432
Avg. wage growth women w/o children, 25-44 y.o.	5.3911	5.4640
Avg. wage growth women w/ 1 child, 25-44 y.o.	4.0210	4.6210
Avg. wage growth women w/ 2+ children, 25-44 y.o.	3.8628	3.7793

back

Other targeted moments

- $\Delta \ln[w_{it}] = \beta_0 + \beta_1 w_{it}^0 + \beta_2 \tau_{it} + \beta_3 \tau_{it}^2 + \beta_4 w_{it}^0 \tau_{it} + \beta_5 w_{it}^0 \tau_{it}^2 + \beta_6 n_{it} + \epsilon_{it}$

Description	Data	Model
Temporary contracts		
w_{it}^0	-0.4330	-0.6225
τ_{it}	-7.2910	-15.7166
τ_{it}^2	0.3970	1.4807
$w_{it}^0 \tau_{it}$	0.1040	0.2184
$w_{it}^0 \tau_{it}^2$	-0.0060	-0.0220
Permanent contracts		
w_{it}^0	-0.1570	-0.2686
τ_{it}	-2.2590	-3.8193
τ_{it}^2	0.0970	0.1876
$w_{it}^0 \tau_{it}$	0.0270	0.0598
$w_{it}^0 \tau_{it}^2$	-1.0000e-03	-0.0031

back

Other targeted moments

- $\Delta \ln[w_{it}] = \beta_0 + \beta_1 w_{it}^0 + \beta_2 \tau_{it} + \beta_3 \tau_{it}^2 + \beta_4 w_{it}^0 \tau_{it} + \beta_5 w_{it}^0 \tau_{it}^2 + \beta_6 n_{it} + \epsilon_{it}$

Description	Data	Model
Flexible occupations		
w_{it}^0	-0.2130	-0.3723
τ_{it}	-3.2780	-5.4560
τ_{it}^2	0.1490	0.2664
$w_{it}^0 \tau_{it}$	0.0410	0.0817
$w_{it}^0 \tau_{it}^2$	-0.0020	-0.0043
Non-flexible occupations		
w_{it}^0	-0.2270	-0.4128
τ_{it}	-2.9030	-5.8077
τ_{it}^2	0.1290	0.2776
$w_{it}^0 \tau_{it}$	0.0430	0.0856
$w_{it}^0 \tau_{it}^2$	-0.0020	-0.0040

back

Counterfactuals. Effects of Labor Market Duality

	Baseline	Counterfactual		
Cost of dismissal during WWR (euros)	Not allowed	Not allowed	Not allowed	Not allowed
Mandated length of temporary contracts	4 years	2 years	6 years	No duality
Cost of dismissal, permanent contracts (euros)	5165.69	5165.69	5165.69	2582.84
Labor Market Outcomes				
Temporary to permanent contract, rate 25-44 y.o. %	11.40	17.84	8.96	-
Non-employed women, 25-44 y.o. %	42.30	44.34	41.49	47.66
Women in temporary contracts, 25-44 y.o. %	18.27	12.73	21.63	-
Women in permanent contracts, 25-44 y.o. %	39.43	42.93	36.89	52.34
Avg. wage, 25-44 y.o.	60.79	59.19	61.73	56.35
Fertility Outcomes				
Probability of extra kid, non-employed women 25-44 y.o. %	1.20	1.14	1.22	1.07
Probability of extra kid, employed women 25-44 y.o. %	0.88	0.91	0.87	0.97
Probability of extra kid, women in temporary contracts 25-44 y.o. %	2.78	3.97	2.34	-
Probability of extra kid, women in permanent contracts 25-44 y.o. %	1.29	1.18	1.37	-

back

Counterfactuals. Effect of Employment Protection

	Baseline	Counterfactual	
Cost of dismissal during WWR (euros)	Not allowed	Not allowed	Not allowed
Mandated length of temporary contracts	4 years	4 years	4 years
Cost of dismissal, permanent contracts (euros)	5165.69	0	10331.38
Labor Market Outcomes			
Temporary to permanent contract, rate 25-44 y.o. %	11.40	11.72	11.41
Non-employed women, 25-44 y.o. %	42.30	40.05	45.38
Women in temporary contracts, 25-44 y.o. %	18.27	18.42	17.55
Women in permanent contracts, 25-44 y.o. %	39.43	41.54	37.07
Avg. wage, 25-44 y.o.	60.79	61.16	60.18
Fertility Outcomes			
Probability of extra kid, non-employed women 25-44 y.o. %	1.20	1.26	1.12
Probability of extra kid, employed women 25-44 y.o. %	0.88	0.84	0.93
Probability of extra kid, women in temporary contracts 25-44 y.o. %	2.78	2.75	2.89
Probability of extra kid, women in permanent contracts 25-44 y.o. %	1.29	1.22	1.37

back

Counterfactuals. Effect of Subsidies

	Baseline	Counterfactual	
		Child benefits 50 euros (monthly)	Hiring subsidies 5% (wage bill)
Cost of dismissal during WWR (euros)	Not allowed	Not allowed	Not allowed
Mandated length of temporary contracts	4 years	4 years	4 years
Cost of dismissal, permanent contracts (euros)	5165.69	5165.69	5165.6878
Labor Market Outcomes			
Temporary to permanent contract, rate 25-44 y.o. %	11.40	11.43	11.60
Non-employed women, 25-44 y.o. %	42.30	42.51	37.95
Women in temporary contracts, 25-44 y.o. %	18.27	18.17	19.12
Women in permanent contracts, 25-44 y.o. %	39.43	39.32	42.94
Avg. wage, 25-44 y.o.	60.79	60.69	63.87
Fertility Outcomes			
Probability of extra kid, non-employed women 25-44 y.o. %	1.20	1.19	1.34
Probability of extra kid, employed women 25-44 y.o. %	0.88	0.88	0.82
Probability of extra kid, women in temporary contracts 25-44 y.o. %	2.78	2.80	2.66
Probability of extra kid, women in permanent contracts 25-44 y.o. %	1.29	1.29	1.18

back

Welfare trade-off: young vs. old

back