Collective bargaining, firm heterogeneity and unemployment

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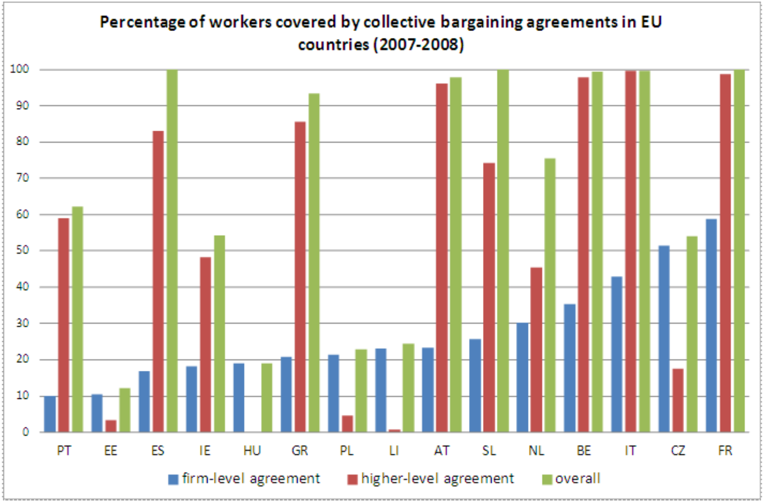
Motivation

- The diverse behavior of labor markets in industrialized economies during the crisis has drawn attention to the institutional features of labor markets
- Wage setting institutions are a key determinant of labor market responses to economic change
- In continental Europe, wage setting is predominantly in the form of **collective bargaining**

Collective bargaining in Europe



Source: Wage Dynamics Network

Collective bargaining, wage compression and labor market performance

- Certain features of collective bargaining tend to hinder wage adjustment over time: indexation to inflation, automatic extension of expired agreements (Spain), etc.
- Centralization of collective bargaining tends to *compress* the wage distribution
  - International evidence summarized in Flanagan (1999)
  - Spain: Izquierdo, Moral & Urtasun (2003)
- Failure of wages to reflect firm-specific and sector-specific factors may have undesirable consequences for economic efficiency and labor market outcomes
- This paper tries to understand, from a theoretical point of view, how the structure of wage bargaining may affect labor market performance in the presence of firm heterogeneity

Framework

- One-sector Mortensen-Pissarides economy
- Firm-worker pairs are subject to idiosyncratic productivity shocks
- Two bargaining scenarios:
  - **Firm-level bargaining**: each firm-worker pair agrees on a firm-specific wage
  - **Sector-level bargaining**: sector-level firm and worker representatives agree on a common wage for all firms
- In each scenario, jobs are destroyed below (and are created above) a certain productivity threshold

Main theoretical results

- Unemployment is *higher* in the sector-level bargaining scenario
  - Higher job destruction rate: low productivity firms cannot afford to pay the sector-level wage
  - Lower job finding rate: new jobs with low productivity generate lower profits
- An 'efficient opting out' scenario replicates the unemployment rate of the firm-level bargaining scenario
  - Low productivity firm-worker pairs agree to opt out of the sector-level agreement and bargain individually
  - JC/JD threshold for opting out firms equals the one under firm-level bargaining $\Rightarrow$ same transition rates

Numerical analysis

- Calibrate the model to an archetypical continental European economy
- Unemployment rate is about 5pp lower under firm-level bargaining (or efficient opting out)

Related literature

- Seminal paper: Calmfors-Driffill (1988)
  - Inverse U-shape relationship between degree of centralization and unemployment
  - Large firms, DRS, right-to-manage bargaining; *symmetric firms*
  - Two opposing effects: market power (restrains $W \uparrow$ at lower levels) vs externalities on aggregate price level (restraints $W \uparrow$ at higher levels)
- Boeri & Burda (2009): Mortensen-Pissarides model, focus on endogenous choice of collective bargaining in the presence of firing costs
- Many empirical, cross-country studies: Flanagan (1999) (survey in JEL), Nickell and Nunziata (2005)
  - Mixed evidence on the effects of collective bargaining

MODEL

Matching

- Total labor force normalized to 1
- Constant returns to scale matching technology

$$m(u, v),$$

where u is unemployment (rate) and v is vacancies

- Vacancy filling probability,

$$\frac{m(u,v)}{v} = m\left(\frac{1}{v/u}, 1\right) \equiv q(\theta),$$

where $\theta \equiv v/u$ is labor market tightness

- Job finding probability,

$$\frac{m(u,v)}{u} = m\left(1, \frac{v}{u}\right) \equiv p\left(\theta\right) = \theta q(\theta).$$

Production

- Each job produces z
- Jobs differ in their productivity
- We assume (without loss of generality) that z follows an iid process with cdf $F(z)$

Value functions

- Let $b = f, s$ denote the bargaining regime: firm-level ($b = f$), sector-level ($b = s$)
- In each regime, jobs with productivity below a threshold R^b are destroyed
- Value for the firm of job with productivity z,

$$J^b(z) = z - w^b(z) + \beta(1-\rho)\int_{R^b} J^b(x)dF(x),$$

- Value of the same job for the worker,

$$\begin{aligned} W^b(z) &= w^b(z) + \beta(1-\rho)\int_{R^b} W^b(x)dF(x) \\ &+\beta\left[\rho + (1-\rho)F\left(R^b\right)\right]U^b, \end{aligned}$$

where U^b is the value of unemployment

Wage bargaining

- We consider two bargaining scenarios: *firm-level* bargaining, and *sector-level* bargaining
- In both cases, we assume credible threats (as in Hall & Milgrom, 2008):
  - In the absence of agreement, workers receive payoff δ and firms incur cost γ
  - Both parties continue negotiating in the following period
- Disagreement payoffs of firm and worker,

$$\tilde{J}^b = -\gamma + \frac{1-\rho}{1+r} \int_{R^b} J^b(x) dF(x),$$

$$\tilde{W}^b = \delta + \frac{1-\rho}{1+r} \left\{ \int_{R^b} W^b(x) dF(x) + F\left(R^b\right) U^b \right\} + \frac{\rho U^b}{1+r},$$

$b = f, s.$

- Symmetric Nash bargaining in both cases

Firm-level bargaining

- Firm and worker surplus,

$$J^f(z) - \tilde{J}^f = z - w^f(z) + \gamma,$$

$$W^f(z) - \tilde{W}^f = w^f(z) - \delta.$$

- Nash bargaining,

$$w^f(z) = \arg\max_{w^f(z)} \left[z - w^f(z) + \gamma\right] \left[w^f(z) - \delta\right]$$

- Wage agreement,

$$w^f(z) = \frac{z}{2} + \frac{\delta + \gamma}{2}.$$

- Firm and worker split the joint surplus equally: $w^f(z) - \delta = z - w^f(z) - (-\gamma)$.

Sector-level bargaining

- Wages bargained by sector-level union and sector-level employer federation
- They choose a common wage $w^s(z) = w^s$ for all firms in the sector (wage compression). Firm and worker surplus,

$$J^s(z) - \tilde{J}^s = z - w^s + \gamma,$$

$$W^s - \tilde{W}^s = w^s - \delta.$$

- Negotiators care about aggregate surplus of those jobs that continue operating once the agreement comes into effect ($=$ # of surviving jobs, n, times average surplus)
- We assume negotiators take as given the productivity threshold (R) and the resulting employment level (n)
    - Maximize comparability with firm-level bargaining scenario and focus on the effect of wage compression
    - Later we relax this assumption

Sector-level bargaining (2)

- Aggregate surplus,

$$n^s \int_{R^s} \left(J^s(z) - \tilde{J}^s \right) \frac{dF(z)}{1 - F(R^s)} = n^s \left(\int_{R^s} z \frac{dF(z)}{1 - F(R^s)} - w^s + \gamma \right),$$

$$n^s \left(W^s - \tilde{W}^s \right) = n^s \left(w^s - \delta \right).$$

- Nash bargaining

$$w^s = \arg\max_{w^s} \left[\left(\int_{R^s} z \frac{dF(z)}{1 - F(R^s)} - w^s + \gamma \right) \right] \left[\left(w^s - \delta \right) \right]$$

- Wage agreement,

$$w^s = \frac{E\left(z \mid z \geq R^s\right)}{2} + \frac{\delta + \gamma}{2},$$

where $E\left(z \mid z \geq R^s\right) \equiv \int_{R^s} z dF(z) / \left[1 - F(R^s)\right]$

Job destruction

- Job destruction threshold R^b determined by zero firm surplus condition: $J^b\left(R^b\right) = 0$
- *Job destruction* condition in each regime

$$0 = \frac{R^f}{2} - \frac{\delta+\gamma}{2} + \beta\left(1-\rho\right)\int_{R^f} J^f\left(z\right) dF\left(z\right), \qquad (\mathrm{JD}^f)$$

$$0 = R^s - \frac{E\left(z \mid z \geq R^s\right)}{2} - \frac{\delta+\gamma}{2} + \beta\left(1-\rho\right)\int_{R^s} J^s\left(z\right) dF\left(z\right), \qquad (\mathrm{JD}^s)$$

where

$$J^f\left(z\right) = \frac{z-R^f}{2},$$

$$J^s\left(z\right) = z - R^s.$$

Job destruction: firm-level vs sector-level

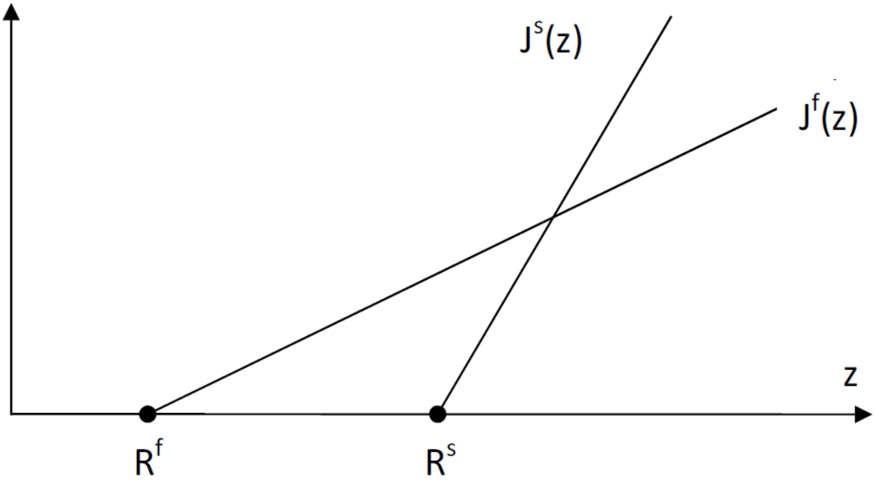
Lemma

The job destruction threshold in the sector-level bargaining equilibrium is higher than in the firm-level bargaining equilibrium: $R^s > R^f$.

Therefore, the job destruction rate is higher under sector-level bargaining,

$$F\left(R^s\right) > F\left(R^f\right).$$

Surplus functions



Job creation

- We assume stochastic job matching: upon matching with a worker, firm observes the productivity z of the new job
- If $z \geq R^b$, the firm finds the job profitable and the match is actually formed, $b = f, s$
- Therefore, job creation threshold = job destruction threshold = R^b
- Free entry of vacancies $\Rightarrow$ *Job creation* condition,

$$\frac{\kappa}{q(\theta^b)} = \beta\,(1-\rho)\int_{R^b} J^b(x)dF\,(x)\,, \qquad (\text{JC}^b,\ b = f, s)$$

where κ is vacancy cost

Job creation: firm-level vs sector-level

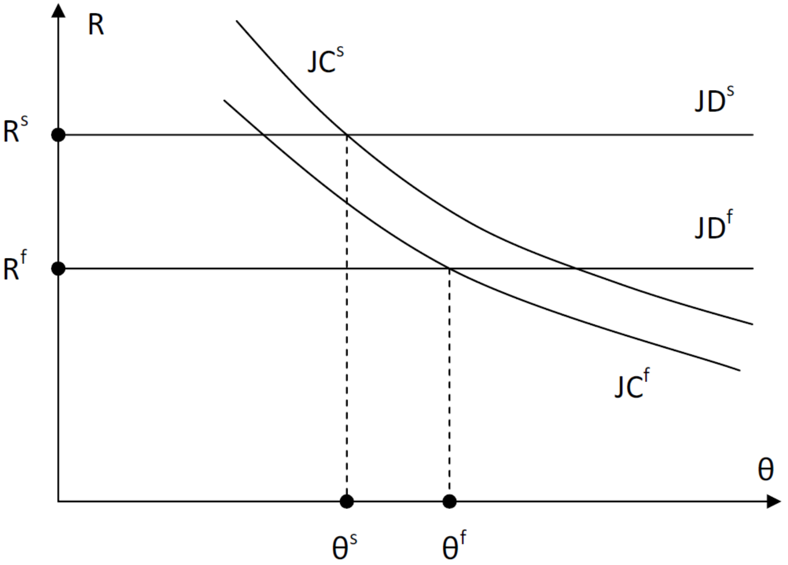
Lemma

Labor market tightness in the sector-level bargaining equilibrium is lower than in the firm-level bargaining equilibrium: $\theta^s < \theta^f$.

Therefore, the job finding rate is lower under sector-level bargaining,

$$p\left(\theta^s\right)\left[1 - F\left(R^s\right)\right] < p(\theta^f)\left[1 - F\left(R^f\right)\right].$$

Equilibrium



Equilibrium unemployment

Employment and unemployment evolve according to

$$n_t^b = (1-\rho)\left[1 - F\left(R^b\right)\right] n_{t-1}^b + p(\theta^b)(1-\rho)\left[1 - F\left(R^b\right)\right] u_{t-1}^b,$$

$$u_t^b = 1 - n_t^b.$$

In the stationary equilibrium,

$$u^b = \frac{\rho + (1-\rho) F\left(R^b\right)}{\rho + (1-\rho) F\left(R^b\right) + p(\theta^b)(1-\rho)\left[1 - F\left(R^b\right)\right]}.$$

Since $F\left(R^s\right) > F(R^f)$ and $p(\theta^s) < p(\theta^f)$,

Proposition *Unemployment is higher in the sector-level than in the firm-level bargaining equilibrium,* $u^s > u^f$

Efficient opting out

- Sector-level bargaining scenario can be interpreted as a situation in which firm-level agreements that lower sector-level standards are either illegal or very difficult/costly to implement
- Assume now that a regulatory reform allows firm-worker pairs to opt out of sector-level agreements costlessly *if* they find it mutually beneficial
- We may refer to this scenario as 'efficient opting out'
- Both sector-level and firm-level agreement will coexist.

Efficient opting out

- There will be one JD threshold for opting-out firms, R^{f*}, and one for non-opting-out firms, R^{s*}
- Wage agreements at each bargaining level have the same form as before,

$$w^{f*}(z) = \frac{z}{2} + \frac{\delta + \gamma}{2},$$

$$w^{s*} = \frac{E(z \mid z \geq R^{s*})}{2} + \frac{\delta + \gamma}{2}.$$

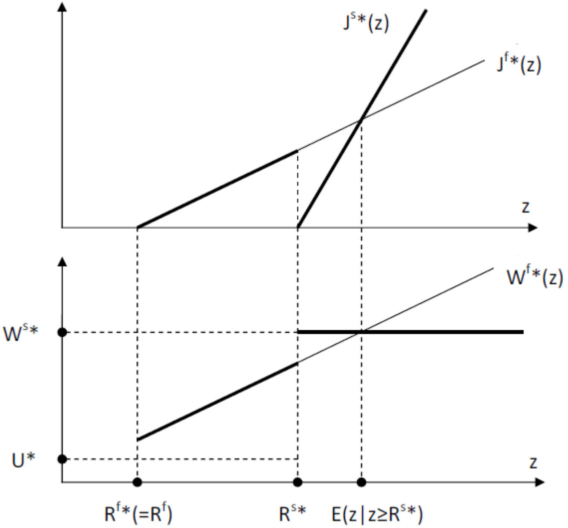
- So do surplus functions,

$$J^{f*}(z) = \frac{z - R^{f*}}{2}.$$

$$J^{s*}(z) = z - R^{s*}.$$

- Also, $R^{s*} > R^{f*}$, $J^{f*}(\bar{z}^{*s}) = J^{s*}(\bar{z}^{*s})$ and $W^{f*}(\bar{z}^{*s}) = W^{s*}$

Surplus functions under efficient opting out



Efficient opting out

- Only firm-worker pairs with productivity in the range $[R^{f*}, R^{s*})$ will agree to opt out
- Job destruction condition for each segment, $J^{b*}(R^{b*}) = 0$, $b = f, s$:

$$\frac{\delta + \gamma}{2} = \frac{R^{f*}}{2} + \beta(1-\rho)\left[\int_{R^{f*}}^{R^{s*}} J^{f*}(z)dF(x) + \int_{R^{s*}} J^{s*}(z)dF(x)\right],$$

$$\frac{\delta+\gamma}{2} = R^{s*} - \frac{\bar{z}^{*s}}{2} + \beta(1-\rho)\left[\int_{R^{f*}}^{R^{s*}} J^{f*}(z)dF(x) + \int_{R^{s*}} J^{s*}(z)dF(x)\right]$$

- Job creation condition,

$$\frac{\kappa}{q(\theta^*)} = \beta(1-\rho)\left[\int_{R^{f*}}^{R^{s*}} J^{f*}(z)dF(x) + \int_{R^{s*}} J^{s*}(z)dF(x)\right].$$

Efficient opting out

Lemma

The JD threshold for opting-out firms in the efficient opting-out equilibrium is the same as the JD threshold in the firm-level bargaining equilibrium: $R^{f*} = R^f$.

Lemma

Labor market tightness in the efficient opting-out equilibrium is the same as in the firm-level bargaining equilibrium: $\theta^* = \theta^f$.

Since R^{f*} is *the* relevant threshold in this scenario ,

Proposition *Unemployment in the efficient opting-out equilibrium is the same as in the firm-level bargaining equilibrium:* $u^* = u^f$

NUMERICAL ANALYSIS

Calibration

- Quarterly frequency
- Prototypical continental European economy: $JFR = 20\%$, $JDR = 2\%$
  $\Rightarrow u = \frac{JDR}{JDR+JFR} = 9.1\%$
- *Sector-level* bargaining as baseline scenario

Parameter	Notation	Value	Target/source
Discount factor	r	0.01	real interest rate $=$ 4% p.a.
Exogenous separation rate	ρ	0.01	1/2 total separation rate
SD (log)prod.	σ	0.15	illustrative
Mean (log)prod.	μ	$-\sigma^2/2$	$E(z) = 1$
Elasticity matching fct	ϵ	0.5	Petrongolo-Pissarides 2001
Scale matching fct	m_0	0.4082	job-finding rate: 20% p.q.
Sum disagreement payoffs	$\delta + \gamma$	0.9853	separation rate: 2% p.q.
Vacancy posting cost	κ	0.2420	$\theta = 1/4$

Comparison of bargaining scenarios

Variable	Notation	Bargaining scenario	
		Sector-level	Firm-level
Labor market tightness	θ	0.25	0.3776
Productivity threshold	R	0.6979	0.2566
Average worker product	$E\left(z \mid z \geq R\right)$	1.0034	1.0000
Average real wage	$E\left(w\left(z\right) \mid z \geq R\right)$	0.9944	0.9926
Job-finding rate	$\left[1\text{-}F\left(R\right)\right]\left(1\text{-}\rho\right)\theta q(\theta)$	0.20	0.2483
Separation rate	$\rho + \left(1 - \rho\right) F\left(R\right)$	0.02	0.01
Unemployment rate	u	**0.0909**	**0.0387**

Robustness

	$\sigma = 0.10$		$\sigma = 0.15$		$\sigma = 0.20$	
Variable	Sector	Firm	Sector	Firm	Sector	Firm
tightness	0.25	0.3760	0.25	0.3776	0.25	0.3792
prod. threshold	0.7888	0.4813	0.6979	0.2566	0.6160	0.0532
Average prod.	1.0024	1.0000	1.0034	1.0000	1.0043	1.0000
Average wage	0.9961	0.9949	0.9944	0.9926	0.9928	0.9906
Job-finding rate	0.20	0.2478	0.20	0.2483	0.20	0.2488
Separation rate	0.02	0.01	0.02	0.01	0.02	0.01
Unemployment	0.0909	0.0388	0.0909	0.0387	0.0909	0.0386

Alternative sector-level bargaining setup

- So far we have assumed sector-level negotiators take as given the employment level
- We now assume they internalize the effects of the wage agreement on employment
- Given the agreed wage, firms decide the level of employment by choosing the JC-JD threshold (R)
- We may thus interpret this scenario as *right-to-manage* sector-level bargaining.
- Denote this scenario with $b = r$

Right-to-manage sector-level bargaining

- Bargaining problem,

$$w^r = \arg\max_{w^r} \left[n_t^r \left(\int_R z \frac{dF(z)}{1-F(R)} - w^r + \gamma \right) \right] \left[n_t^r \left(w^r - \delta \right) \right]$$

subject to

$$n_t^r = \left[1 - F(R) \right] (1-\rho) \left[n_{t-1}^r + \theta^r q(\theta^r) u_{t-1}^r \right],$$

$$R = w^r - \frac{1-\rho}{1+r} \int_{R^r} J^r(x) dF(x).$$

Right-to-manage sector-level bargaining (2)

- Implicit solution,

$$w^r = \frac{E(z \mid z \geq R^r) + \gamma}{2+\chi} + \frac{1+\chi}{2+\chi}\delta \quad \underset{\chi\to 0}{\longrightarrow} w^s,$$

where

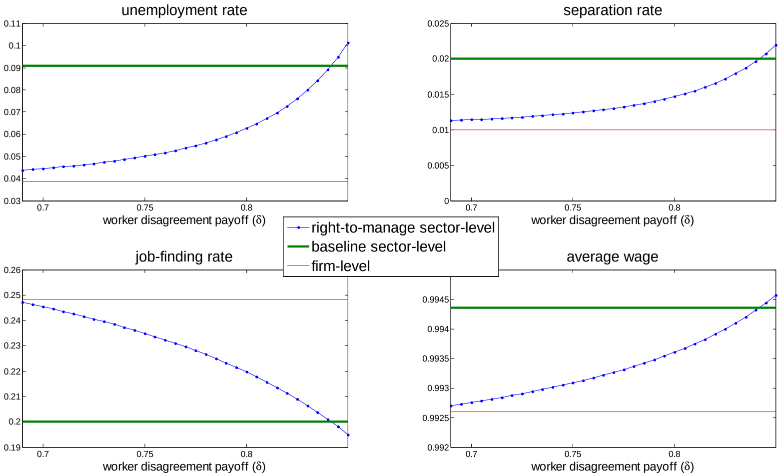
$$\chi \equiv \frac{f(R^r)\left[(w^r - \delta) + (R^r - w^r + \gamma)\right]}{1 - F(R^r) - f(R^r)(w^r - \delta)}.$$

- The term χ captures two effects: an increase in w^r and thus in R
  - destroys the surplus $w^r - \delta$ for the mass $f(R^r)$ of workers at the margin (union's concern for employment loss due to higher wage claims)
  - eliminates the surplus $R^r - w^r + \gamma = J^r(R^r) - \tilde{J}^r = -\tilde{J}^r < 0$ for the mass $f(R^r)$ of firms at the margin
- If former effect dominates ($\chi > 0$), then $w^r < w^s$ and $u^r < u^s$

Right-to-manage sector-level bargaining (3)

- Our calibration strategy implied a unique value for $\delta + \gamma$. Both parameters entered in equilibrium conditions of regimes $b = f, s$ *only* through that sum
- For regime $b = r$, it also matters how $\delta + \gamma$ is distributed between δ and γ.
- We compute the right-to-manage sector-level bargaining equilibrium for different values of δ
    - with γ then computed as $(\delta + \gamma) - \delta$

Unemployment under different bargaining scenarios



Right-to-manage sector-level bargaining (4)

- δ typically depends on other characteristics of labour legislation: strike regulations, strike funds, wage floors / automatic extension of expired agreements during negotiations, etc.
- It thus seems natural to assume that δ is relatively close to the wage while working
- Reasonable range for worker income loss during negotiations: 10-15% $\Rightarrow \delta / w \simeq \delta \in [0.85, 0.90]$

Conclusions

- We have compared firm-level vs sector-level bargaining in a one-sector Mortensen-Pissarides economy
- Two main theoretical results
  - Unemployment is *higher* under sector-level bargaining
  - Allowing for 'efficient opting out' allows to reduce unemployment down to its level under firm-level bargaining
- For an archetypical continental European calibration, the unemployment rate is about 5pp lower in the firm-level bargaining scenario
- When negotiators internalize the employment effects of higher wages, unemployment under sector-level bargaining is closer to, but still higher than, its level under firm-level bargaining