Preferences for Rigid versus Individualized Wage Setting in Search Economies with Firing Frictions

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August 27, 2003

Abstract

Firing frictions affect worker and firm preferences for rigid wages versus individualized Nash bargaining in a standard model of equilibrium unemployment in which workers vary by skill. Benefits of rigid wages derive from savings on renegotiation costs; firing frictions further increase the attractiveness of wage rigidity. For standard calibrations, the model can account for political equilibria in favor of wage rigidity, as well as the existence of centralized bargaining, excess coverage and free-riding.

JEL: J5, J6, D7

Keywords : Wage rigidities, job protection, firing frictions, renegotiation costs, excess coverage, equilibrium unemployment.

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1 Introduction

This paper explores the value of different regimes of wage determination to workers and employers in a model of equilibrium unemployment. In doing so, we seek to better understand i) the increasing heterogeneity across countries in the presence of unions and ii) the phenomenon of excess coverage observed especially in European labor markets. Excess coverage generally refers to the extension of collective agreements to wages paid to non-union members, but can also include other aspects of union influence on the nature of the employment relationship. This phenomenon has been documented recently by the OECD (1996) and Boeri, Calmfors and Brugiavini (2001).

The equilibrium search and matching framework (Mortensen and Pissarides 1994, 2000, henceforth MP) provides the model framework. We distinguish between jobs with match-surplus shared between employers and workers in a decentralised fashion (flexible-wage regime), and those with wages determined outside the parameters of the individual employment relationship (rigid-wage regime). We thereby introduce two new frictions in the MP framework. The first is that in the individually bargained wage regime, worker-firm matches are subject to renegotiation costs when productivity changes. These renegotiation costs are seen as an inherent aspect of decentralized labor markets. Flexible wage setting in a competitive search market is compared with a rigid-wage labor market, in which pay is determined without reference to individual match productivity.

The second distortion in the model, which has yet to be considered in the context of the MP framework, is wage rigidity. By assumption, the rigid wage economy avoids recurrent renegotiation costs, but at the cost of (both privately and socially) inefficient separations. The introduction of labor market rigidity in the MP model changes sharply worker valuation of jobs by skill class. Some workers will prefer flexible labor markets, other prefer rigid labor markets.

We then show that workers of different skill level have different preferences over rigid versus flexible labor markets, and show this using a calibrated version of the model. Changes in exogenous parameters yield different skills levels of indifference and hence affect the skill profile of the two distributions of workers, which prefer the flexible regime versus the rigid-wage regime. In addition, our modification of the MP model allows us to study the effects on the attractiveness of membership at different skill level of deadweight severance costs imposed on firms in order to reduce job destruction. Such costs

are frequently, but by no means always, imposed in the context of collective bargaining. While the severance tax unambiguously reduces welfare in the economy, we are able to show that worker preferences for a rigid-wage regime increase in the presence of job protection. This result explains why unions vigorously oppose reforms reducing such costs. An important finding is that while renegotiation cost increase the value of rigid wage regime to workers, it is rather the existence of severance or firing frictions which are essential for generating a rigid-wage segment of the workforce.

The rest of the paper is organized as follows. Section 2 presents some stylised facts about membership and excess coverage in OECD countries. Section 3 contrasts the benchmark model of equilibrium unemployment with renegotiation costs with an alternative regime with rigid wages. Section 4 studies preferences of workers for the two regimes in the context of a calibrated version of the model and considers how they vary in response to changes in underlying institutions and the level of the rigid-wage. Section 5 employs the model to discuss unions, excess coverage, free riding and related issues. Section 6 concludes.

1.1 Trends in Membership and Coverage

Figure 1 plots the weighted average of union density rates (union members as a percentage of wage and salary workers) in the countries of the European Union over the last 40 years. Data are drawn from Ebbinghaus and Visser (2000). After reaching a peak in 1978, membership declined back to its Post-war levels. This declining trend in the European overall membership rate was by no means uniform across the board. The cross-country variation in membership rates actually widened over time as can be visually appreciated by looking at the distance between the upper and lower lines (which represent an unweighted standard deviation above and below the average union membership rate).

The overall decline in membership does not appear to be associated with a reduced influence of unions in wage determination and, more broadly, economic policies. Table 1 gives an overview of membership density versus coverage of union contracts in selected OECD countries, and displays the so-called "excess coverage" (OECD terminology) rate, that is, the difference between membership rates and the share of the workforce involved by collective agreements. More precisely, the coverage rate is defined as the ratio of the eligible workforce – employees with bargaining rights – covered by collec-

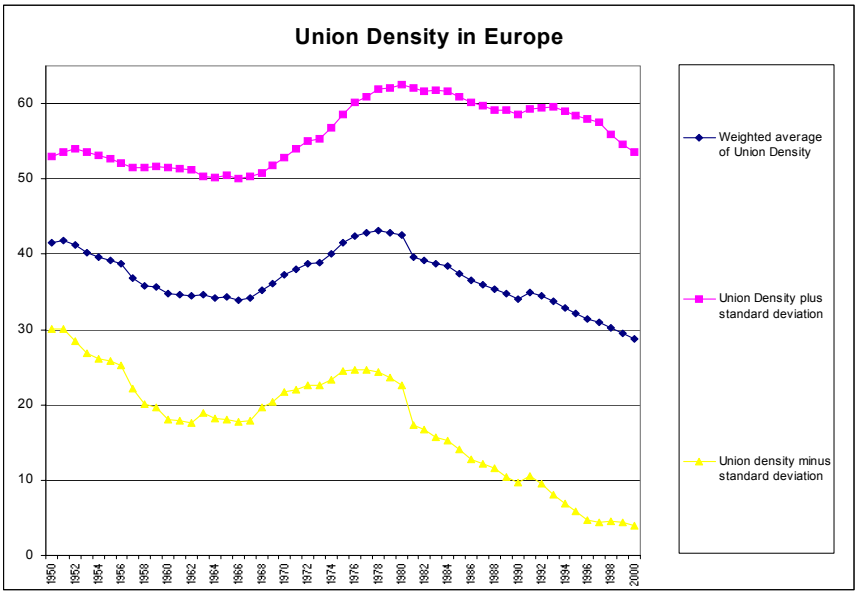


Figure 1:

tive agreements (as measured on the basis of national sources or consensus views among national experts on industrial relations). Excess coverage is then obtained as difference between coverage and union density rates, and is as high as 80 per cent in France and the Netherlands.

While Boeri, Brugiavini and Calmfors (2001) and the extensive literature reviewed therein as well as Checchi and Lucifora (2002), provide some explanations for the heterogeneity in the evolution of union density among EU members, they do not offer a framework endogenining membership within a general equilibrium model of the labor market. They also do not address the excess coverage puzzle. How can it be that union influence is so much independent of union membership? Why do employers accept extensions of the coverage of collectively agreed wages much beyond unions presence?

Figure 2: TABLE 1. UNION MEMBERSHIP DENSITY AND COVERAGE

	Union Density				Coverage	Excess coverage
	1985	1990	1995	1998	1995	1995
Austria	52	47	41	39	98,0	57,0
Belgium	51	50	54		90,0	36,0
Denmark	79	75	78	76	69,0	-9,0
Finland	69	73	80	79	95,0	15,0
France	19	14	10	10	95,7	85,7
Germany		36	29	26	92,5	66,5
Italy	42	39	39	38	81,8	42,8
Netherlands	28	24	24	23	88,5	64,5
Portugal		40	30		69,0	39,0
Spain	9	11	17	16	78,5	61,5
Sweden	82	82	88	88	89,8	1,8
UK	45	38	32	30	40,0	8,0
Australia	49	43	35		80,0	45,0
Canada	37	36	36		35,5	-0,5
Norway	55	56	55		73,8	18,8
Switzerland	29	25	23		49,3	26,3
USA	20	16	14		16,6	2,6

Source: Boeri, Calmfors and Brugiavini (2001), Ebbinghouse and Visser (2000).

2 From Individualized to Collective Wage Determination

2.1 General description

In this section we extend the basic set of the search/matching model of Mortensen and Pissarides (MP) (1994, 1999, 2000) allowing for i) the presence of wage-renegotiaton costs, and ii) a collective agreements, rigid-wage regime, in addition to the individualized wage setting regime of the MP model. Closest in spirit is Mortensen and Pissarides (1999).

Assume a continuum of labor markets indexed by $s \in (0, 1]$ where s can be thought of as a nonrandom, observable component of productivity, skill. Workers cannot change their skill level. Firms can work with all types of workers but only one at any given point in time. When matched, a firm and a worker generate a flow productivity sx, where $x \in (0, 1]$ is a match-specific component referred to as a "shock." For production to occur, a worker must be matched with a job. All new matches (i.e. filled jobs) begin at the highest possible value of x ($x = 1$). Immediately thereafter, match productivity

changes at Poisson frequency λ and is a random draw with a fixed, known cumulative distribution $F(x)$. Workers supply their labor inelastically and are either unemployed or employed. Firms either produce with one worker, or search with an open vacancy. They can enter freely into all labor markets at zero cost, but must pay a search or recruitment cost of k per unit period.

In either regime, we assume an exogenous deadweight loss or firing tax sT assessed on all termination of matches, with $T < \frac{1}{r+\lambda}$. It is paid to a third party (i.e. is dissipated) and can be thought of as pure deadweight loss, induced either by natural aspects of the employment relationship, or, more likely, by government regulation. These include legal fees paid to lawyers and other third parties when severance is contested as well severance-related strikes, sabotage, *Dienst nach Vorschrift* (dilatory performance of work) or court-initiated delays in termination of labor contracts. This firing tax is to be distinguished from severance compensation (a lump-sum transfer from employer to employee upon severance), which in principle can be offset by a compensating wage adjustment.[1] We also allow for a value of leisure, b, independent of s.

Our model deviates from the MP model by incorporating wage renegotiation costs, ρ , which are paid by firms whenever individualized wages are adjusted in response to match-specific productivity shocks. These costs can only be avoided by dissolving the match, but can be avoided in the collective-wage regime, which we now describe. A rigid wage search labor market is one where labor compensation is independent of local or idiosyncratic influences; i.e. match productivity or market tightness in the particular skill category. It may, however, depend on skill. We will denote this rigid-wage as w^r.

2.2 Steady-State Equilibrium State Valuations in a Labor Market of Skill s

Flexible wage regime We first define steady-state, equilibrium valuations of unemployment and employment in a labor market of arbitrary skill s, when wages are perfectly flexible.[2]. Given our assumtions, the valuation by workers of unemployment (U), and employment ($W(x)$), and by firms of an

[1] One fascinating issue involving holdup problem and the wage bargain with severance taxes does not arise in our model, since the wage is independent of the idiosyncratic productivity of the match. See Pissarides (2000) and Mortensen and Pissarides (1999).

[2] Where it is understood to hold for all skill groups, the subscript for s will be suppressed for notational convenience.

open vacancy (V) versus a job ($J(x)$) is given by the following four functional equations given x:

$$rU = b + \theta\, q(\theta)\,[W(1) - U] \tag{1a}$$

$$rV = -sk + q(\theta)\,[J(1) - V] \tag{2}$$

$$rW(x) = w(x) + \lambda \int_R^1 (W(z) - W(x) - \rho) dF(z) + \lambda F(R)(U - W(x)). \tag{3}$$

$$rJ(x) = sx - w(x) + \lambda \int_R^1 ((J(z) - J(x)) dF(z) + \lambda F(R)(V - sT - J(x)). \tag{4}$$

Equation (1a) equates the flow yield from an "asset" at interest rate r to income in unemployment b plus an expected "capital gain" resulting from employment at $x = 1$. The ratio of vacancies to unemployment $\theta \equiv v/u$ is a sufficient statistic of market tightness and arises from a constant-returns-to-scale matching function $m = m(u, v)$, so the probability of a vacancy matching with a worker is $q = \frac{m(u,v)}{v} = m(\theta, 1)$, with $q'(\theta) < 0$.Equation (2) determines the valuation of an unfilled vacancy. The flow cost of maintaining a posted vacancy is assumed proportional to skill and given by sk. Given an assumed common startup productivity level for all worker-job matches ($x = 1$), it follows that all vacancies in a given labor market are identical *ex-ante*.

The function $W(x)$ in (3) returns the value of employment in a job-worker match with current productivity x. Given x, the implicit rate of return on the asset W is equal to the current wage plus the implied capital gain or loss on the employment relationship. In the case of a gain, this is measured net of a nontransferable, unavoidable "cost of renegotiation" ρ which must be paid each time a shock occurs *for the match to continue*, since a change to x implies an adjustment of the wage. The lower bound of the definite integral R is the endogenous cutoff or threshold value of productivity x, below which the match is no longer profitable and the job/worker pair is destroyed. Because match dissolution allows the worker-firm pair to avoid paying ρ, the equilibrium value of R will reflect the savings on the renegotiation cost which are possible when the match is destroyed. A similar arbitrage argument determines the valuation to a firm of a filled job in (4), given the current realization of x and for a worker of skill level s.

One innovation in this paper with respect to the MP model is to introduce a friction arising in the renegotiation of wages whenever a productivity shock occurs, modeled as a one-off cost ρ. Formally, the worker pays this cost, but since wages are continuously bargained over, both parties will ultimately share the costs of renegotiation in equilibrium. For simplicity, we assume that the renegotiation cost is unavoidable and represents frictions inherent to the continuation of a flexible wage contract. One interpretation of ρ is an unavoidable investment necessary to maintain the existing employment relationship, given that the shock has occurred.

Rigid wage regime Wage renegotiation costs are avoided the rigid-wage regime, where by construction, the equilibrium valuation of labor markets states by workers (U^r and W^r) and firms (V^r, J^r) are independent of idiosyncratic productivity x:

$$rU^r = b + \theta^r q\left(\theta^r\right)\left[W^r - U^r\right] \tag{5}$$

$$rV^r = -sk + q\left(\theta\right)\left[J(1) - V^r\right] \tag{6}$$

$$rW^r = \overline{w} + \phi s + \lambda F(R^r)(U^r - W^r) \tag{7}$$

$$rJ^r(x) = sx - (\overline{w} + \phi s) + \lambda \int_{R^r}^{1} ((J^r(z) - J^r(x))dF(z) + \lambda F(R^r)(V^r - J^r(x) - sT). \tag{8}$$

Here R^r is the reservation productivity from the employer's perspective, which applies to a match in the rigid-wage regime; the job is destroyed for realizations of x lower than R^r. Notice that R^r will take different values for different skill levels and will also depend on $\overline{w}$, ϕ, T and other parameters. At this point, it is natural to impose a participation constraint on employment $W^r \geq U^r$, where U^r denotes the value of unemployment for a worker in the rigid wage segment.

There are no restrictions on the entry of firms in each skill segment and in both regimes. Hence, the equilibrium value of vacant jobs will satisfy the free entry condition $V = 0$, so (2) becomes

$$sk = q\left(\theta\right) J(1). \tag{9}$$

whilst in the rigid-wage segment:

$$J^r(1) = \frac{sk}{q\left(\theta^r\right)}. \tag{10}$$

2.3 Wage Determination

Flexible wage regime In the individualized wage setting regime, workers' remuneration is determined by a Nash sharing rule.[3] For an existing match in the competitive labor market, the Nash-bargained wage is given by

$$w(x) = \arg\max \left[W(x) - U\right]^{\beta}\left[J(x) + sT - V\right]^{(1-\beta)}$$

yielding the first order condition

$$W(x) - U = \beta\left[J(x) + W(x) + sT - V - U\right]. \tag{11}$$

Combining (9) and $V = 0$ with (3) and (11) evaluated at $x = 1$ yields

$$rU = b + \frac{\beta sk\theta}{1-\beta}. \tag{12}$$

The equilibrium value of unemployment is linear in θ, which in this model is a sufficient statistic for tightness in labor markets. We use (12) to obtain the equilibrium wage rule:

$$w(x) = (1-\beta)\left[b + \lambda(1 - F(R))\rho\right] + \beta s\left(k\theta + x + \lambda T\right). \tag{13}$$

Notice that the equilibrium wage depends not only on familiar parameters such as b (the monetary value of unemployment or leisure), θ (labor market tightness) and x (match productivity), and T (severance cost), but also on λ, the shock probability, and the renegotiation cost ρ. These factors are more important, the more likely a job is to *survive* $(1 - F(R))$. Idiosyncratic productivity shocks which do not lead to match dissolution make the worker partially liable for paying renegotiation costs. By dissolving the match and passing into unemployment, renegotiation costs can be avoided; consequently, a greater wage is needed to indemnify for this contingency. Effectively, the fallback of the worker is increased by the *savings* on future renegotiation costs that is implied by a breakdown of negotiations and spell of unemployment[4]. The more power the employer has, the more likely will the wage reflect this "compensating differential" as opposed to rents accruing to the match.

[3] Here we follow standard MP (1994) and Pissarides (2000).

[4] Notice that the hold-up problem (Malcomson, 1997) does not arise in this context because the incidence of ρ is, by assumption, not subject to negotiation.

Rigid wage regime Rigid wages are parametrized as $w^r = \overline{w} + \phi s$ with $0 < \phi < 1$. $\overline{w}$, where $\overline{w} \geq b$, can be thought of as a minimum wage, while ϕ reflects skill-dependence of compensation independent of match productivity. Low values suggest "egalitarian" wage structures, with higher values corresponding to pay according to ability.

2.4 Job Creation, Destruction and Equilibrium

2.4.1 Job Creation

Flexible wage regime The derivation of the *job creation condition* in the flexible regime follows Pissarides (2000). Combine the equilibrium wage equation (13) with the valuation equation (4), evaluated for a filled job at $x = R$, plus the fact that at the destruction margin, $J(R) = 0$, we obtain:

$$0 = (1-\beta)\left[sR - b - \lambda(1 - F(R))\rho\right] - \beta s(k\theta + T) + \lambda \int_R^1 J(z)dF(z). \quad (14)$$

Solving for $\lambda \int_R^1 J(z)dF(z)$ and again inserting this result into (4), eliminating the wage using (13) and imposing $V = 0$ yields

$$(r + \lambda) J(x) = (1-\beta)s(x - R) + \beta s(r + \lambda)T \quad (15)$$

Finally use this expression and the zero profit condition (9), set $x = 1$ and divide by s to obtain:

$$(1-\beta)\left(\frac{1-R}{r+\lambda} - T\right) = \frac{k}{q(\theta)} \quad (16)$$

This condition on R and θ is represented in the left panel of Figure 3 by the downward-sloping *JC-curve* (for *job creation)*.[5] Notice that neither s or ρ affects the position of the JC curve. The intuition for this result is that renegotiation costs do not affect the incentive to create a job at any given skill level, but rather influence the viability of the job via the surplus available to the match. Insofar as hiring-recruitment costs are proportional

[5]Implicit differentiation of (16) gives $\frac{dR}{d\theta} = \frac{(r+\lambda)kq'}{(1-\beta)sq^2}$, where f is the density associated with F. Since $q'(\theta) < 0$, $\frac{dR}{d\theta} < 0$ unambiguously.

to skills, there is no bias on the job creation margin in favour of a particular skill level.[6]

Rigid wage regime The job creation condition for a job in the collective-wage labor market is shown in the Appendix to be given by

$$\frac{1-R^r}{r+\lambda} - T = \frac{k}{q\left(\theta^r\right)}. \tag{17}$$

The JC curve in the rigid labor market is plotted in right panel of Figure 3. It remains strictly downward sloping in (θ^r, R^r)-space, since $q' < 0$, and lies everywhere above that of the competitive labor market. Note that it is also independent of s.

2.4.2 Job Destruction

Flexible wage regime As in the MP model, jobs are destroyed when productivity falls below its corresponding reservation or threshold level. In the individual-bargaining regime, R is implicitly defined for each skill s by the condition

$$J(R) + sT = 0. \tag{18}$$

At the same time, Nash bargaining (see below) also implies that R satisfies the zero match-surplus condition:

$$J(R) + sT - V + W(R) - U = 0 \tag{19}$$

and, given the free entry condition $V = 0$, it follows that

$$W(R) = U$$

that is, in this regime separations are privately, but not necessarily socially, efficient in the sense of Pissarides (2000).

[6] Job *destruction* margins are, however, affected by skills: the reservation productivity level is indeed decreasing in s. See Mortensen and Pissarides (2000). When hiring costs are not proportional to the skill level, but are fixed, then the job creation condition will no longer be independent of s. Insofar as market tightness increases with s, the worker fallback option will improve with skill and this in turn may render R non-monotonic in s.

The reservation productivity level for the competitive search market, R, is determined implicitly by the *job destruction* condition[7]:

$$sR + \frac{s\lambda}{r+\lambda}\int_R^1 (z-R)dF(z) + rsT = b + \frac{\beta sk\theta}{1-\beta} + \lambda\left[1-F(R)\right]s\rho \quad (20)$$

The left-hand side is the flow benefit of a continuing match with productivity R; this is the current value plus the option value deriving from possible future improvements over the next time interval. The right-hand side represents the (opportunity) costs of maintaining the match at the threshold value of idiosyncratic productivity, *plus the expected value of renegotiation costs.* This *job destruction* (JD) *condition* defines an upward-sloping curve in (θ, R) space, which we show in the left panel of Figure 1.[8]

Rigid wage regime The hallmark of the rigid wage regime is that the value of a job to the employee is independent of match productivity. Hence, the set of idiosyncratic productivities for which the job is destroyed will not necessarily coincide with those for which the job has zero value to the worker at the assumed rigid wage. Rather, the participation constraint implies that for a given skill level, $W^r(R^r) = W^r > U^r$. In collective-wage labor markets, the "consensual" dissolution of an employment relationship no longer applies, and there are always too many separations from the workers' perspective. Separations are inefficient in the sense that for some range of productivities workers will be fired, but at the given wage, they would prefer to continue working. *Except on a set of measure zero, there are only involuntary layoffs in rigid wage regime.* In contrast, quits and layoffs are indistinguishable in competitive search labor markets.[9]

Because the rigid wage is not the outcome of individual level bargaining, surplus division obeys a rule of the residual claimant type. Let $S^r(x)$ be the total surplus resulting from a match for any s, so for any $x \in [R^r, 1]$

$$J^r(x) = \max(-sT, S^r(x) - (W^r - U^r)). \quad (21)$$

[7] The derivation of this condition is standard and can be found in the Appendix.

[8] Differentiate (20) totally and solve for $dR/d\theta$ to obtain

$\frac{dR}{d\theta} = \frac{\frac{\beta k}{1-\beta}}{s\left[1-\frac{\lambda}{r+\lambda}(1-F)\right]+\lambda f\rho} > 0.$

[9] Quits by workers cannot result in material gains, by assumption. Amending this assumption is subject for future research.

The firm obtains all surplus greater than $(W^r - U^r)$. The maximum operator applies since the firm can always close operation, here at cost sT. Unlike the individual-wage labor market, the decision to destroy a job is taken by employers unilaterally and given by $J^r < -sT$ for any s; yet in general at this point $W^r > U^r$. The reservation productivity R^r for a match under collective bargaining for skill level s, that is, the reservation value for jobs in this regime is given by (see Appendix):

$$sR^r + \frac{\lambda s}{r+\lambda}\int_{R^r}^{1}(x - R^r)dF(x) = \overline{w} + \phi s - rsT \tag{22}$$

Unlike the individual-wage case, the component related to renegotiation costs is absent. This expression represents the job destruction condition in the rigid search market, the JD-curve, which is plotted in (θ^r, R^r) space in Figure 2. By inspection it is easy to see that the JD curve is horizontal, reflecting the independence of R^r of local labor market conditions. The unambiguous effect of increasing the firing tax T is evident from the figure: it reduces the job destruction threshold and raises the average duration of a job.

In contrast to (20), neither labor market tightness (θ^r) nor individual worker bargaining strength (β) appear in the job destruction condition. The collective-wage influences the outcome via R^r, which is endogenously determined as the intersection of the JC and JD curves for every s. As in the individual-wage labor market, an increase in λ *ceteris paribus* shifts back the job destruction curve towards the origin.

2.4.3 Equilibrium

Flexible wage regime The intersection of (20) with the job creation condition (16) defines a labor market equilibrium for submarket with skill s. For each skill level there exists a unique equilibrium reservation productivity and labor tightness pair (R^*, θ^*) given by the implicit functions of deterministic productivity s, the Poisson arrival rate λ, renegotiation costs ρ and income in unemployment b:

$$R^* = R^*(s, \lambda, \rho, b, T)$$
$$\theta^* = \theta^*(s, \lambda, \rho, b, T).$$

The result is depicted in Figure 3.

Given the equilibrium R^* and θ^*, the unemployment rate in the labor submarket for skill level s follows from the familiar flow condition for constant unemployment:

$$u^* \equiv u^*(s, \lambda, \rho, b) = \frac{\lambda F(R^*)}{\lambda F(R^*) + \theta^* q(\theta^*)}. \tag{23}$$

Rigid wage regime The intersection of the JD and the JC curves depicted in the right panel of Figure 3 gives unique equilibrium values of the reservation productivity and market tightness for the rigid search labor market, which we call $R^r = R^r(s, b, \overline{w}, \phi, T)$ and $\theta^r = \theta^r(s, b, \overline{w}, \phi, T)$ respectively.

Analogous to (23), the equilibrium unemployment rate u^{r*} in a rigid-wage labor market with skill level s is given by .

$$u^r = \frac{\lambda F(R^r)}{\lambda F(R^r) + \theta^r q(\theta^r)} \equiv u^r(s, b, \overline{w}, \phi). \tag{24}$$

2.4.4 Comparative Statics

The dependence of the endogenous variables on the model parameters in the two regimes are described in the table below.

TABLE 1. COMPARATIVE STATICS RESULTS

Effect of $\Longrightarrow$ ....*on* $\Downarrow$		s	λ	ρ	b	β	T	$\overline{w}$	ϕ
Flexible wage regime	R^*	$-$	$+$	$+$	$+$	$+$	$-$		
	θ^*	$+$	$+$	$-$	$-$	$-$	$-$		
	u^*	$-$	$+$	$+$	$+$	$+$	?		
Rigid wage regime	R^r	$-$	x		x		$-$	$+$	$+$
	θ^r	$+$	x		x		$-$	$-$	$-$
	u^r	$-$	x		x		?	$+$	$+$

An increase in s is shifts the JD curve downwards, and shifts the JC curve outwards from the origin, so an increase in skill unambiguously tightens the labor market and lowers the firing threshold in both regimes. An increase in the frequency of productivity shocks, renegotiation costs and the value of

Figure 3: Equilibrium in a Search Labor Market with Flexible Wages

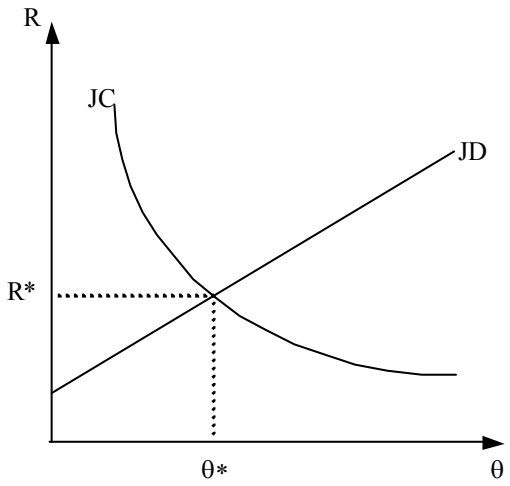
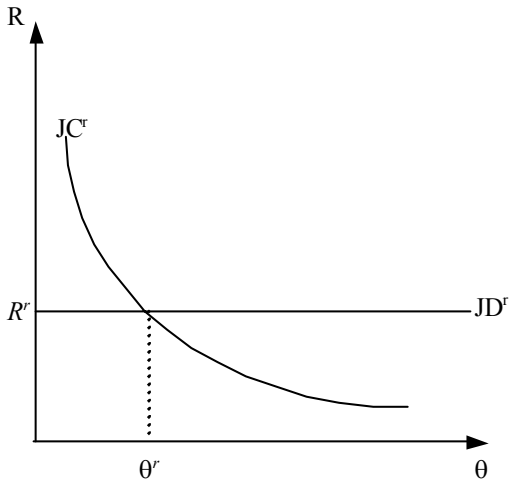


Figure 4: Equilibrium in a Search Market with Rigid Wages



leisure unambiguously increases unemployment in the individualized segment via their effects on wages. To the extent that a rigid wage does not depend on b, λ and ρ (and $\overline{w} > b$), job creation and destruction margins (hence unemployment) are unaffected by changes in these parameters. As noted above, increases in the minimum wage and in the slope of the wage-skill profile in the rigid segment have unambiguous effects on job duration (negative), market tightness (negative) and unemployment (positive). Finally the firing tax reduces both job creation and destruction while its effect on unemployment is ambiguous.

2.5 Closed Labor Markets

Flexible wage regime Due to the presence of renegotiation costs, costs of posting vacancies and skill-independent income in unemployment, a market for labor may not exist for all skill levels in the competitive search regime. It is useful to define $\underline{s}^*$, the minimal skill class for which the labor market is open ($\theta > 0$); that is to say, in which positive vacancies are observed. If no vacancies are posted, the unemployment rate is 100% and the labor market

is said to be *closed*.[10] The value for $\underline{s}^*$ is implicitly given by $\max(s : \theta^* = 0, s : R^* = 1)$, such that all labor markets for skills levels lower than $\underline{s}^*$ are closed. By inspection of Figure 3, no intersection in the allowable range for R ($0 < R \leq 1$) with $\theta = 0$ is possible, so the binding constraint is $R \leq 1$. Taking the limit of the JD condition (20) as R approaches 1 implies

$$\underline{s} = \left[\frac{b(1-\beta) + \beta sk\theta}{(1-\beta)(1+rT)} \right]$$

or, for admissible (i.e. positive) values of θ,

$$\theta = \frac{(s(1+rT) - b)(1-\beta)}{\beta sk}.$$

In order to interpret this condition, it is better to consider the case where $T = 0$: here $\theta > 0$ as long as $s > b$, that is, for the labor market to be open[11], match productivity at the outset must strictly exceed the flow benefit from leisure. This condition is less strict than that in the rigid labor market, as will be shown below.

Rigid wage regime In this regime, the critical minimal skill $\underline{s}^r$ is defined implicitly by the condition $\theta^r(\underline{s}^r) = 0$ or $R^r(\underline{s}^r) = 1$. Consider first the condition $\theta^r(\underline{s}^r) > 0$, that is, that the supply of vacancies is strictly positive. By inspection of (17), this requires $R^r \leq 1-(r+\lambda)T$. Thus no labor markets will be open for skills with $R^r \in [1-(r+\lambda)T, 1]$. An alternative condition derives from the limit of (22) as $R^r \to 1$, or $s \geq \frac{\overline{w}}{1-\phi+rT}$. It follows that $\underline{s}^r$ will be the larger of $\frac{\overline{w}}{1-\phi+rT}$ and $s : R^r = 1-(r+\lambda)T$. Given the participation constraint, $\underline{s}^r > b = \underline{s}^*$.In words, the range of skills participating in the labour market is smaller in the collective-wage regime.

[10] Evidently there is no gain from employing workers with a productivity which does not cover the opportunities costs of both parties, so that no worker would ever be observed working at a wage lower than b.

[11] The renegotiation cost does not appear because in the limit as $R \to 1$, the probablility of match dissolution approaches unity, rendering the renegotiation cost irrelevant. Similarly, the cost of posting a vacancy merely affects the level of unemployment but not the viability of the market.

3 Worker and Firm Preferences for Labor Market Regimes: A Calibration

3.1 Model Specification

The objective of this section is to evaluate the properties of a calibrated version of the model with particular functional forms, especially the preferences of workers of different exogenous skill classes for the two regimes. We thus follow a tradition begun by Mortensen/Millard (1997) and Mortensen/Pissarides (1999) in analyzing the effects of labor market institutions. We consider an economy with matching success probabilities given by a Cobb-Douglas form $q(\theta) = A\theta^{-\alpha}$ with $A > 0$, $0 < \alpha < 1$. The idiosyncratic shock is distributed uniformly over the interval (0,1]. Under these conditions, the job creation condition for market of skill s in the competitive search labor market is given by

$$\theta^* = \left[(1-\beta)\frac{A(1-R^*)}{k(r+\lambda)}\right]^{1/\alpha}, \tag{25}$$

while in the rigid search market it is characterized by the condition

$$\theta^r = \left[\frac{A}{k}\left(\frac{1-R^r}{r+\lambda} - T\right)\right]^{1/\alpha}. \tag{26}$$

The job destruction conditions are respectively

$$sR^* + \frac{s\lambda(1-R^*)^2}{2\,(r+\lambda)} = b + \frac{\beta sk\theta^*}{1-\beta} + \lambda\,(1-R^*)\,\rho \tag{27}$$

and

$$sR^r + \frac{s\lambda(1-R^r)^2}{2\,(r+\lambda)} = \overline{w} + \phi s - rsT. \tag{28}$$

3.2 Numerical values and characteristics of the model economy

Figure 5 displays the two value functions under the assumptions outlined above for each of the two regimes, calibrated using parameter values given in Table 6. Values chosen for λ and k are close to those found in Yashiv (2000) for a calibration of the MP model to Israeli data, as well as Mortensen and

Pissarides (1999). The fixed rigid wage component is arbitrarily set just at unemployment income, which is itself established at a level leaving about one-sixth of the skill distribution out of employment under competitive conditions. We impose the Hosios condition (Hosios 1990), so the undistorted decentralized equilibrium can actually achieve the (restricted) social optimum.[12] The value for the renegotiation costs is admittedly arbitrary. In the baseline simulation it is set equal to 20% of one quarter's output.[13]

TABLE 6. PARAMETER VALUES FOR BASELINE CALIBRATION

A (matching function effectiveness)	0.60
$\alpha = \beta$ (elasticity of $q(\theta)$ and labor bargaining power)	0.50
b (income in unemployment)	0.15
λ (frequency of the match-specific shock)	0.10
r (real interest rate per quarter)	0.05
ρ (renegotiation or match maintenence costs)	0.20
k (recruitment costs, proportional to productivity)	0.15
$\overline{w}$ (base or minimum wage)	0.15
ϕ (pay scale parameter)	0.55
T (firing tax, proportional to productivity)	1.00

Assuming a uniform distribution of workers across skill classes, the equilibrium in the decentralized economy with the baseline calibration has a mean unemployment rate of 6.4% with a mean and median completed steady state unemployment duration of 1.2 and 1.0 quarters, respectively. In the rigid wage economy, the unemployment rate is 6.2% with a mean (median) duration of 3.3 (0.4) quarters. The striking deviation of median from mean in the rigid case results from wage rigidity, and is reflected in the wide range of unemployment rates from a low of 1.4% to a high of 93%. This range of equilibrium unemployment rates is absent from the individually bargained wage economy, since wages decline when labor markets are soft (θ is low). As a result, labor markets are open for 81% of the productivity classes, compared with only 60% in the rigid wage economy.

[12] This rules out the most obvious justification of the role of unions. See Boone and Bovenberg (2000) for an analysis of optimal taxation in the MP model.

[13] Recall that the renegotiation cost represents the monetary valuation of all (including intangible) costs of rewriting the contract upon the realization of the idiosyncratic productivity shock.

3.3 Evaluating Preferences for Labor Market Regimes

3.3.1 Flexible Wage Regime

We now derive expressions for the value to a worker in employment at full initial productivity ($W(1)$), and the value of a newly-filled vacancy $J(1)$. Their sum comprises the total available gross surplus available to the match, $S(1)$. Rearrange the first order condition or sharing rule (11) using (16), and (12) we can write

$$W(1) = \frac{b}{r} + \frac{\beta s\left(1 - R^*\right)}{(r+\lambda)} + \frac{\beta s k \theta^*}{r\left(1-\beta\right)} \tag{29}$$

and evidently,

$$\frac{\partial W(1)}{\partial s} = \frac{\beta(1-R^*)}{(r+\lambda)} + \frac{\beta k\theta^*}{r\left(1-\beta\right)} - \frac{\beta s}{(r+\lambda)}\frac{\partial R^*}{\partial s} + \frac{\beta s k}{r\left(1-\beta\right)}\frac{\partial \theta^*}{\partial s}$$

$$= \frac{\beta}{(r+\lambda)r}\left[r\left(1-R^*\right) + \frac{(r+\lambda)\beta k\theta^*}{(1-\beta)} - rs\frac{\partial R^*}{\partial s} + \frac{k\left(r+\lambda\right)}{(1-\beta)}\frac{\partial \theta^*}{\partial s}\right] > 0. \tag{30}$$

so in (s, W) space, the valuation of the competitive employment state is strictly increasing in skill s. Intuitively, s has three effects on the valuation of a job. First it increases the flow payoff in all cases that the job survives. Second it lowers the threshold value of productivity, holding all else constant, and thereby increases the expected duration of the job. Finally, it raises equilibrium job tightness in the local labor market, raising the probability of finding a job in that labor market, given that one is unemployed.[14]

For the valuation of firms, we have

$$J(1) = \frac{sk}{q(\theta)}$$

[14]The sign of the second derivative involves the curvature of response of R^* and θ respectively to s :

$$\frac{\partial W^2(1)}{\partial s^2} = -\frac{\beta}{(r+\lambda)}\left[\frac{\partial R^*}{\partial s} + s\frac{\partial^2 R^*}{\partial s^2}\right] + \frac{\beta k}{r\left(1-\beta\right)}\left[\frac{\partial \theta^*}{\partial s} + s\frac{\partial^2 \theta^*}{\partial s^2}\right] \tag{31}$$

and is ambiguous. One sufficient condition for convexity of the value of competitive segment employment is that R^* and θ are not too responsive to s: $\frac{s\frac{\partial^2 R^*}{\partial s^2}}{\frac{\partial R^*}{\partial s}} < 1$ and $\frac{s\frac{\partial^2 \theta^*}{\partial s^2}}{\frac{\partial \theta^*}{\partial s}} > -1$.

and differentiate, obtaining:

$$\frac{\partial J(1)}{\partial s} = \frac{k}{q(\theta)} - \frac{skq'}{q^2}\frac{\partial \theta}{\partial s} > 0 \tag{32}$$

so that an increase in skills unambiguously increases the value of the firm (filled job). For the same reasons as above, the sign of the second derivative of $J(1)$ with respect to s cannot be determined unambiguously.

The signs of derivatives of state evaluations of employment and filled jobs can be derived in a straightforward way and are summarized in the Table 2.

TABLE 2

Effect of ...	b	ρ	λ	β	k
...on					
$W(1)$	?	$-$	$-$	$+$	$-$
$J(1)$	$-$	$-$	$-$	$-$	?

3.3.2 Rigid wage regime

Consider the relationship between skills and the value of employment in the rigid-wage segment. Combining (7) and (5) and solving we obtain:

$$W^r = \frac{b}{r} + \frac{1}{1+\frac{\lambda F(R^r)}{r+\theta^r q(\theta^r)}}\left[\frac{(\overline{w}+\phi s)-b}{r}\right]$$

Note that if $\overline{w} = b$,

$$W^r = \frac{1}{r}\left[b + \frac{1}{1+\frac{\lambda F(R^r)}{r+\theta^r q(\theta^r)}}\phi s\right].$$

As in the individualized-wage segment, it is possible to show that W^r is unambiguously increasing in skill s. Intuitively, raising s raises the value of employment because it increases pay directly, as well as equilibrium job tightness in the local labor market, raising the probability of finding a job. It also increases the duration of a job. As long as ϕ is strictly positive, higher skills will be associated with a higher flow payoff in the continuation region. As in the competitive case, the sign of the second derivative of W^r is ambiguous.

For the valuation of firms, differentiate (8) evalutated at $x = 1$ to obtain

$$\frac{\partial J^r(1)}{\partial s} = \frac{k}{q\left(\theta^r\right)} - \frac{skq'}{q^2}\frac{\partial \theta^r}{\partial s} > 0. \tag{34}$$

As in the individualized wage regime, the second derivative of $J^r(1)$ is ambiguous.

The following table summarizes the effects of other changes on $W^r(1)$ and $J^r(1)$ conditional on the match surviving:

TABLE 4

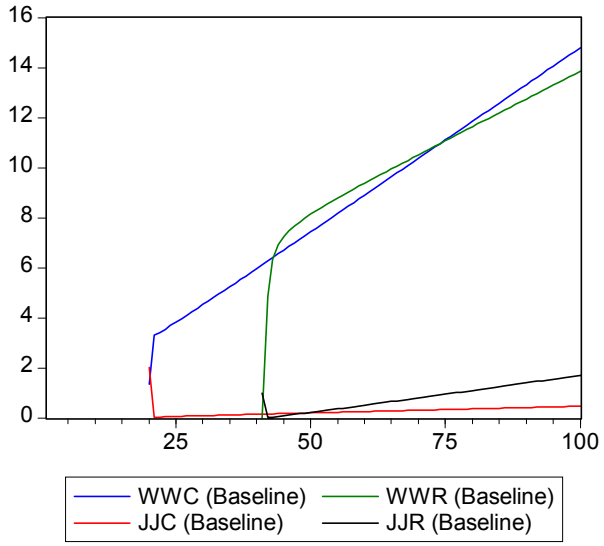
Effect of ...	$\overline{w}$	ϕ	λ	T
...on				
$W^r(1)$	$+$	$+$	$-$	$-$
$J^r(1)$	$-$	$-$	$-$	$+$

3.4 Results

In Figure 5, the valuation of employment and a filled job under both regimes is plotted by skill s for the baseline calibration. As can be seen, the labor market is shut down for the lowest skill levels in both segments. As intuition predicts, higher-skill workers prefer to have their wages set under competitive conditions, while low-skill workers tend prefer the rigid regime - if their labor market is open. Moving upwards on the skill ladder, the labor market starts operating in the rigid-wage segment. When low skill types can actually choose among the two segments, they would opt for the rigid wage regime. For higher skill levels, however, the workers' most preferred regime is individual bargaining. At the same time, more skill classes are shut out of labor market activity under the rigid regime. Local sensitivity analysis of the calibration around the baseline reveals that the fraction of those working in rigid labor markets which prefer them to competitive markets is positively related to the interest rate, the Poisson incidence parameter λ, the productivity pay parameter ϕ, the base wage $\overline{w}$, the cost of renegotiation ρ and the firing tax T.

In Figure 5 the preferences of the employed for the regime clearly depend on skill, so the distribution of skill in the economy will play a pivotal role in determining aggregate preferences. In our base calibration depicted above, workers with skill levels $s = [0.45, 0.74]$ will prefer the rigid wage regime, while workers with skill in the intervals $[0.42, 0.44]$ and $[0.75, 1.00]$ prefer the competitive regime. With uniform distribution of skill, if the two alternatives

Figure 5: Equilibrium State Valuations in the two Regimes, Baseline Calibration



were subjected to a vote among those in work in both regimes, the rigid regime would defeat the flexible economy in a one-on-one election among those with jobs, and this result would be even more likely with significant mass in the middle of the skill distribution. Furthermore, if the agenda is such that workers with skills for which the labor market is closed vote their most preferred flexible wage, the voter of median productivity will also prefer a rigid wage regime.

It is noteworthy that firms working with 50% of all potential skill levels and about two-thirds of all firms in operation in the rigid wage regime will favor maintaining the status quo. In this model, "capitalists" are likely to represent a conservative force in favor of rigid wage regimes, unless they represent pressure from outside lobbying for regime change. This is because for reasonable values of ϕ, firms profit more from high productivity workers in the rigid regime.

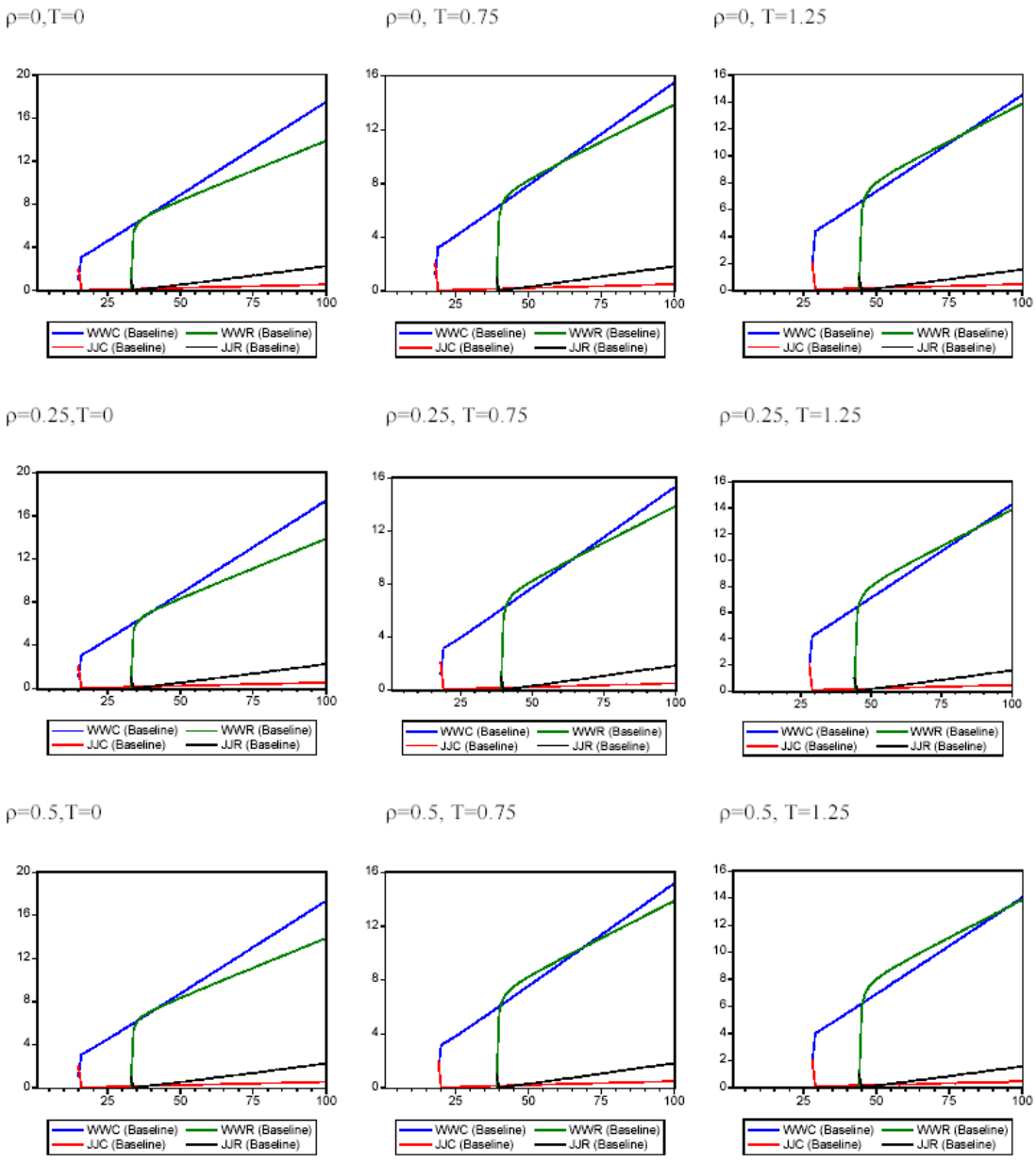
4 Renegotiation Costs, Firing Taxes and Preferences for Collective Bargaining

4.1 Renegotiation Costs versus Firing Taxes

Figure 6 displays alternative standard calibrations with $\rho \in \{0, 0.0, 25.0.5\}$ and $T \in \{0, 0.75, 1.25\}$. Taken alone, the level of renegotiation costs ρ necessary to induce significant support for a rigid wage regime are too large to be realistic. The results suggest that - at least for models obeying the Hosios condition - in the absence of significant frictions, the Nash sharing rule delivers outcomes in the MP model that are unlikely to be improved upon.

Figure 6 does suggest, however, that the relative attractiveness of the rigid wage regime is enhanced when the firing tax is applicable in *both* regimes ($T > 0$). The greater the given firing friction, the more popular rigid wages are likely to be. This prediction is corroborated by union support for labor market regulations, as well as the correlation of employment protection legislation with union organization (e.g., Boeri, Brugiavini and Calmfors, 2001; Checchi and Lucifora, 2003). Severance regulation appears to be a complement to wage rigidities, rather than a substitute. This complementarity is, of course, stronger when employment protection is offered only on the rigid-wage segment, e.g., where labor is unionized. Figure 6 also suggests that

Figure 6: Regime Valuation for Alternative Renegotiation Costs (ρ) and Firing Taxes (T)



the relative popularity of rigid wages is stronger when both firing taxes *and* renegotiation costs are operative.

4.2 Interpretation: Labor Unions, Collective Bargaining and Endogenous Membership

Up to now the analysis has considered given wage policies; explaining policies actually chosen in labor markets is a more difficult task. A traditional approach is to study some decision-maker (union, government) choosing a wage policy unilaterally to maximize some objective function given the constraints implied by the labor market and the overall economy (see Oswald 1985, Farber 1986, Booth 1995). An alternative, which looks beyond unions as the sole determinant of wages, asks whether a rigid wage *policy* can find majority support in the population. Yet another would combine the two, asking whether a union is self-sustaining, in the sense that the wage policy or rule chosen by the median voter of a given membership generates a new membership which corresponds to the initial one. In this section, we sketch the model's potential for explaining the endogeneity of union membership as well as "excess coverage" (OECD 1996) and free-riding by non-members, using this last approach. In this interpretation, a rigid wage regime is chosen by a single union. Implicitly, we have assumed that the fixed setup costs are too high to admit more than one union; exploring the exact nature of scale economies here is the subject of future research.

Suppose that workers of a given skill level s must credibly commit once-and-for-all the labor market regime which maximizes the value of employment at the outset of a new match ($x = 1$). This is consistent with evidence on the dynamics of union membership, suggesting that de-unionisation occurs mainly because new firms and new jobs are not unionised, and not through resignation of incumbent workers (Machin, 2000).[15] The decision is a simple comparison of the valuation of employment in the two states, $W^*(1)$ and W^r, so the fraction of (open) markets for skill in which $W^*(1) > W^r$ represents a measure of political support for labor rigidities. At the same time, union membership is costly - say, a fraction d of the wage each period, implying

[15] There is no incentive for workers to abandon the rigid-wage regime after the match is created as productivity can only decline from the initial match level. We do however explicitly rule out the possibility that workers who initially shun union membership later endorse the rigid-wage regime.

that a necessary condition for membership is

$$d < r\left(W^*(1) - W^r\right)/w^r. \tag{35}$$

Yet this is not a sufficient condition, as the adoption of the rigid wage regime is a public good and rational workers would refuse to pay dues if they could enjoy the benefits without doing so.

Union membership does, however, confer the right to determine the rigid-wage regime as an alternative to the flexible wage search environment in a democratic decisionmaking process. Members can vote on their most preferred degree of wage rigidity. Naturally, the order of the agenda is crucial and a more detailed and careful discussion of these issues must be left to further research. Here we will only scratch the surface of a number of interesting complications which arise via agenda-setting, and consider only voting over the most-preferred productivity-wage scale parameter, ϕ. For the calibration described above, it is possible to show that the *most preferred* wage for a worker of arbitrary skill s, $\phi^*(s)$, is monotone increasing in s.The firing friction/tax parameter T is held constant throughout.

4.3 The Decisionmaking Procedure

The decisionmaking procedure is modeled as follows. The outcome of the competitive search labor market with a severance tax applied to all labor markets is taken as given, as characterized in Figure 5. Workers evaluate their gains from rigid labor markets expressed as the class of wage policies discussed in this paper: $w^r = \overline{w} + \phi s$, and voting only occurs over ϕ, with $\overline{w} = b = 0.15$. We set membership dues to be 3% of the wage ($d = .03$) – which is broadly in line with membership fees in EU countries when account is taken worker leisure time absorbed by union meetings – and assume that workers join the union if (35) holds. A vote on ϕ is held among these workers, and the value of ϕ most preferred by the median worker of that group is the candidate wage rule. This rule, if implemented, induces a new membership, a new most preferred policy, and a new level of aggregate employment, etc. The question is: is there a fixed point in this iterative process? The point is not trivial, since a union with dynamic membership linked to employment could, by pursuing an overly aggressive wage policy, vote itself out of existence.[16]

[16] See Blanchard and Summers (1986) and Burda (1990) for examples in which this occurs, even when expectations are rational and workers perfectly understand the process.

For the baseline calibration, there is a unique fixed point given by $\phi = 0.49$, corresponding to the most preferred ϕ of the worker of productivity class $s = 0.49$.[17] Given the uniform distribution of skill in the economy, this recursive process results in an outcome in which 65% of markets (or 65% of all skill classes) are open. Workers in 21% of all skill classes actually join the union, corresponding to a membership rate of about 32%. At the same time, workers in 30% of all skill levels prefer (and thus accept or adopt) the rigid labor market regime, implying a coverage rate of about 46%. "Excess coverage" is thus roughly 30%, in line with findings of the OECD for many European countries (OECD, 1996). Reducing union dues to $d = 0.01$ (equivalently, making union membership more attractive) results in a slightly more aggressive wage policy ($\phi = 0.50$), most-preferred by worker of productivity $s = 0.53$, but with a higher membership rate (29% of all skill levels and 45% of all open markets) and an excess coverage of only about 14%. The model is thus capable of accounting for stylized facts in union membership and the coverage of collective bargaining discussed by the OECD (1996) and Boeri et al. (2001)

5 Conclusion

This paper shows that equilibrium search and matching theory of unemployment along the lines of Mortensen and Pissarides (1994, 2000) can be employed to study issues related to collective bargaining and to preferences of workers, including issues of union coverage. Our main results can be summarised as follows: First, the introduction of renogotiation costs in a competitive search market makes a rigid wage regime attractive to a non-trivial segment of the working population. Even the most "rigid" of rigid wage regimes can find broad support - in the sense that workers' utility is higher than in competitive search submarket. We have argued that this support may be expressed as membership in a labor union, but also as political endorsement of rigid wage policies (such as minimum wage policies and the extension of contract wages to nonunionized workers). Interestingly, the lowest and the highest skilled will prefer the competitive search market: the former because they are frozen out of access to a job, the latter because they can do better in competitive search market.

[17] Here we employed a grid of 100 skill classes and thus have rounded results to the nearest hundredth..

Second, severance protection (a firing tax that is a loss to the economy) can increase the relative popularity of rigid wage policies, because it further increases utility of rigid wage workers who keep their jobs, measured relative to the competitive search equilibrium. Although severance taxation is a deadweight loss for the labor market, it can increase the relative appeal of rigid wage policies for low-skill workers which are not at greatest risk of job loss.

Third, we sketch a way to disantangle membership of a union from general preferences for rigid wages. The extensive theoretical literature on labor unions summarized for example in Booth (1995) has tended to take membership as given. This makes it difficult to interpret the declines in union membership observed in most OECD countries and the role played by administrative extension of the coverage of collective agreements. Even less attention is devoted to the way in which labor market institutions and the legal framework for collective bargaining affect the decision to join a union. Hence, the existing body of theory offers little guidance in understanding two developments common to many European countries in the last two decades: the decline in membership and the increasing "excess coverage rates", namely the difference between the share of workers to which collective agreements apply (e.g., because of the administrative extension of collective agreements) and the share of workers belonging to the unions signing the agreements. In our framework, members are those who would accept a lower rigid wage and thus are willing to pay union dues out of what they receive belonging to the rigid wage regime, in order to set the agenda for the union.

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7 Appendix (August 8 2003)

Appendix is under revision but can be supplied by request (burda@wiwi.hu-berlin.de)