The Employment Effects of Severance Payments with Wage Rigidities*

Pietro Garibaldi
Bocconi University, and CEPR

Giovanni L. Violante
New York University, and CEPR

Abstract

Firing costs due to employment protection legislation have two separate dimensions: a transfer from the firm to the worker to be laid off and a tax paid outside the firm-worker pair. We document that quantitatively transfers are a much larger component than taxes. Nevertheless, to avoid the "bonding critique" most of the existing literature overlooks the transfer component by making the implicit assumption that, in the presence of wage rigidity, mandatory severance payments have the same real effects as firing taxes. This paper shows, in the context of a search model, that this presumption is in general misplaced: the impact of severance payments on unemployment is qualitatively different from that of firing taxes, and it varies according to the bite of the wage rigidity. When the wage rigidity is endogenously determined by a centralized monopoly union, severance payments increase unemployment. This prediction finds empirical support in a panel dataset of OECD countries.

Keywords: Firing Tax, Severance Payment, Unemployment, Wage Rigidity.

JEL Classification: E24, J64, J65.

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1 Introduction

Job security provisions are a set of rules and restrictions governing the dismissals of employees. A careful look at the employment protection legislation (EPL) throughout developed countries shows that such provisions impose a "firing cost" to the firm that has two separate dimensions: a *transfer* from the firm to the worker to be laid off, and a *tax* to be paid outside the job-worker pair.[1]

Since the classical work of Lazear (1988, 1990), it is well known that, in the absence of contractual and market frictions, a government-mandated pure transfer (e.g., a severance payment) from the firm to the dismissed worker can be neutralized by an appropriately designed wage contract: the firm reduces the entry wage of the worker by an amount equal to the expected present value of the future transfer, so as to leave the expected cumulative wage bill arising from the employment relationship unchanged.

This powerful theoretical result –typically named the "bonding critique"– has led the vast majority of researchers to conceptualize firing costs as taxes.[2] Taxes represent real costs on labor shedding paid outside the firm-worker pair, and as such cannot be undone by side negotiations. Ljungqvist (2002) provides a comprehensive overview of the various models studying the effects of layoff taxes on unemployment. Some firm conclusions have been established in this literature. Notably, a firing tax reduces the layoff rate and unemployment incidence by making firing more costly to employers, and increases job creation and unemployment duration because the larger labor costs tend to weaken job creation, with an overall ambiguous effect on unemployment.[3]

The mainstream approach can, in principle, be justified on two grounds: 1) if quantitatively the tax component of EPL is substantially larger than the transfer component; 2) if the existence of contractual imperfections in actual labor markets induces the transfer

[1] The transfer component includes institutions such as the requirements to provide the worker with advance notification, with severance payments for no-fault dismissal, and with other monetary compensations for unfair dismissal. The tax component is a set of administrative restrictions and procedures that the firm has to obey if it wants to lay off. It includes pure red tape costs, legal expenses in case of a trial, and any financial penalties imposed by a ruling judge. See OECD (1999) for a recent survey of the literature and an update of the EPL indicators.

[2] Bertola and Rogerson (1997, page 1149) call it the "standard view of firing costs".

[3] A non-exhaustive list of contributions on the economics of firing taxes includes Bentolila and Bertola (1990), Bertola (1990), Burda (1992), Hopenhayn and Rogerson (1993), Bentolila and Saint-Paul (1994), Millard and Mortensen (1994), Bertola and Rogerson (1997), Mortensen and Pissarides (1998), Pissarides (2000).

component to act exactly as a tax on equilibrium (un)employment. In this paper, we show that both presumptions are likely to be misplaced.

First, quantitatively, the transfer component of EPL appears sizeable, and may even be considerably larger than the tax component. For the case of Italy, one of the countries with the strictest employment protection legislation, our estimates suggest the transfer component of the total firing cost for an employer-initiated separation against a blue collar of average tenure is at least twice as large as the tax component, i.e. 2/3 of the total firing cost. Thus, from a quantitative standpoint, the transfer cannot be ignored.

Second, in the European labor market context, a number of institutional constraints impede the firm and the worker to freely bargain individually towards a match-specific wage contract.[4] Within the context of a Mortensen-Pissarides-style matching model with both endogenous separations and match formations and with a two-tier (insider-outsider) labor market structure, we show explicitly that, in the absence of full contractual flexibility in the wage setting process, severance payments have real effects on employment. As a baseline analytical framework, we assume that the source of wage rigidity is exogenous to the model, and that fixed wages do not react to changes in policy parameters. While firing taxes always maintain the same impact on the labor market flows, the effects of the transfer differ according to the "bite" of the wage rigidity: when insiders' wages are constrained, job security provisions reduce unemployment, whereas when outsiders' wages are constrained, they can increase unemployment. Only with full wage rigidity, the transfer component of employment protection acts exactly as a firing tax.

In real life labor market, and in a medium-long run perspective, wage setting institutions are likely to internalize changes in the size of statutory firing costs. We therefore extend the model to a framework where majority voting within a coalition of employed insider workers (e.g., a monopoly union) determines the level of the institutional constraint to individual wage setting. In equilibrium this constraint depends on all key parameters of the economy, including the severance payment. We derive two main results. First, when outsiders are unconstrained in their bargaining, the neutrality of severance payments is restored. The intuition is that the institutional wage setting internalizes the employment protection rules "efficiently", i.e. exactly as decentralized individual bargaining. Second, when the endoge-

[4]These impediments arise, for example, from a statutory minimum wage, from the presence of unions, and from enforceable collective bargaining agreements at the level of the entire industry/economy within which the firm operates.

nous wage constrained negotiated by the insiders' union is widespread and applies to all employed workers (including outsiders), severance payments increase unemployment. The intuition is that in such setting outsiders' wages are increasing in the severance payment, since they contain the rent on the firing cost extracted by the insiders' union.

Overall, our set of new theoretical results suggests that in the presence of wage rigidities, severance payments have in general different employment effect than firing taxes, both in the short run and in the medium-long run. In the medium-long run, an institutional setting with generous severance payments and centralized wage bargaining should be associated with higher unemployment. We take this prediction to the data, using a recently assembled data-set on time varying institutions by Belot and van Ours (2004). We show that the interaction between a measure of employment protection and an index of centralized wage bargaining increases significantly unemployment in a panel of 17 OECD countries between 1960 and 2000.

Related Literature– The alternative view taken in this paper, whereby rather than modelling EPL as a separation tax we search for allocative effects of the pure transfer in economies with contractual imperfections, is followed also by Cahuc and Zylberberg (1999), Guell (2000), and Alvarez and Veracierto (2001). Cahuc and Zylberberg study the real effects of severance payments in a search model where the productivity of the match is not publicly observable, thus wage renegotiations cannot be enforced by an external party and will take place only if they are mutually advantageous. Guell points out that in a Shapiro-Stiglitz model where the worker's effort can only be imperfectly monitored, severance payments can reduce employment in equilibrium: since the transfer increases the value of unemployment and therefore makes the punishment for shirking less effective, to re-establish the appropriate wedge between the value of employment and that of unemployment so that exerting effort is incentive compatible for the worker, the firm must raise wages and reduce labor demand. Alvarez and Veracierto examine quantitatively the insurance role of severance payments in an economy where the unemployment risk is uninsurable.

Recently, there has been a renewed attention to the role of wage rigidities in search models. Hall (2003), and Shimer (2003a, 2003b) have argued that rigid wages are the key for search model to be able to replicate the major business cycle facts about vacancies and unemployment fluctuations. In particular Shimer (2003b) shows that an exogenously fixed wage generates approximately the right variance for these two variables at that frequency. This rapidly growing literature seems to suggest that wage rigidities are an important contractual imperfection in actual labor markets.

The rest of the paper is organized as follows. In section 2 we argue that, quantitatively, the transfer is a large component of the total firing costs. In section 3 we outline the stochastic matching model used for the theoretical analysis and restate, in the context of our framework, the well-known result on the neutrality severance payments in the case of full wage flexibility. In section 4, we inspect the comparative statics of the tax and the transfer component of EPL in an economy where the wage rigidity is exogenous and distinguish various cases, according to its bite. Section 5 presents an extension of the benchmark model where the institutional constraint to wage setting is determined endogenously. Section 6 tests some empirical predictions of the model on a panel of OECD countries. Section 7 concludes the paper.

2 Preamble: the size of the transfer component in firing costs

As we argued in the Introduction, if the fraction of the total firing cost representing a deadweight loss for the firm-worker pair dominates the transfer component, then the standard approach of the literature finds a natural justification. Decomposing the total firing cost between tax and transfer component is an exercise that requires detailed knowledge of the country-specific institutions.[5] In this section, we provide estimates of the transfer and tax components in the statutory firing cost for Italy, one of the countries with the strictest Employment Protection Legislation (OECD, 1999). Our estimates show that transfers significantly exceed taxes.

In the Italian legislation, an employer-initiated layoff against an individual employee is legitimate only when it satisfies a "just clause". The Italian civil law (st. n 604/1966, sect. 3) foresees that individual dismissals are legal only under the two headings: *justified objective motive*, i.e. "justified reasons concerning the production activity, the organization of labor in the firm and its regular functioning", and *justified subjective motives*, i.e. "a significantly inadequate fulfillment of the employee's tasks specified by the court". The first case involves events which are outside the employee's control, while the second case requires misconduct

[5]This requirement goes well beyond the information published by the OECD (1999). Possibly, for this reason we are not aware of any other study trying to make this comparison.

on the part of the worker. The worker has always the right to appeal the firm's decision, and the final judgment ultimately depends on the court's interpretation of the case. If the worker does not appeal the firing decision, or if the separation is ruled fair, the legislation does not impose any firing cost to the firm.[6] Conversely, when the separation is ruled unfair and illegitimate, the court imposes a specific set of transfers and "taxes" to the firm, which we analyze next.[7]

Ex-post firing cost– Specifically, we start by considering a situation where an employer-initiated individual separation against a blue-collar worker with average tenure (8 years) in a firm with more than 15 employees is ruled unfair by the judge after a twelve months trial, the average length of a labor trail in Italy. This firing cost is therefore ex-post with respect to the court's decision. Although, this is not the exact counterpart of the cost in the firm's hiring and firing decision, it is a useful starting point.

First of all, the worker will be granted the foregone wages from the separation's day up to the court ruling (i.e. 12 months under our assumptions), while the firm will pay the foregone social insurance contributions augmented by a penalty for delayed payment. In addition, the worker may choose between a severance payments of 15 months or the right of being reinstated by the firm that unlawfully fired him.[8] In over 95 percent of the cases, the worker opts for the former option. Finally, all the legal costs will be paid by the firm. Thus, if we let n be the number of months that it takes to reach a court decision, w the gross monthly wage, τ^s the social security contributions, τ^h the health insurance contribution, ϕ the penalty rate on foregone contributions, sp the mandatory severance payments for unfair dismissal and lc the total legal cost, the total ex-post firing cost FC is

$$FC = nw + (\tau^s + \tau^h + \phi)nw + sp + lc.$$

The pure transfer component paid by the firm to the worker is

$$S = nw + \alpha\tau^s nw + sp,$$

[6] The union to whom the worker is affiliated usually bears all the legal costs in this case.

[7] Concerning the definition of a legitimate separation, the Italian EPL does not make any difference in terms of firm size. Yet, the maximum compensation to which unlawfully fired workers are entitled varies with firm size in two important dimensions. For small firms (with less than 15 employees), the choice between a full reinstatement and a severance payment rests with the firm. Further, for a worker employed in firms with less than 15 employees the maximum severance payment that can be obtained in court is limited to six months wages.

[8] See Ichino (1996) for the legal sources of this binding rule. Note that the number reported by the OECD (1999, Table 2.A.2, page 95) on the statutory severance payment in Italy is erroneous, since it refers instead to the mandatory deferred wage scheme (T.F.R), a very different institution.

Table 1: Tax and Transfer Components of Firing Cost in Italy

	Components of Firing Cost		
	Total	Tax	Transfer
Foregone Wages (nw)	12	0	12
Health Insurance $\left(\tau^h w\right)$	1	1	0
Social Security Contributions $(\tau^s w)$	4	4	0
Sanctions for Delayed Payments (ϕw)	3	3	0
Legal Costs (lc)	6	6	0
Severance Payments (sp)	15	0	15
Ex-post Firing Cost (FC)	41	14	27
Share	100	34	66
Cost in Off-Court Agreement $(p_u(S+T/2))$	17	0	17
Total Ex-ante Firing Cost $(\widetilde{FC})$	18.75	3.5	15.25
Share	100	19	81

Note: Estimate of transfer and tax component of ex-post and ex-ante firing cost for a firm with more than 15 employees in Italy that fires a blue collar worker with average tenure. Entries are in terms of monthly wages.
Source: Authors' calculation based on Galdon-Sanchez and Guell (2000), Ichino (1996), and OECD (1999).

where α is the share of the social security contributions that is rebated to the worker in the form of increased future pensions, in which case such payroll contribution should be counted as transfer inside the match. The tax component is

$$T = (1-\alpha)\tau^s nw + (\tau^h + \phi)nw + lc.$$

Table 1 provides an estimate of the size of FC as well as of the components T and S in the total firing costs when $\alpha = 0$, the share that minimizes the transfer component, i.e. the least favorable to our case. The estimate suggests that the total ex-post cost is over 40 monthly wages, and the transfer component of the total firing costs amounts to 66 percent.

Ex-ante firing cost– The above computation results in an impressively high firing cost, although it is based on the worst possible scenario for the firm: once the case has been taken to court and the judge has reached a verdict favorable to the worker. Obviously, ex-ante the firm-worker pair does not know with certainty whether the separation will be ruled unfair by the tribunal: let p_u denote the probability of such event. Many employer-initiated separations are not settled in court. Firms and workers often find a satisfactory settlement out of court and strike a deal before the full trial is over. In the case of an off-court agreement, the parties can save any court penalties that may eventually be imposed by a judge, and all the legal costs linked to the trial. In particular, if the two parties bargain in a symmetric Nash fashion on the settlement, the joint maximization problem will solve

$$\max_{\widehat{S}} \left[\widehat{S} - p_u S\right]^{\frac{1}{2}} \left[-\widehat{S} + p_u \left(S + T\right)\right]^{\frac{1}{2}},$$

where we denote by $\hat{S}$ the point of agreement between firm and worker. Notice that we have assumed –as common practice in Italy– that the labor union will pay the legal costs in case the layoff is ruled fair. The solution gives $\hat{S} = p_u \left(S + \frac{T}{2}\right)$ which is an amount larger than the expected transfer the worker would receive, but smaller than the total cost (transfer plus tax) the firm would pay in case the firing is ruled unfair. The intuition is that half of the tax becomes part of the settlement. For the purpose of our analysis, it is important to remark that in this case the entire firing cost for the firm is a *transfer* to the dismissed worker.

Let p_a be the probability of agreement off-court. If we ignore discounting, the ex-ante (with respect to the court's verdict) expected firing cost $\widetilde{FC}$ is

$$\widetilde{FC} = p_a p_u \left(S + \frac{T}{2}\right) + (1 - p_a) \left[p_u FC + (1 - p_u) C_L\right], \tag{1}$$

where C_L is the firing cost incurred by the firm when the judge rules the firing legitimate. Since, as we explained above, in the Italian legislation $C_L = 0$, the expected transfer component is

$$\widetilde{S} = p_a p_u \left(S + \frac{T}{2}\right) + (1 - p_a)\, p_u S \tag{2}$$

while the expected tax component is

$$\widetilde{T} = (1 - p_a)\, p_u T. \tag{3}$$

Galdon-Sanchez and Guell (Table 2, 2002), using data based on actual court sentences, compute that in Italy the probability of reaching an off-court agreement (p_a) is roughly 0.50, and the probability of the individual layoff being ruled unfair (p_u) is also approximately 0.50. With these probabilities, using the estimates of Table I, $\widetilde{FC}$ falls to 18 monthly wages. However, for the sake of our analysis, what matters is the fact that the share of the transfer rises to over 80 percent of the total.

We view this computation as a first attempt towards a more refined analysis of the relative magnitude of taxes and transfers in the EPL of the different OECD countries, which will become possible when detailed country-specific institutional knowledge is made accessible to economists. In the meantime, the Italian example speaks loudly against the view that severance payments can be ignored because they are quantitatively small compared to firing taxes.

3 The benchmark model

This section outlines the economic environment where we study the employment effects of severance payments under a range of possible degrees of flexibility in the wage setting process. The model is built on the "stochastic job matching" model pioneered by Jovanovic (1979) and surveyed by Pissarides (2000, chapter 6).

Demographics and Preferences– The labor market is populated by a measure 1 of infinitely lived workers and a "large" supply of potential firms (or jobs, or production units). Utility is linear and transferable, and all agents discount the future at the exogenous rate r, strictly positive. A worker can be either employed or unemployed and a firm either filled or vacant.

Matching– There is a fixed measure v of matching licences that can be rented every period by firms at the (endogenously determined) price q. Potential firms compete for matching licenses, and free entry will ensure that the value of participating to the matching process is exactly zero. Vacant firms with matching licenses and unemployed workers meet randomly (there is no on-the-job search). Denote by α the fixed contact rate for an unemployed worker and by u the measure of unemployed workers, then the contact rate for a vacant firm will be $(\alpha u)/v$. Upon meeting, the initial value product of a match x is drawn from a twice continuously differentiable cumulative distribution function $F(x)$, with density $f(x)$, and finite support over the interval $[0, \bar{x}]$. The realization of the idiosyncratic component x is known to the parties only after they meet, so that a contact may not lead to job formation. Firms who successfully match with a worker move to the production line, and release the costly matching license who is immediately rented out to another vacant firm.

Production– A match produces output y with the linear technology $y = x$. After being matched, the worker starts producing output with the productivity level initially drawn upon meeting. Over time, matches are subject to idiosyncratic productivity shocks with Poisson arrival rate $\lambda > 0$. Conditional on λ striking, the value of the match is drawn from the same distribution $F(x)$. Draws are *i.i.d.* over time and across production units.

Employment Protection Legislation– Firms have the authority to terminate unproductive jobs by firing the worker and, symmetrically, workers have the right to quit and search for a new match at any time. The government enforces a severance payment $S > 0$ which represents a pure transfer from the firm to the worker upon job separation. The EPL policy implies a *two-tier* labor market structure: initially, the match belongs to an "outsider" phase where firing penalties are not binding. This phase will last until the next renegotiation takes place, i.e. until λ strikes for the first time. At this point the worker has moved into an "insider" phase where she is entitled to job security provisions.

Wage Determination– The existence of a search friction together with costly vacancies gives rise to pure rents to be split, and thus to a bilateral monopoly problem upon meeting. We begin by studying the case where wage setting is fully flexible at the level of each individual firm-worker match. Following the bulk of the matching literature, we assume that match specific wages and profits are the outcome of a generalized Nash bargaining between the parties with workers' bargaining share equal to $\beta > 0$. Wage contracts are renegotiated each time new information about the match is revealed (i.e. when λ strikes).

Next, we consider situations where for some groups of workers the individually bargained wage does not apply because of a binding institutional constraint that sets the wage at a level ω. The presence of a minimum wage, industry or occupation-wide unions, national collective bargaining can lead to such outcome. We first take the degree of wage rigidity ω as exogenous, and in particular we assume it is not responsive to changes in the size of the mandatory transfer S. Next, we provide an endogenous determination mechanism for ω and let the degree of wage rigidity respond to the policy S in the comparative statics; we postpone the description of this latter block of the model until Section 5.

Values– Values for market participants are V for a vacant firm holding a matching license; $J_o(x)$ and $J_i(x)$ for a firm matched with an outsider and an insider worker, respectively; $W_o(x)$ and $W_i(x)$ for outsider and insider employed workers; U for unemployed workers. It is straightforward to derive expressions for all these value functions:

$$rV = -q + \frac{\alpha u}{v} \left\{ \int_{R_o}^{\bar{x}} J_o(z) dF(z) - [1 - F(R_o)] V \right\}, \quad (4)$$

$$(r + \lambda) J_k(x) = x - w_k(x) + \lambda \int_{R_i}^{\bar{x}} J_i(z) dF(z) - \lambda F(R_i) S, \qquad k = o, i \quad (5)$$

$$(r + \lambda) W_k(x) = w_k(x) + \lambda \int_{R_i}^{\bar{x}} W_i(z) dF(z) + \lambda F(R_i)(U + S), \qquad k = o, i \quad (6)$$

$$rU = \alpha \left\{ \int_{R_o}^{\bar{x}} W_o(z) dF(z) - [1 - F(R_o)] U \right\}, \quad (7)$$

where the subscripts o and i stand respectively for outsider and insider status, and where $w_o(x), w_i(x)$ denote the wages paid to outsider and insider workers in a match with productivity x. In writing the value functions, we have made use of the fact that firms and workers will follow a reservation wage strategy when making their decisions whether to accept or reject a new match upon meeting (with associated reservation productivity R_o), and whether to continue or break up an existing match after a new productivity realization has been drawn (with associated reservation productivity R_i).

Some remarks on the framework sketched above are in order. First, the reader might be more accustomed to the Mortensen and Pissarides (1994) model where the number of vacancies is endogenous, but their posting price is fixed, and all random meetings are transformed into jobs starting with the highest productivity. Although our stochastic matching model has fixed meeting rates for workers, it still has a free entry condition (the price q is bid up until expected profits are zero), thus it retains an endogenous entry margin operating through the choice of the reservation productivity R_o. It turns out that this version of the matching model is simpler to analyze in presence of a two-tier wage structure, while maintaining at the same time several features of the classic Mortensen and Pissarides framework.[9]

Interestingly, it is possible to show that an exogenous shifter (e.g., a productivity shock, or a tax) induces very similar comparative statics on the price q in our model, and on the number of vacancies in the traditional framework. Hence, by examining the change in q in our model one can infer how binding the constraint of fixed vacancies is for the economy, and how total vacancies would react in the traditional model.

[9] See also Acemoglu (1999) and Violante (2002) for applications of this alternative version of the matching model with fixed production sites and endogenous rental price for sites.

Second, the dual "insider-outsider" structure allows firms in our economy to hire workers on particular contracts whose nature is temporary (with expected duration $1/\lambda$) and excludes firing penalties. Theoretically, as we will see, this two-tier structure is the minimum requirement to allow the market to "undo" the government-mandated severance payments and, as such, it represents an important benchmark. In practice, in actual economies these contracts (such as fixed-term contracts, temporary contracts for probationary periods, or apprenticeship/training contracts) covering entry jobs or initial periods in an employment relationship are widespread: Garibaldi and Mauro (2002) report that on average 13% of employment (and almost 25% of workers between 20 and 29 years old) in Continental Europe is covered by contracts involving no layoff cost.[10]

Third, risk neutrality (or market completeness) is a standard assumption in the search literature, useful to keep the environment analytically tractable. Through this assumption we also intentionally focus only on the consequences of severance payments for unemployment and rule out any insurance argument which, although important, is beyond the scope of this paper.[11]

3.1 Equilibrium with flexible wage setting

When the individual bargaining is unconstrained by institutions, it is important to distinguish the different bargaining problems faced by outsiders and insiders. In the first stage of the employment relation job termination policies do not enter the negotiation, as the outsider worker is not eligible by law, and the Nash sharing rule for outsiders reads

$$(1-\beta)[W_o(x)-U] = \beta\,[J_o(x)-V]\,, \tag{8}$$

[10]Notice that we are sidestepping the issue of the conversion of temporary contracts into permanent ones, since when λ strikes for the first time, the worker simultaneously acquires her insider status and the right to job security provisions. Strictly speaking, in our economy temporary contracts have average duration $1/\lambda$ and then they turn automatically into permanent contracts. Notwithstanding this simplification, the crucial difference between outsiders and insiders –their different threat point at the bargaining table– remains intact in the model. In earlier work (Garibaldi and Violante 2000) we have used a more general model where the productivity change and the change in employment status follow two independent Poisson processes: all the key results of section 3.1 and 4 are unchanged, but the algebraic derivations are considerably more complex and the model does not allow a graphical representation of the equilibrium since the reservation productivity for the separation decision of outsiders becomes part of the equilibrium as well and raises the dimensionality of the problem to three variables. The framework adopted in this paper is simpler and conveys the intuition more transparently.

[11]See Alvarez and Veracierto (2001), Bertola (2001), and Pissarides (2002) for recent studies of the insurance properties of EPL policies.

where the threat point of the worker is the value of unemployment U and the threat point to the firm is the value of a vacancy V. Conversely, for an insider match where severance payments S are due, the sharing rule reads

$$(1-\beta)[W_i(x)-(U+S)]=\beta[J_i(x)-(V-S)], \tag{9}$$

where the threat point of the firm (worker) is now reduced (augmented) by the severance payment.[12] We are now in a position to formally define the equilibrium of our economy.

Definition (Stationary Equilibrium): *A stationary equilibrium with given policy S, is a set of value functions $\{V, J_o(x), J_i(x), U, W_o(x), W_i(x)\}$, a pair of reservation productivities $\{R_o, R_i\}$, a pair of wage rules $\{w_o(x), w_i(x)\}$, a rental price for matching licenses q, and an unemployment rate u that satisfy the following conditions: 1) there is free entry in the matching market, thus from* (4), $V=0$ and $q=\frac{\alpha u}{v}\int_{R_i}^{\bar{x}} J_o(z)dF(z)$*; 2) the optimal reservation strategy for job creation implies $J_o(R_o)=0$; 3) the optimal reservation strategy for job destruction implies $J_i(R_i)+S=0$; 4) outsider and insider wages are determined, respectively, by* (8) *and* (9)*; 5) the value functions (J_o, J_i, W_o, W_i, U) are determined by equations* (5) − (7)*; 6) the equilibrium balanced flow condition in the labor market implies the unemployment rate $u=\frac{\lambda F(R_i)}{\lambda F(R_i)+\alpha[1-F(R_o)]}$.*

The definition of equilibrium is quite standard. Competition among entrant firms will bid up the rental price of a matching license q until it equals exactly the flow expected present value of holding a license. In turn, this will bring the ex-ante value of a vacancy V to zero. Upon meeting, a firm will accept a worker (and create a new match) as long as its value is strictly positive, given that being vacant has zero value, i.e. for productivity draws above R_o; and it will destroy a match when the new productivity draw implies a discounted present value of operating losses higher than S, the total firing costs the government forces upon the firm at separation, i.e. for productivity draws below R_i. As explained above, wages are the outcome of a decentralized Nash bargaining. Finally, the labor market is in equilibrium when

[12] Often, the law forces the firm to pay only if it is the firm itself who initiates the separation (i.e. fires the worker). In the data, generally, quits and layoffs are very difficult to distinguish. McLaughlin (1991) discusses the empirical restrictions that efficient turnover theory implies for the data. Specifically, with cooperative bargaining it is theoretically impossible to distinguish between quit and layoffs without analyzing the extended form associated to the bargaining game, which is beyond the scope of this paper. Fella (1999) provides a technical analysis of such a game and examines its consequences for policy analysis in models with Nash bargaining.

the outflow from unemployment, at rate $\alpha [1 - F(R_o)]$ equals the inflow into unemployment, at rate $\lambda F(R_i)$.

Characterization– It is straightforward to show (see Appendix) that the equilibrium of this model boils down to solving for (R_o, R_i) through a pair of equations: the job creation (JC) equation obtained from the optimal hiring condition $J_o(R_o) = 0$, and the job destruction equation (JD) derived from the optimal firing condition $J_i(R_i) + S = 0$. Given (R_o, R_i), unemployment u is determined by the balanced flow condition. With R_o, R_i and u in hand, the rental price q is determined residually. The job creation and job destruction equations are:

$$R_o - rU(R_o) + \frac{\lambda}{r+\lambda} \int_{R_i}^{\bar{x}} [1 - F(z)]dz = 0, \tag{JC}$$

$$R_i - rU(R_o) + \frac{\lambda}{r+\lambda} \int_{R_i}^{\bar{x}} [1 - F(z)]dz = 0, \tag{JD}$$

where

$$rU(R_o) = \frac{\alpha\beta}{r+\lambda} \int_{R_o}^{1} [1 - F(z)]dz. \tag{10}$$

The (JC) curve is positively sloped in the (R_o, R_i) space. The interpretation is simple. Consider a pair (R_o, R_i) on the job creation curve, where $J_o(R_o) = 0$. A marginal increase in R_i reduces the expected gains from a new realization of the idiosyncratic shock occurring at rate λ and makes the value of the outsider job negative. Thus, to remain on the curve it is necessary to compensate this expected loss to the firm with a rise in the productivity of the marginal job. The latter is obtained by increasing R_o with its direct impact on the marginal job's productivity and through a reduction in the wage via a decline in the worker's outside option rU.[13]

The (JD) curve is negatively sloped in the (R_o, R_i) space. Along the exit margin, we have $J_i(R_i) + S = 0$. An increase in R_o decreases the wage of the marginal insider job through its negative effect on the worker's outside option rU and raises the value of the job. Thus, to restore the job destruction condition it is necessary to reduce the value of the marginal job for the firm, which is done by decreasing R_i.[14]

[13] Simple inspection of the value of unemployment shows that rU is declining in R_o.

[14] Note that an increase in R_i has two opposite effects on the marginal job: a direct positive effect through the marginal productivity and a negative effect through the expected loss from a new realization of the idiosyncratic shock. It can be proved that the direct effect dominates the indirect effect, so there is an overall positive relationship between $J_i(R_i)$ and R_i.

From the analysis of the slopes of the two curves it follows naturally that whenever an interior equilibrium exists, it is unique and is obtained by the crossing of the (JC) and (JD) curves in the (R_o, R_i) space. Existence is guaranteed if and only if $\alpha\beta > \lambda$ (see Appendix). To understand this condition, first notice that an immediate implication of the (JC) and (JD) equations is that in the fully flexible equilibrium $R_o = R_i$, i.e. the two reservation productivities characterizing the job creation and the job destruction decisions coincide. It is then easy to see that when $\alpha\beta < \lambda$ the equilibrium value of both reservation productivities would be constrained at zero: the option value of keeping the worker (proportional to λ) is so much larger than her cost (proportional to $\alpha\beta$) that the firm hires any worker and never finds optimal to fire.

Neutrality of the Severance Payment– With a two-tier wage regime, the severance payment S has no allocative effects on the labor market: inspecting the (JC) and (JD) equations, which represent the reduced-form of the model, it is immediate to see that S does not appear. This is a reincarnation in matching models of the classical Lazear's neutrality result (Lazear 1988, 1990). The intuition comes from the outsider and insider wage rules (see the Appendix for a derivation)

$$w_o(x) = \beta x + (1-\beta)rU - \lambda S, \tag{11}$$

$$w_i(x) = \beta x + (1-\beta)rU + rS. \tag{12}$$

It is clear that by reducing appropriately the first-tier wage, the firm can make the worker prepay entirely the severance payment S: the outsider worker's wage is diminished by an amount λS every period and her first-tier status will last on average exactly $1/\lambda$. As an insider, because of the change in the threat point, the worker will earn her interests on the principal held by the firm and, upon separation, he will receive the principal back. Given risk-neutrality, this actuarially fair scheme has no allocative effects.

4 Exogenous wage rigidity

Consider now the case where institutional constraints impede a fully flexible wage setting at the level of the individual firm-worker pair. We begin by assuming these constraints are exogenous, in the sense that changes in the statutory severance payment S do not affect the determination of the wage rigidity ω.

Given the two-tier (insider-outsider) structure of the labor market, there are three cases to analyze, each one corresponding to a different "bite" of the institutional constraint. The natural starting point is the extreme case of full wage rigidity where the constraint is binding for every match in the economy, including outsiders. Next, we analyze the case where the constraint is binding only for insiders, but wage setting is flexible for outsiders. Third, we study the case where insider workers bargain freely with their firms, but the institutional constraint is binding for outsider workers.[15]

What kind of labor market institutions can be at the origin of the different degrees of wage rigidity? Recall that outsider workers are defined in our model as those holding jobs without employment protection rights, i.e. apprenticeship, and temporary contracts. In general, the most relevant source of wage rigidity is represented by collective bargaining taking place at a level higher than the individual plant. When such agreements do not cover temporary and flexible contracts (e.g., Belgium, Greece and, partly, France), we fall in our second case above (insiders constrained). However, in some countries collective bargaining agreements for workers on permanent contracts extend by law to those on fixed-term contracts, with variable proportions (e.g., 60% in Spain, 80% in Italy and virtually 100% in Sweden). These countries fall broadly in our first category (full wage rigidity). Finally, it is natural to think of the third case (outsiders constrained) as one where a minimum wage constraint is binding for low-paid jobs, but bargaining is highly decentralized (e.g., U.K., and U.S.). To sum up, differential institutions across countries determine various degrees of wage rigidities and, as we will show, diverse degrees of wage rigidity can induce, in turn, opposite employment effects of severance payments.[16]

4.1 Full wage rigidity

Consider the case where the wage ω applies to every job in the economy. When we combine the equations in $(5)-(7)$ with the assumption that wages are exogenously fixed at ω, we arrive

[15] An equilibrium for this model is defined exactly as above, except for point *4)*. One should replace *4)* by the appropriate wage determination rules, according to these 3 cases.

[16] The OECD Employment Outlook (1998), in particular Tables 2.1 and 3.2, provides detailed information on cross-country differences in minimum wages and temporary contracts. See Iversen (1998) for an index of centralization of the wage bargaining which combines a measure of union density with a measure of the prevalent level of bargaining and the enforceability of bargaining agreements.

at the pair of equations (derived in the Appendix) which fully characterize the equilibrium:

$$R_o - \omega + \frac{\lambda}{r+\lambda}\int_{R_i}^{\bar{x}} [1 - F(z)]\, dz - \lambda S \;\; = \;\; 0, \tag{13}$$

$$R_i - \omega + \frac{\lambda}{r+\lambda}\int_{R_i}^{\bar{x}} [1 - F(z)]\, dz + rS \;\; = \;\; 0. \tag{14}$$

Severance Payment as Tax– The comparative statics of S are straightforward: a rise in S decreases R_i (and unemployment incidence), whereas it increases R_o (and unemployment duration) with ambiguous net impact on the equilibrium unemployment rate. From the point of view of the individual firm, since wages are outside its control, a mandatory transfer to the worker cannot be undone and represents a tax on separations, with the standard comparative statics of the firing tax in matching models with wage flexibility (see Millard and Mortensen 1994, Mortensen and Pissarides 1998, and Pissarides 2000). Figure 1 illustrates this case graphically.

4.2 Wage rigidity binding for insiders

We now turn to the case where wages on outsider jobs are fully flexible, but wages for insiders are exogenously fixed at ω. The reduced form of the model becomes

$$R_o - rU\left(R_0\right) + \frac{\lambda}{\left(r+\lambda\right)\left(1-\beta\right)}\int_{R_i}^{\bar{x}} [1 - F(z)] dz \;\; = \;\; 0, \tag{15}$$

$$R_i - \omega + \frac{\lambda}{r+\lambda}\int_{R_i}^{\bar{x}} [1 - F(z)] dz + rS \;\; = \;\; 0, \tag{16}$$

and the comparative statics with respect to the employment protection policy are characterized by

Lemma 1 (Insiders constrained): *When the insider wage is fixed at ω but outsider wages are fully flexible, a rise in S shifts down only the (JD) curve, inducing a fall in both R_o and R_i. Thus, a larger S reduces unemployment unambiguously.*

Proof. See Appendix. ■

Since the wage is fully downward flexible for outsiders, S is absent from both the (JC) condition and the value of unemployment rU. However, given the wage rigidity for insiders, the transfer S enters exactly like a tax in the (JD) condition. A rise in S makes separations more costly for the firm which responds by delaying separations and decreasing the firing threshold R_i. As a result unemployment incidence falls. This decline in R_i prolongs expected tenures and increases the value of a newly created match, thus firms are willing to accept matches with workers of lower productivity, i.e. also R_o (and unemployment duration) decreases. Figure 1 depicts also this case.

4.3 Wage rigidity binding for outsiders

Suppose now that the wage rigidity constraint is binding for outsider workers, whereas wages for the insiders are still the outcome of the decentralized Nash bargaining, as in (12).[17] The (JC) condition becomes

$$R_o - \omega + \frac{\lambda(1-\beta)}{r+\lambda}\int_{R_i}^{\bar{x}}[1-F(z)]dz - \lambda S = 0, \tag{17}$$

and the job destruction equation is given by

$$R_i - rU\left(R_o, R_i, S\right) + \frac{\lambda}{r+\lambda}\int_{R_i}^{\bar{x}}[1-F(z)]dz = 0, \tag{18}$$

where we have made the dependence of rU on the triple (R_o, R_i, S) explicit.[18] The novelty here is that the value of unemployment depends directly on the severance payment S. The comparative statics with respect to S are characterized by

Lemma 2 (Outsiders constrained): *When the outsider wage is fixed at ω but insider wages are fully flexible, a rise in S shifts the (JC) curve down and the (JD) curve up, inducing a rise in R_o and an ambiguous change in R_i. Thus, a larger S can increase equilibrium unemployment.*

Proof. See Appendix. ■

Figure 2 displays the shifts of the (JC) and (JD) curves in the (R_o, R_i) space following a rise in S. Understanding the shift of the (JC) curve after an increase in S is immediate: with a wage floor constraint binding at entry, the severance payment cannot be fully undone by lowering outsider wages, hence firms perceive the increase in severance payments as synonymous of an increase in the expected labor costs (like a tax), and respond to such increase by becoming more demanding on the entry margin (and by raising R_o). This is the first real effect of S.

[17] If we think of this institutional constraint as a minimum wage, then technically to be sure that every insider is paid above the minimum wage, we need to check that in equilibrium $w_i(R_i) > w_o(\bar{x})$. A sufficient condition is $(r+\lambda)S > \beta(\bar{x} - R_i)$.

[18] The analytical expression for $rU\left(R_o, R_i, S\right)$ is derived in the Appendix.

The shift of the (JD) curve is slightly more complex because of the presence of the function $rU(R_i, R_o, S)$. How does this function depend on its arguments? A larger R_o decreases the value of unemployment as it makes firms more demanding in hiring; a larger R_i decreases the value of unemployment because it shortens job durations, hence it reduces the value of search; finally, S directly increases the value of search because the unemployed worker discounts the fact that once she has found a new job and she will have become an insider, she can count on the severance payment upon separation: a transfer from the firm that she has not fully prepaid while outsider because of the binding constraint on wage determination.

The presence of the severance payment in the worker's outside option, absent in the previous cases analyzed, increases the bargaining power of the insider worker at the negotiation table, and induces upward wage pressure in equilibrium. For a marginal job on the destruction threshold –see equation (18)– this wage pressure must be compensated by a marginal increase in the expected value of the job, which is obtained by a rise in the reservation productivity level at destruction R_i. In other words, the job destruction curve shifts *upward*, with the result that R_i could potentially increase, inducing a rise in unemployment incidence. Finally, since the change in R_i is now smaller (and possibly positive), an even higher productivity level R_o is required to create a productive job, which amplifies the final increase in R_o.[19]

In conclusion, the qualitative predictions of the theory on the employment effects of severance payments depend crucially on the extent to which the institutions constraining the individual-level wage bargaining are binding. When insider wages are constrained, job security provisions reduce unemployment, whereas when outsider wages are constrained, they can increase unemployment. Only with full wage rigidity, the transfer component of employment protection has the standard comparative statics of the firing tax. But, are the effects of the firing tax in the three wage rigidity regimes analyzed above the same as in the flexible-wage case? Next, we analyze precisely this question.

4.4 The robust effects of firing taxes

The crucial difference between the transfer and the tax components of the firing cost is that the latter is dissipated outside the match. The results of this section do not depend on

[19]One should note that this case corresponds to an economy where every worker who is fired starts her new employment on the minimum wage. Thus, it is particularly relevant for young, unskilled workers who have not cumulated enough transferable experience to command a high wage upon re-employment.

whether the tax is rebated to the households or wasted, thus for the sake of simplicity we make the latter assumption. Here, we demonstrate that the employment effects of a firing tax T are extremely robust across all the scenarios analyzed so far.[20]

Lemma 3 (Firing Tax): *Independently of the bite of the wage rigidity, a rise in the firing tax T shifts down both the (JD) and the (JC) curves: R_i (and unemployment incidence) declines, and R_o (and unemployment duration) increases, thus the net effect on the equilibrium unemployment rate is ambiguous.*

Proof. See Appendix. ■

Bentolila and Bertola (1990) derived this result with full wage rigidity and with full wage flexibility (but one-tier), respectively. As emphasized later by Mortensen and Pissarides (1998), the two-tier flexible wage structure that allows to undo the entire severance payment can only neutralize a fraction β of the firing tax T which, therefore, has the standard real effects.

Lemma 3 extends the Bentolila-Bertola-Mortensen-Pissarides result to the intermediate cases where the wage rigidity constraint is binding for either group of workers. Recall that when the outsiders are constrained, the severance payment has a key effect on the job destruction rate through the equilibrium value of unemployment (recall equation 18). Conversely, the firing tax T does not enter directly in the value of unemployment rU because it is destined outside the pair, which explains the different comparative statics of transfer and tax in this case.

Interestingly, in our model it can be also proved that with full wage rigidity, following a rise in the firing tax T, the separation rate (unemployment duration) decreases (increases) by a larger amount compared to the economy with full flexibility, so the impact of the tax on labor market flows is amplified by wage rigidity. The intuition is straightforward: if wages are downward flexible, the firm can discharge part of the tax onto the worker, thus profits from the match are reduced by a lower amount and firms, in turn, increase the creation threshold R_o by a smaller magnitude. This rise in R_o leads to a decline in wages (through the equilibrium outside option rU) which partially compensates the firm from the increase in T and allows her to decrease the destruction margin R_i by a lower amount.

[20] Our conclusion is formulated in the context of matching models. Here a caveat is needed: Ljungqvist (2002) shows that the effects of firing taxes on labor market outcome are model dependent, and other models may yield somewhat different predictions in terms of unemployment.

Overall, the fact that firing taxes have always the same effects no matter how binding the institutional wage rigidity is in the economy, is a very useful conclusion for policy-makers.

5 Endogenous wage rigidity

We now extend the model to allow the institutional wage rigidity ω to depend explicitly on the statutory transfer S made within the job-worker pair. This extension aims at capturing the idea that the coalition or the organization establishing the institutional constraint on individual wage bargaining does respond to changes in the size of the government-mandated severance payment. To the extent that the process through which institutions internalize external changes is time-consuming, one can think of the investigation in the previous section as corresponding to a short run analysis whereas this section presents the medium-long run comparative statics of severance payments.

Institutional Setting– There exists a workers' organization (union) in the economy imposing a "perfectly egalitarian wage policy rule" among its members. Outsiders and unemployed workers are excluded from the membership. Insider workers are heterogeneous in the productivity level x of their match, so they have potentially conflicting preferences over the wage level ω to set. The union chooses, by majority voting, the wage level ω to be set in all matches, but firms are free to destroy all the matches with negative value. This set-up is reminiscent of the classical monopoly union model, whereby the union imposes its preferred wage level to the firm, which then determines employment from its labor demand curve (McDonald and Solow, 1981).[21]

To simplify the problem and maintain analytical tractability, we make the assumption that the value of unemployment is exogenously fixed at $\mathbf{U}$. There are several ways to justify this assumption. In Saint-Paul (2002) the value of unemployment is exogenous because there is an activity alternative to search (e.g. home-production) with given return, and in equilibrium the value of search has to equalize the value of the alternative activity. Another explanation, consistent with our framework, is that there is a continuum of sectors indexed by $n \in [0, \bar{n}]$, each one with the same distribution of firm-specific productivity $F(x)$, and

[21] One does not need to assume that the bargaining power of the firm is zero in the wage setting. Consider a model where the union chooses, by majority voting, a delegate among its insider members who will bargain, unconstrained, with its own firm. The wage level emerging from such *pilot negotiation* is then applied to all insider workers. It is easy to show that this more general "right-to-manage" framework is completely isomorphic to our benchmark model.

each one with a separate union setting ω^n in their own sector. Because of random matching, an unemployed worker can be contacted randomly by firms throughout all sectors in the economy, so the equilibrium value of search is given by the average value of unemployment $r\mathbf{U} = \int_0^{\bar{n}} rU(\omega^n)dn$. Since each sector is small with respect to the aggregate, the wage outcome has no impact on $\mathbf{U}$.

It is important to remark that although $\mathbf{U}$ is taken as given when voting, insider workers fully internalize the impact of their wage choice on the equilibrium destruction margin R_i. We shall explain below that this simplification is useful to find an intuitive sufficient condition for the validity of the median voter's approach, but the main comparative statics results of Lemma 5 do not depend on it.

Majority Voting– Voting is once and for all.[22] Insiders' preferences on the wage ω are defined by

$$\hat{W}_i(x,\omega) = \begin{cases} W_i(\omega), & \text{if } J_i(x,\omega) \geq -S \\ \mathbf{U} + S, & \text{otherwise.} \end{cases} \tag{19}$$

In other words, workers recognize that if the chosen wage is excessively high and leads to a negative value of the match for the employer (i.e. the firm's participation constraint $J_i(x,\omega) + S \geq 0$ is violated), the match will be destroyed and the worker will become unemployed.

Next, we demonstrate that when either one of a pair of intuitive conditions holds, the preferences defined in (19) are single-peaked, thus the "median voter theorem" applies and majority voting leads to a unique outcome ω^*. To fully understand the Lemma below, it is useful to introduce some notation. Denote by $\varepsilon_{a,b}$ the elasticity of a with respect to b, and by ω^* the wage level where $\frac{\partial W_i}{\partial \omega} = 0$.

Lemma 4 (Single peakedness): *(i) If $\varepsilon_{[\omega - r(\mathbf{U}+s)],\omega} > \varepsilon_{F(R_i),\omega}$, the voting preferences $\hat{W}_i(x,\omega)$ of any given insider worker with match productivity x are single-peaked, and the maximum is at the point $\bar{\omega}(x)$ where the firm's participation constraint is binding; (2) If $\varepsilon_{[\omega^* - r(\mathbf{U}+s)],\omega} < \varepsilon_{f(R_i),\omega}$, the voting preferences $\hat{W}_i(x,\omega)$of any given insider worker with*

[22] Repeated voting, period by period, is extremely challenging to study analytically. Most papers resort to computational techniques (e.g., Krusell and Rios-Rull, 1996). Only recently examples of tractable dynamic voting models have appeared in the literature (e.g. Hassler, Rodrigez-Mora, Storesletten, Zilibotti, 2003). Saint-Paul (2002) makes our same assumption on voting and argues that one can think of the equilibrium of this model in terms of the steady-state of a repeated voting equilibrium as the frequency of voting goes to zero.

match productivity x are single-peaked, and the maximum is either at the interior point ω^* or at the point $\bar{\omega}(x)$, depending on the level of x.

Proof. See Appendix. ■

This result originates from a simple trade-off. Choosing a higher wage ω induces two effects on workers' welfare. On the one hand, it increases the worker's current payoff from working (*income effect*), on the other hand it raises the probability of being fired (*job security effect*), since R_i is increasing in ω. While the income effect increases workers' welfare, the job security effect reduces it. These two opposing forces are evident in the expression below (see Appendix) that describes how the value of an insider worker changes with her wage,

$$\frac{\partial W_i(\omega)}{\partial \omega} = \frac{1}{r + \lambda F(R_i(\omega))} \left[1 - \lambda F'(R_i(\omega)) \frac{\partial R_i}{\partial \omega} (W_i(\omega) - (\mathbf{U} + S)) \right].$$

The term "1" represents the positive income effect, whereas the negative term captures the job-security effect, proportional to the potential loss of surplus from separation.

When $\varepsilon_{[\omega - r(\mathbf{U}+s)],\omega} > \varepsilon_{F(R_i),\omega}$, a higher wage increases the current labor income proportionately more than the probability of being fired, and the income effect dominates the job security effect over the entire range of ω. Recall that the firm participation constraint $J_i(x, \omega) \geq -S$ implies a value $\bar{\omega}(x)$ –increasing in x– beyond which the firm will destroy the match. For $\omega > \bar{\omega}(x)$, the preferences of the worker are given by $(\mathbf{U} + S)$, the value of search gross of the mandatory compensation for being laid-off. Since $(\mathbf{U} + S)$ is independent of ω by assumption, and it is strictly lower than $W_i(\omega)$, the maximum is exactly at $\bar{\omega}(x)$ and preferences are single-peaked. Figure 3 (upper panel) depicts this scenario.

Conversely, when $\varepsilon_{[\omega^* - r(\mathbf{U}+s)],\omega} < \varepsilon_{f(R_i),\omega}$ eventually the job-security effect ends up dominating and $W_i(\omega)$ is strictly concave at its extrema. By continuity, it has a unique interior maximum ω^* and a decreasing region beyond that point. The lower panel of Figure 3 illustrates the two cases that can potentially arise when a worker with productivity x evaluates his preferences over wages. In one case x is so small that the firm's participation constraint cuts the worker's objective function before the maximum of $W_i(\omega)$, so the preferred alternative by the worker in question is the wage that makes the firm exactly indifferent between firing and keeping the worker, i.e. $\bar{\omega}(x)$. In the other case, x is large and the peak ω^* is an interior solution because the effect associated to the increased layoff probability starts dominating before the firm's participation constraint becomes binding.[23]

[23]The shape of these voting preferences over ω are reminiscent of the shape of the voting preferences

Thereafter, we will work under the assumption that the welfare of the median insider is maximized at the interior solution ω^*. Besides the natural appeal of the interior maximum, an undesirable implication of the corner solution is that right after the vote, half of the insiders (the measure of workers below the constrained median voter) would lose their job.

5.1 Comparative statics

Thanks to single-peakedness, the median voter theorem applies and ω^* is the equilibrium outcome of the vote determined by aggregating all unions members' choices. It is now possible analyze how a change in the severance payment S translates into equilibrium unemployment when the the median voter in the union can react to this change by setting a different wage level ω^*. In line with the earlier analysis, we compare steady-state allocations corresponding to different values of S. We distinguish two cases, one where the endogenous wage rigidity applies only to the insider workers, and the other where it extends to all workers, including outsiders.[24]

Lemma 5 (Endogenous wage rigidity): *Suppose that the insiders' preferences are single-peaked and the outcome of the vote is the interior solution ω^*. Then, (i) when the endogenous wage rigidity ω^* is binding for both outsiders and insiders (full wage rigidity), and the median voter is an insider, severance payments S increase unemployment unambiguously; (ii) when the endogenous wage rigidity ω^* is binding for insiders, but outsider wages are fully flexible (insiders constrained), severance payments S are neutral; (iii) in the latter case, severance payments S remain neutral even when the value of search U is endogenous.*

Proof. See Appendix. ■

Surprisingly, this Lemma restores the original "neutrality result" of severance payments when the outsiders' bargaining is unconstrained. The key to understand this result is that the median voter's mechanism implies that the chosen wage ω^* contains the flow rent on

over employment protection in Saint-Paul (2001, Figure 1, page 683). There, as well, beyond a concave portion corresponding to the value of employment W, there is a flat region corresponding to the value of unemployment U for levels of job security provision such that the worker loses its job immediately after the vote. Moreover, the two contrasting effects explained above are present in the monopoly union model sketched by Mortensen and Pissarides (1998), where the choice of the union is on the workers' bargaining share β in each job, rather than on the wage ω directly.

[24] The definition of the equilibrium in the model with endogenous wage rigidity is exactly as in Section 3.1, except for point 4). Insider wages are determined by the median insider worker's solution to the maximization of the preferences over ω defined in (27), whereas outsider wages are either determined by (11) in the case they can bargain unconstrained, or are equal to the insiders wage in the case of full wage rigidity.

the mandatory severance payment rS extracted by the insiders at the expense of the firm, exactly as the wage that any individual insider would negotiate in an unconstrained fashion (recall equation 12). After substituting the equilibrium wage ω^* into the job destruction condition (15), it is immediate to see that S drops out of the equation (see Appendix). Since outsiders bargain freely with their firms, the (JC) condition is unaffected by the policy, so S is neutral on the equilibrium allocations. Note that the neutrality result of Lemma 5 is robust to endogenizing the value of unemployment U through equation (10).

When the coverage of the insiders' wage contract ω^* extends to the outsider contract as well, then severance payments have once again real consequences. To understand, recall that when outsiders' bargaining is unconstrained, in the face of a rise in S firms can reduce entry wages to make workers prepay the additional severance payment. When outsiders receive the wage set by the insiders, firms are forced to pay a higher wage to outsiders too, since the insider wage is increasing in S because of the rent on the employment protection restriction rS. It is still true that R_i is unaffected by S, but now R_o rises unambiguously with S and so does unemployment.

6 Empirical implications

The key result of the previous Section is that the employment effects of severance payments differ according to the degree of centralization and coverage of unions' wage setting. The wage bargaining between outsider workers and firms is likely to be constrained in situations where wage determination is very centralized, and/or where the degree of coverage of unions contracts is extensive. In these cases, larger severance payments have adverse effects on unemployment, but in other cases where bargaining is more decentralized severance payments remain neutral. Put differently, it is the *interaction* between the strictness of EPL and the type of wage setting institutions that matters for unemployment. This novel prediction of our theory is empirically testable.

A growing empirical literature has analyzed the determinant of unemployment across countries. All these papers exploit both the time series and cross sectional dimension of the data, and regress the level of unemployment (or employment) across several OECD countries over the past 40 years on a series of explanatory shocks, and a series of institutional variables. Among the institutions considered, most papers include the total tax rate, a measure of union density, union coverage, the degree of centralization in the wage bargaining process,

Table 2: Estimation Results for the Unemployment Rate

Dependent Variable: OECD Standardized Unemployment Rate	I		II		III		IV	
Variables								
Tax	0.02	*0.37*	0.03	*0.68*	0.02	*0.38*	0.04	*0.74*
Replacement Rate	-0.03	*1.31*	-0.03	*1.60*	-0.03	*1.26*	-0.03	*1.33*
Empl. Protection (EPL)	**-0.02**	*2.25*	**-0.07**	*3.71*	-0.02	*1.12*	0.00	*0.20*
Union Density (DEN)	**0.06**	*1.87*	**0.07**	*2.04*	**0.06**	*1.87*	**0.12**	*2.45*
Centralization (CEN)	0.00	*0.80*	**-0.03**	*3.09*	0.00	*0.81*	-0.01	*0.84*
Union Coverage (COV)	0.00	*1.80*	-0.01	*1.62*	-0.01	*1.29*	**-0.01**	*2.19*
Change in Inflation	**-0.60**	*2.65*	**-0.53**	*2.39*	**-0.60**	*2.64*	**-0.59**	*2.59*
Interactions								
EPL*CEN	-	-	**0.02**	*2.91*	-	-	-	-
EPL*COV	-	-	-	-	0.01	*0.12*	-	-
EPL*DEN	-	-	-	-	-	-	-0.05	*1.44*
R^2	0.82		0.83		0.82		0.82	
Country Fixed Effects	Yes		Yes		Yes		Yes	
Time Dummies	Yes		Yes		Yes		Yes	

Total number of observations is 136. The time period is 1960-2000. Variables are 5-years averages.
See text and Belot and van Ours (2004) for detailed information on variable definition and construction.
Absolute t-values based on heteroskedastic-consistent standard errors are in italics, next to the point estimate.
Source: Authors' calculation based on the data set compiled by Belot and van Ours (2004).

employment protection, and unemployment insurance replacement rates.[25] Our objective in this section is to use the same data used in those papers for estimating the interaction effect outlined above.

In particular, we use a dataset recently compiled by Belot and van Ours (2004) on time-varying institutional variables for 17 OECD countries from 1960 to 2000. Although we use all their institutional variables as controls, our main focus is on employment protection and on an index of centralization.

Employment protection legislation is measured by Belot and van Ours through an index ranging from 0 to 3 with larger values referring to stricter job-security provisions. Unfortunately, this index does not distinguish between the tax and the transfer component. In light of our early discussion, we would need a specific estimate of the severance payment, but such measure is not available cross-country. However, we argue that this is not a serious concern in our study for two reasons: 1) in as much as the bulk of EPL takes the form of transfers, as our analysis in Section 2 suggests, our EPL measure should be highly correlated with the size of severance payments; 2) our theoretical analysis of Section 4.4 made clear that the comparative statics of the tax are robust across every possible degree of wage rigidity, thus

[25]See, among others, Belot and van Ours (2001, 2004), Bertola, Blau and Khan (2002), Blanchard and Wolfers (2002), Nickell et al. (2002).

Table 3: Estimation Results for the Employment Rate

Dependent Variable: OECD Employment Rate	V		VI		VII		VIII	
Variables								
Tax	-0.13	*1.23*	-0.15	*1.58*	-0.16	*1.49*	-0.15	*1.42*
Replacement Rate	**0.15**	*4.01*	**0.16**	*4.53*	**0.17**	*4.20*	**0.14**	*3.94*
Empl. Protection (EPL)	0.02	*1.21*	**0.11**	*3.18*	**0.09**	*2.01*	-0.01	*-0.28*
Union Density (DEN)	-0.07	*1.20*	-0.08	*1.45*	-0.07	*1.19*	-0.14	*-1.60*
Centralization (CEN)	-0.01	*0.72*	**0.05**	*2.34*	-0.01	*0.56*	-0.01	*-0.72*
Union Coverage (COV)	**0.05**	*3.89*	**0.05**	*3.89*	**0.08**	*4.69*	**0.06**	*3.99*
Change in Inflation	**0.84**	*2.10*	**0.70**	*1.81*	**0.80**	*2.01*	**0.83**	*2.05*
Interactions								
EPL*CEN	-	-	**-0.04**	*2.70*	-	-	-	-
EPL*COV	-	-	-	-	**-0.03**	*1.66*	-	-
EPL*DEN	-	-	-	-	-	-	0.06	*0.93*
R^2	0.84		0.85		0.84		0.84	
Country Fixed Effects	Yes		Yes		Yes		Yes	
Time Dummies	Yes		Yes		Yes		Yes	

Total number of observations is 136. The time period is 1960-2000. Variables are 5-years averages.
See text and Belot and van Ours (2004) for detailed information on variable definition and construction.
Absolute t-values based on heteroskedastic-consistent standard errors are in italics, next to the point estimate.
Source: Authors' calculation based on data set compiled by Belot and van Ours (2004).

the interaction effect should only capture the impact of severance payments. Centralization of wage bargaining is measured by an index that ranges from 1 to 3, with larger values referring to countries and periods with more centralized wage bargaining.

To test our empirical implication, we follow the model specification used by Belot and van Ours (2004). If u_{jt} is the unemployment rate in country j at time t, our regression model is then

$$u_{jt} = \alpha_j + \alpha_t + \beta' Z_{j,t} + \delta_e EPL_{j,t} + \delta_c CEN_{j,t} + \delta_{ec} CEN_{j,t} * EPL_{j,t} + \varepsilon_{j,t} \tag{20}$$

where α_j are country fixed effects, α_t are time dummies, $Z_{j,t}$ is a vector of time-varying country-specific shocks and time varying country-specific institutions (other than centralization and employment protection), and $\varepsilon_{j,t}$ is an error term. The key variables of interest are EPL, CEN, and the interaction term. Our theoretical analysis predicts that $\delta_{ec} > 0$, but we do not have clear predictions for the sign of δ_e, and δ_c alone.

Each observation corresponds to the measurement of a particular variable in country j for a five-year average (starting from 1960-1965, until 1995-2000). [26] Therefore, in the time

[26] The countries included in the study are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, Sweden, Switzerland, United, Kingdom, United States. We refer the reader to Belot and van Ours (2001, 2004) for further details.

dimension, changes in the unemployment rate take place over a decade, a frequency that squares well with our interpretation of the results of Section 5 as a medium-long run view.

Table 2 presents the baseline results. Model I shows the estimated coefficients of equation (20) without any interaction term. The institutional variables are overall not significant, with the only exception of the coefficient on employment protection which appears negative and statistically significant.[27] The country-specific shock considered in the Belot and van Ours specification is the change in inflation, which appears to have a negative and robust effect on unemployment, as expected.

Model II in Table 2 presents our preferred estimates of equation (20). The result suggests that the coefficient δ_{ec} is positive and significant: employment protection legislation increases the unemployment rate when bargaining takes place at a more centralized level.

We perform two robustness checks on this finding. The first robustness check uses the employment rate as an alternative dependent variable, and is presented in Table 3. Model (VI) shows that the interaction coefficient with centralization has the predicted sign and is still significant.

The second robustness check concerns the definition of the variable aimed at capturing the institutional wage rigidity. One can argue that wage rigidity is not fully captured by the centralization index CEN, if the coverage of the contracts centrally negotiated by the union is small. In this sense, the union coverage index COV compiled by Belot and van Ours represents a valid alternative. Finally, for completeness we also consider the extent of union density, even though the link between union density and widespread wage rigidity is less compelling, since decentralized bargaining can coexist in an heavily unionized economy when the boundary of the unions do not exceed each individual plant.

Our results show that the interaction of EPL and union coverage COV has the predicted sign, but it is significant only when the dependent variable is the employment rate (Model VII). Conversely, the interaction between EPL and union density (DEN) is not significant on either the employment rate (Model VIII) or the unemployment rate (Model IV).

[27] This result is somewhat surprising, since in most of the literature the coefficient on employment protection is typically not significant. Indeed, such effect is not particularly robust as its significance disappears in Models III, IV, V, VIII.

7 Concluding remarks

Employment protection legislation includes both a tax component and a pure transfer component (severance payment). For the Italian economy, one with the strictest job security provisions, we document that the transfer component is between two and four times as big as the tax. Thus from a quantitative standpoint, faced with the choice wether modelling the firing cost like a tax or like a transfer, one should opt for the latter.

However, since Lazear (1988, 1990), it is well established that without severe contractual imperfections, mandatory transfers are neutral on the labor market equilibrium. As Blanchard (1998) explicitly recognizes, to avoid the Lazear's criticism the bulk of the existing literature models firing restrictions like taxes, as a useful shortcut to describe a world in which severance payments –coupled with some form of market imperfection– would have real effects on the economy. The implicit assumption is that under such circumstances the transfer would behave exactly as a tax. Bertola and Rogerson (1997) call it the *standard view* of firing costs.

In this paper we take no such shortcut and ask the following question: when bonding possibilities are limited by some form of wage rigidity (arguably the most relevant contractual imperfection in actual labor markets), what are the real effects of severance payments? Are they qualitatively comparable with the well known effects of firing taxes? In general, the answer is no. Our analysis demonstrates that only in the case of full wage rigidity, when the institutional constraint to wage setting is not allowed to internalize the change in firing costs (i.e., in the short run), are the firing tax and the pure transfer exactly equivalent. In all other cases, they differ. Surprisingly, when the institutional process leading to the wage rigidity constraint is endogenized (i.e., in the medium-long run), in some cases the neutrality of severance payments can be restored.

Our new set of theoretical results on the interaction between job security provisions and bargaining institutions lead to testable implications that found some support in an empirical analysis based on a panel of OECD countries: strict employment protection regulations are more harmful for employment when paired with a strongly centralized bargaining process.

We hope that our results will help establishing an *alternative view* of firing costs: rather than focusing on the tax component alone, the literature should explore in greater details the real effects of pure transfers in models with micro-founded contractual and market imperfections in order to assess how far actual economies are from the ideal benchmark of "Lazear neutrality".

One limit of the paper is that our analytical results are derived in a version of the standard matching model where the number of vacancies is exogenously fixed (although match formation is still endogenous). We speculate that our main conclusions do not depend crucially on this simplification, but future work should verify this conjecture within the more familiar Mortensen-Pissarides setup.

Appendix

Equilibrium with flexible wage setting

Derivation of insider and outsider wages– To derive the outsider wage (11), start from the sharing rule (8) and multiply both sides by $(\lambda + r)$. Next, substitute into (8) the expressions for $(r+\lambda)\,J_o(x)$ and $(r+\lambda)\,[W_o(x) - U]$ obtained from (5) – (7). It is useful to define the surplus function $\Omega(x)$ as the joint value of the match for the firm and the worker net of their outside options, i.e. $\Omega(x) = J_k(x) + W_k(x) - U$, with $k = o, i$. Notice that since the current value of the joint surplus does not depend on how x is split between wage and profit, and since the continuation values for $J_k(x)$ and $W_k(x)$ do not depend on the employment status (e.g. insider or outsider), the surplus of a job with productivity x is the same for outsider and insider workers. From the definition of the surplus, one can then use the relationships $W_i(x) - U = \beta\Omega(x) + S$ and $J_i(x) = (1-\beta)\,\Omega(x) - S$ into the Nash rule (8) to arrive at

$$\beta\,[x - w_o(x) - \lambda S] = (1-\beta)\,[w_0\,(x) - rU + \lambda S]\,,$$

which yields the expression for the outsider wage in (11). Following similar steps, one arrives from (9) to (12).

Derivation of the two equilibrium conditions– From the definition of the equilibrium, recall that the job creation condition is defined as $J_o(R_o) = 0$, which from (5) can be written as

$$R_o - w_o(R_o) + \lambda \int_{R_i}^{\bar{x}} J_i(z)dF(z) - \lambda F(R_i)S = 0.$$

From the Nash bargaining on the part of insiders, it follows that

$$J_i(x) = (1-\beta)\Omega(x) - S, \tag{21}$$

so that substituting this expression in the equation above, after integration by parts one has

$$R_o - w_o(R_o) + \frac{\lambda(1-\beta)}{r+\lambda}\int_{R_i}^{\bar{x}} [1 - F(z)]dz - \lambda S = 0. \tag{22}$$

Note that in the integration by parts of $\int_{R_i}^{\bar{x}} \Omega(z)dF(z)$, it is useful to exploit that

$$\Omega(\bar{x}) = \int_{R_i}^{\bar{x}} \Omega'(z)dz = \int_{R_i}^{\bar{x}} \frac{1}{r+\lambda}dz.$$

The equilibrium job destruction condition is defined as $J_i(R_i) = -S$. After some simple manipulation, which involves equation (21) and an integration by parts similar to the one above, one arrives at

$$R_i - w_i(R_i) + \frac{\lambda(1-\beta)}{r+\lambda}\int_{R_i}^{\bar{x}} [1 - F(z)]dz + rS = 0. \tag{23}$$

Substituting the wage rules derived above out of equations (22) and (23), one arrives at the (JC) and (JD) conditions in the main text. The next step is to find an expression for rU only as a function of the reservation productivities. Using the expression for the surplus $\Omega(x)$ together with the outside bargaining rule in equation (8), one has $W_o(x) - U = \beta\Omega(x)$. Substituting this relation into (7), after an integration by parts, the permanent income of the unemployed reads as in equation (10). The (JC) and (JD) equations together with (10) form a nonlinear system in the two unknowns (R_o, R_i). Once we have a solution for and (R_o, R_i), all the other equilibrium objects are determined (including equilibrium unemployment), hence the pair of reservation values is a sufficient statistics to fully describe equilibrium prices and allocations.

Existence and uniqueness of the equilibrium– It is convenient to substitute the relationship $R_o = R_i$ and the expression for the flow value of unemployment (10) into the (JD) equation, to obtain

$$R_i + \frac{(\lambda - \alpha\beta)}{r+\lambda} \int_{R_i}^{\bar{x}} [1 - F(z)]dz = 0.$$

If $\alpha\beta < \lambda$, then the LHS is positive for $R_i = 0$ and increasing in R_i, thus there is no interior equilibrium in the interval $[0, \bar{x}]$. If $\alpha\beta > \lambda$, the LHS is negative for $R_i = 0$, and positive for $R_i = \bar{x}$, thus there is a unique interior equilibrium.

Full wage rigidity

We begin by deriving conditions (13) and (14), the reduced form of the model when wages are rigid, necessary for the comparative statics. Consider the value of a job for an outsider firm

$$(r+\lambda) J_o(x) = x - \omega + \lambda \int_{R_i}^{\bar{x}} J_i(z)\, dF(z) - \lambda F(R_i) S.$$

Evaluating that expression at $x = R_o$ and integrating by parts, we obtain

$$R_o - \omega + \lambda J_i(\bar{x}) - \frac{\lambda}{r+\lambda} \int_{R_i}^{\bar{x}} F(z)\, dz = 0,$$

and using the fact that $J_i(\bar{x}) = \frac{1}{r+\lambda} \int_{R_i}^{\bar{x}} dz - S$, we obtain (13) in the main text. Consider now the value of a job for an insider firm:

$$(r+\lambda) J_i(x) = x - \omega + \lambda \int_{R_i}^{\bar{x}} J_i(z)\, dF(z) - \lambda F(R_i) S.$$

Evaluating that expression at $x = R_i$, and integrating by parts, we arrive at

$$R_i - \omega + \lambda J_i(\bar{x}) - \frac{\lambda}{r+\lambda} \int_{R_i}^{\bar{x}} F(z)\, dz + (r+\lambda) S = 0,$$

where we have used the fact that $J(R_i) = -S$. Substituting

$$J_i(\bar{x}) - J(R_i) = \int_{R_i}^{\bar{x}} J_i'(z)\, d(z) = \frac{1}{r+\lambda} \int_{R_i}^{\bar{x}} dz \tag{24}$$

in the expression above, we obtain (14) in the main text. Notice that the (JD) curve is horizontal in the (R_o, R_i) space. The comparative statics are immediate.

Insiders constrained (Proof of Lemma 1)

Note that the (JD) condition in this case is exactly the same as in the previous case with full wage rigidity. Hence, to obtain equation (16) in the main text, we follow exactly the steps outlined above to derive equation (14). Consider now the value of an outsider job evaluated at $x = R_o$ such that $J_o(R_o) = 0$, i.e.

$$R_o - w_o(R_o) + \lambda \int_{R_i}^{\bar{x}} J_i(z)dF(z) - \lambda F(R_i)S = 0.$$

Using (11) to substitute out the wage, and using (24) in the integration by parts, we arrive at the new (JC) condition (15) as in the main text. It is straightforward to show that the (JC) is positively sloped, once one recognizes that the expression for $rU(R_o)$ in this case is exactly as in (7) for the full flexibility case. The comparative statics and the other conclusions of Lemma 1 follow easily from standard partial differentiation.

Outsiders constrained (Proof of Lemma 2)

Since ω is binding for the marginal outsider by assumption, but the insider wages are unconstrained, the job creation condition will be

$$R_o - \omega + \lambda \int_{R_i}^{\bar{x}} J_i(z)\, dF(z) - \lambda F(R_i) S = 0.$$

Using Nash bargaining rule for insiders to write $J_i(z)$ as a function of the surplus function $\Omega(z)$ and integrating by parts, one arrives at

$$R_o - \omega + \frac{\lambda(1-\beta)}{r+\lambda} \int_{R_i}^{\bar{x}} [1 - F(z)]\, dz - \lambda S = 0,$$

which is (17) in the main text. The (JD) condition in (18) is derived exactly as in the case with full wage flexibility, but the expression for rU is now different. From (7), we have that

$$rU = \alpha \int_{R_o}^{1} [W_o(\omega) - U]\, dF(z) = \alpha [1 - F(R_o)] [W_o(\omega) - U].$$

Let us now derive an expression for $W_o(\omega) - U$:

$$\begin{aligned}
(r+\lambda)[W_o(\omega) - U] &= \omega + \lambda \int_{R_i}^{\bar{x}} [W_i(z) - U]\, dF(z) + \lambda F(R_i) S - rU, \\
&= \omega + \lambda \int_{R_i}^{\bar{x}} [\beta\Omega(z) + S]\, dF(z) + \lambda F(R_i) S - rU, \\
&= \omega + \frac{\lambda\beta}{r+\lambda} \int_{R_i}^{\bar{x}} [1 - F(z)]\, dz + \lambda S - rU,
\end{aligned}$$

where in the last step we have used the integration by parts of the surplus function and the fact that $(r+\lambda)\Omega'(z) = 1$. In particular, recall that $\Omega(R_i) = 0$. Putting all together, we arrive at an expression that defines implicitly rU as a function of (R_o, R_i, S), i.e.

$$rU(R_o, R_i, S) = \frac{\alpha [1 - F(R_o)]}{(r+\lambda)} \left[\omega + \frac{\lambda\beta}{r+\lambda} \int_{R_i}^{\bar{x}} [1 - F(z)]\, dz + \lambda S - rU(R_o, R_i, S)\right].$$

The comparative statics of rU with respect to R_o, R_i and S are straightforward and yield

$$\frac{drU}{dR_o} < 0, \quad \frac{drU}{dR_i} < 0, \quad \frac{drU}{dS} > 0.$$

Returning to the (JC) and the (JD) curves, one can observe that they have the usual slopes. The (JC) curve shifts downward as S increases. From the (JD) curve

$$R_i - rU\left(\underset{-}{R_o}, \underset{-}{R_i}, \underset{+}{S}\right) + \frac{\lambda}{r+\lambda} \int_{R_i}^{\bar{x}} [1 - F(z)] dz = 0,$$

it is immediate to see that a rise in S shifts the curve upward.

Robust effects of the firing tax (Proof of Lemma 3)

In the presence of a firing tax $T > 0$, the job destruction condition of an insider job becomes $J_i(R_i) = -(S+T)$, and the Nash bargaining in the two-tiers yields

$$\begin{aligned} w_o(x) &= \beta x + (1-\beta)rU - \lambda(S+\beta T), \\ w_i(x) &= \beta x + (1-\beta)rU + r(S+\beta T). \end{aligned}$$

Consequently, the two key equilibrium condition of the economy with full wage flexibility can be rewritten as

$$\begin{aligned} R_o &= rU(R_o) - \frac{\lambda}{r+\lambda}\int_{R_i}^{\bar{x}}[1-F(z)]dz + \lambda T, \\ R_i &= R_o - (r+\lambda)T. \end{aligned}$$

With full wage rigidity, the key equilibrium conditions are modified by the presence of the tax T as follows:

$$\begin{aligned} R_o &= \omega - \frac{\lambda}{r+\lambda}\int_{R_i}^{\bar{x}}[1-F(z)]\,dz + \lambda(S+T), \\ R_i &= R_o - (r+\lambda)(S+T). \end{aligned}$$

When wage rigidity binds for insiders, the key job creation and job destruction conditions augmented with the tax are

$$\begin{aligned} R_o - rU(R_0) + \frac{\lambda}{(r+\lambda)(1-\beta)}\int_{R_i}^{\bar{x}}[1-F(z)]dz - \lambda T &= 0, \\ R_i - \omega + \frac{\lambda}{r+\lambda}\int_{R_i}^{\bar{x}}[1-F(z)]dz + r(S+T) &= 0. \end{aligned}$$

When the wage rigidity binds for outsiders, the (JC) and (JD) curves become

$$\begin{aligned} R_o - \omega + \frac{\lambda(1-\beta)}{r+\lambda}\int_{R_i}^{\bar{x}}[1-F(z)]dz - \lambda(S+T) &= 0, \\ R_i - rU\Big(\underset{-}{R_o}, \underset{-}{R_i}, \underset{+}{S}\Big) + \frac{\lambda}{r+\lambda}\int_{R_i}^{\bar{x}}[1-F(z)]dz + rT &= 0. \end{aligned}$$

Inspecting the pairs of equilibrium conditions in every case is sufficient to conclude that a rise in T will shift the negatively sloped job destruction curve down, and the positively sloped job creation curve upward, leading always to the same qualitative comparative statics for the equilibrium pair (R_o, R_i).

Single-peakedness of insider workers' preferences (Proof of Lemma 4)

The value of employment for an insider changes with ω according to

$$\frac{\partial W_i}{\partial \omega} = \frac{1}{r+\lambda F(R_i)}\left[1 - \lambda F'(R_i)\frac{\partial R_i}{\partial \omega}\left(W_i - (\mathbf{U}+S)\right)\right], \tag{25}$$

where from equation (14) it is easy to derive that

$$\frac{\partial R_i}{\partial \omega} = \frac{r+\lambda}{r+\lambda F(R_i)} > 0. \tag{26}$$

From equations (6), we obtain a simple expression for the surplus

$$W_i - (\mathbf{U}+S) = \frac{\omega - r(\mathbf{U}+S)}{r+\lambda F\left(R_i\right)}. \tag{27}$$

Substituting equations (26) and (27) into (25), we can rewrite $\frac{\partial W_i}{\partial \omega}$ as

$$\frac{\partial W_i}{\partial \omega} = \frac{\left[r+\lambda F\left(R_i\left(\omega\right)\right)\right]^2 - \lambda\left(r+\lambda\right)F'(R_i\left(\omega\right))\left[\omega - r(\mathbf{U}+S)\right]}{\left[r+\lambda F\left(R_i\left(\omega\right)\right)\right]^3}. \tag{28}$$

The minimum feasible value for an insider's wage is $r\left(\mathbf{U}+S\right)$. For $\omega = r\left(\mathbf{U}+S\right)$, $\frac{\partial W_i}{\partial \omega} > 0$, i.e. the income effect dominates the job security effect, thus preferences are always monotonically increasing in ω for low values of ω.

(i) Rearranging this last equation and using (26) , it is immediate to see that if $\varepsilon_{[\omega - r(\mathbf{U}+S)],\omega} > \varepsilon_{F(R_i),\omega}$ then this derivative is always positive and the preferences of an insider worker with productivity x are monotonically increasing over the whole range $\left[r\left(\mathbf{U}+S\right), \bar{\omega}\left(x\right)\right]$, where $\bar{\omega}\left(x\right)$ denotes the wage for which $J_i\left(x,\omega\right) = -S$. For $\omega > \bar{\omega}\left(x\right)$, $\hat{W}_i\left(x,\omega\right) = \mathbf{U}$ which is strictly below $W_i\left(\omega\right)$, and it does not depend on ω by assumption (see Figure 3, upper panel). In this case, the unique preference peak is at $\bar{\omega}\left(x\right)$.

(ii) Denote by ω^* the generic extremum of $W_i\left(\omega\right)$. Given continuity of $\hat{W}_i\left(x,\omega\right)$ with respect to ω, a sufficient condition for $\hat{W}_i\left(x,\omega\right)$ to have a unique interior maximum that does not depend on x is that preferences are strictly concave at ω^*, i.e.$\frac{\partial^2 W_i(x,\omega^*)}{\partial^2 \omega} < 0$. Differentiating one more time equation (28) with respect to ω, using (26), and using the fact that at ω^* the first derivative is null, we have that

$$\frac{\partial^2 W_i\left(x,\omega^*\right)}{\partial^2 \omega} < 0 \Leftrightarrow \lambda\left(r+\lambda\right)f(R_i\left(\omega\right))\left[1 - \frac{f'(R_i\left(\omega\right))}{f(R_i\left(\omega\right))}\frac{\partial R_i}{\partial \omega}\left[\omega - r(\mathbf{U}+S)\right]\right] < 0.$$

Hence,

$$\frac{1}{\omega^* - r(\mathbf{U}+S)} < \frac{f'(R_i\left(\omega^*\right))}{f(R_i\left(\omega^*\right))}\frac{\partial R_i}{\partial \omega} \Leftrightarrow d\ln\left[\omega^* - r(\mathbf{U}+S)\right]/d\omega < d\ln\left[f(R_i\left(\omega^*\right))\right]/d\omega,$$

which is the condition stated in Lemma 4. If $\bar{\omega}\left(x\right) < \omega^*$, then the unique preference peak is at $\bar{\omega}\left(x\right)$, as in (i), but if $\bar{\omega}\left(x\right) \geq \omega^*$, then the unique peak of the insider worker's preferences is its interior maximum ω^* (see Figure 3, lower panel).

Comparative statics with endogenous wage rigidity (Proof of Lemma 5)

(i) When the median voter's preferences are maximized at the interior solution ω^*, then one can operate with standard total differentiation techniques on the first order condition $\frac{\partial W_i(\omega^*,S)}{\partial \omega} = 0$ to characterize the comparative statics of the equilibrium institutional wage constraint ω^* with respect to the policy S. From (28), we have that

$$\frac{\partial W_i}{\partial \omega} = 0 \Leftrightarrow \left[r+\lambda F\left(R_i\left(\omega^*,S\right)\right)\right]^2 - \lambda\left(r+\lambda\right)F'(R_i\left(\omega^*,S\right))\left[\omega - r(\mathbf{U}+S)\right] = 0, \tag{29}$$

where we made explicit the dependence of R_i on S. Note that from (14) it is easy to establish that

$$\frac{\partial R_i}{\partial S} = -r\frac{\partial R_i}{\partial \omega}. \tag{30}$$

Totally differentiating equation (29) with respect to ω^* and S, and using equation (26) we arrive at:

$$\left\{F'(R_i(\omega^*,S)) - F''(R_i(\omega^*,S))\frac{\partial R_i}{\partial \omega}\left[\omega^* - r(\mathbf{U}+S)\right]\right\}d\omega^* =$$
$$\left\{F'(R_i(\omega^*,S))r - F''(R_i(\omega^*,S))\frac{\partial R_i}{\partial S}\left[\omega^* - r(\mathbf{U}+S)\right]\right\}dS,$$

which, using (30), yields immediately $d\omega^*/dS = r$. Hence, without loss of generality, one can write ω^* as the sum of two components, i.e. $\omega^* = \underline{\omega}+rS$, where $\underline{\omega}$ is independent of S. Substituting this expression for ω^* into the (JD) equation (16), simple inspection is sufficient to conclude that S does not appear in this equilibrium condition.

Note that the median voter's wage is increasing in S. Substituting this wage into the job creation condition for the full rigidity case (13), it is easy to see that a larger S shifts upward the (JC) curve. Since the (JD) curve is horizontal and does not shift, unemployment duration (and the unemployment rate) increases unambiguously.

(ii) The (JD) equation is the same as in case (i), so the key result derived above on the neutrality of S on R_i applies here as well. When outsider workers are unconstrained, they bargain freely and the (JC) condition is unaffected by S, so the severance payment is fully neutral.

(iii) The proof of this result is a straightforward extension of the logic we applied so far. Clearly, condition (28) has to be modified to allow differentiating the equilibrium value of unemployment (10) with respect to ω. The rest of the proof is tedious, so we omit it. It suffices to note that, putting together (15) and (16), one can express the value of unemployment only as a function of R_i, i.e. $U(R_i)$. Differentiating the terms involving $U(R_i)$ with respect to ω and S always yields terms that can be collected as in (31), preserving the key result.

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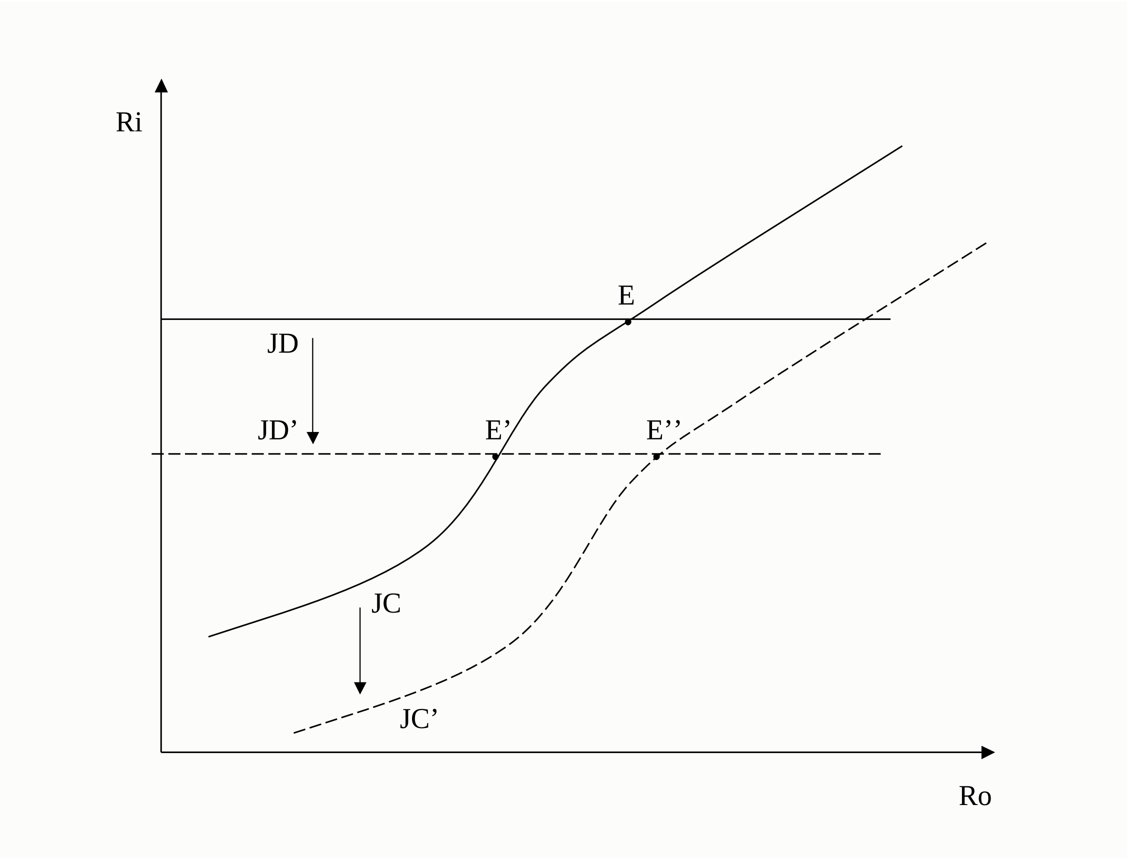
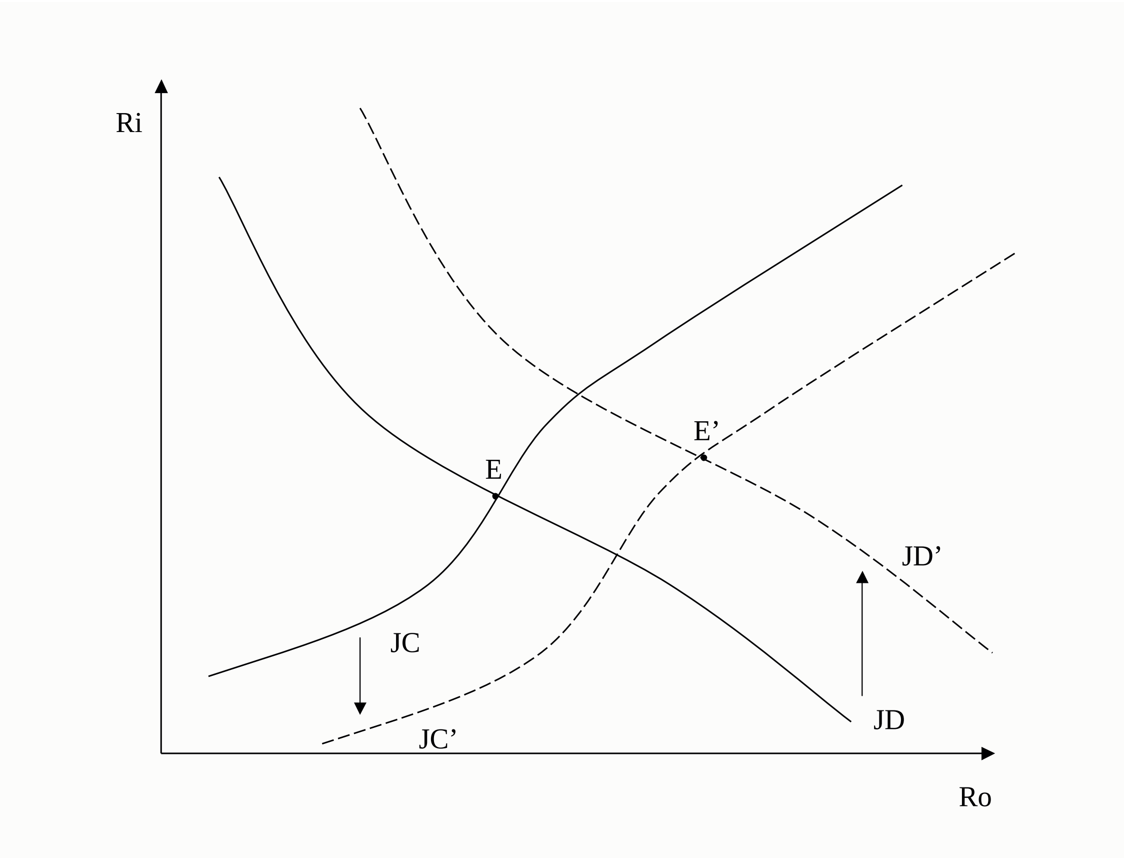
Figure 1: Comparative Statics with Full Wage Rigidity and with Insiders Constrained



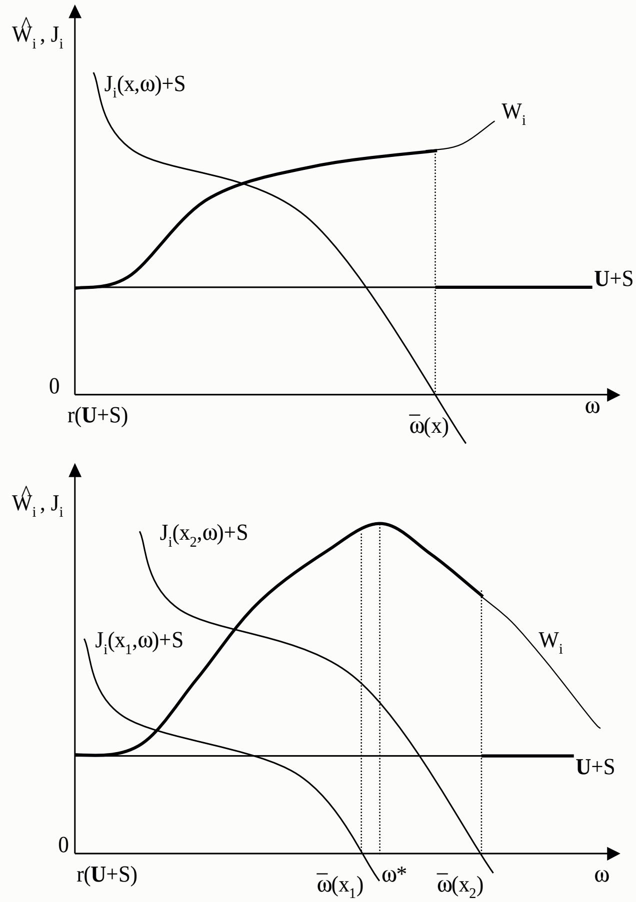
This figure represents the Job Creation and Job Destruction curves, plotted in the (R_o, R_i) space, in an economy with full wage rigidity and in an economy where insiders' wages are constrained, but outsiders bargain freely. The solid lines represent the equilibrium before the rise in S (point E), whereas the dotted lines represent the new equilibrium. In the economy with insiders constrained, a rise in the severance payment S shifts only the JD curve downward towards the new equilibrium E', thus it reduces unemployment unambiguously. In the economy with full wage rigidity, a larger severance payment S shifts down also the JC curve towards E", hence its effect on unemployment are more adverse.

Figure 2: Comparative Statics with Outsiders Constrained



The Job Creation and Job Destruction curves, plotted in the (R_o, R_i) space, before and after an increase in the severance payment S in an economy where the outsiders' wages are constrained, but insiders bargain freely. The solid lines represent the equilibrium before the rise in S (point E), whereas the dotted lines represent the new equilibrium. A larger S increases unemployment duration unambiguously (R_o rises) and, as in the case depicted above, it could also raise unemployment incidence (R_i rises), thereby increasing equilibrium unemployment (point E').

Figure 3: Voters' Preferences over Wages



This Figure depicts the preferences of the insider voter with match productivity x over the wage ω. Two cases can arise, shown in the two panels above. The upper panel represents case (i) of Lemma 4. Here, $W_i(\omega)$ is strictly increasing in ω over the entire range for ω, thus the maximum is reached at $\bar{\omega}(x)$, the wage level at which the firm's participation constraint is binding exactly with equality, i.e. $J_i(x) + S = 0$. The lower panel represents case (ii) of Lemma 4. Here, $W_i(\omega)$ is strictly concave and it has a unique maximum ω^*. The firm's participation constraint could either cut before ω^* (e.g., for $x = x_1$ in the picture) or after ω^* (e.g., for $x = x_2$ in the picture). The feasible optimum for the voter is $\bar{\omega}(x_1)$ in the former case, and ω^* in the latter case.