Firing Tax and Severance Payment in Search Economies: A Comparison

Pietro Garibaldi
Bocconi University, and CEPR

Giovanni L. Violante
University College London, New York University, and CEPR

September 30, 2002

Abstract

Employment Protection rules 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. It is well established that with full wage flexibility statutory severance payments (pure transfers) between employers and dismissed employees are neutral (Lazear 1988, 1990). Most of the existing literature makes the implicit assumption that, in the presence of wage rigidity, such mandatory transfers 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. It is only correct in the case of extreme wage rigidity, whereas when some (but not full) flexibility in the wage setting at the level of an individual employer-worker match is allowed, the impact of severance payments on unemployment duration and incidence is qualitatively different from that of firing taxes (and its sign depends on the nature of the wage rigidity).

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

JEL Classification: E24, J64, J65.

*The paper was firstly written when Gianluca Violante was a visiting scholar in the IMF’s research department. We thank seminar participants at Bocconi, LSE, UCL, CERGE (Prague), the 1999 meeting of the Society for Economic Dynamics, and the 1999 CEPR-ESSLE meeting. We are particularly indebted to Pietro Ichino and Chris Pissarides for useful discussions. Address for correspondence: Gianluca Violante, Department of Economics, New York University, 269 Mercer Street, New York, NY 10003. Email: gianluca.violante@nyu.edu
1 Introduction

Employment protection legislation (EPL) is a set of rules and restrictions governing the dismissals of employees. A careful look at the legislation shows that employment protection rules 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. 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 cash payments 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 trial, and any financial penalties imposed by a ruling judge. While a vast literature in labor economics has studied the qualitative effects of different degrees of firing restrictions on important labor market outcomes such as unemployment and labor turnover, traditionally little emphasis has been given to the distinction between the tax and the transfer component.¹

Quantitatively, the transfer component of EPL appears sizeable, and may even be larger than the tax component. For the case of Italy, one of the country with strictest employment protection legislation, our estimates suggest the the transfer component of the total firing cost for an employer initiated separations against a blue collar of average tenure is at least twice as large as the tax component (see Appendix 1), i.e. 2/3 of the total firing cost. Thus, from a quantitative standpoint, the distinction between tax and transfer cannot be ignored.

Theoretically, the distinction between the transfer and the tax component is of primary importance. It is well known in various fields of economics that a mandatory transfer within a relationship between two parties can be undone by a properly designed contract, provided the absence of certain contractual and market frictions. In the context of a government-mandated pure severance payment from the firm to the dismissed worker, the transfer can be neutralized by the 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.² Conversely, the tax component is a real cost on labor shedding paid outside the firm-worker pair, and as

¹See OECD (1999) for a recent survey of the literature and an update of the EPL indicators.
²This result is typically named the “bonding critique” and it is associated to the classical work of Lazear (1988, 1990).
such cannot be easily undone by side negotiations.

This powerful theoretical result leads to two alternative views: the first is to conceptualize firing costs as taxes, under the –more or less– implicit presumption that the existence of imperfections in actual labor markets would induce the transfer component to act exactly as the tax component. The second is to explore explicitly how specific contractual and market frictions could impede the full neutrality of the severance payment and could induce taxes and transfers to have possibly distinct real effects.

The overwhelming majority of the theoretical literature which studied how labor markets are affected by firing costs has taken the first view and has established some firm conclusions. The first class of models built upon the partial equilibrium problem of the firm facing an exogenously given wage showed that the firing tax reduces layoffs and unemployment incidence by making firing more costly to employers, and has an ambiguous effect on job creation and unemployment duration because the larger labor costs which tend to reduce job creation can be offset by the higher profits due to longer tenures. (Bentolila and Bertola 1990, Bertola 1990, Bentolila and Saint-Paul 1992). The second class of models embedded the firm’s problem in equilibrium matching frameworks and showed that the equilibrium wage is increased by the firing tax –since the tax reduces the outside option of the firm– which further reduces job creation (Millard and Mortensen, 1994, Mortensen and Pissarides 1998). 3

Although the labor market impact of firing taxes are well understood, this literature has little to say on whether the effects of the transfer component are qualitatively comparable to those of the firing taxes once contractual frictions are explicitly introduced in the economy.

In this paper we investigate the possibly distinct qualitative effects of taxes and transfers on labor market allocations in the absence of full flexibility in the wage setting process. In the European labor market context, a number of institutional constraints impede the firm and the worker to bargain individually towards a match-specific wage contract. This impediment can arise from a statutory minimum wage, from the presence of unions, or from enforceable collective bargaining agreements at the level of the entire industry/economy within which the firm operates. Rather than developing a model of only one of such institutions, we prefer to

3Ljungqvist (2001) identifies a third class of models which endogenize labor supply/search effort with the result that the supply of hours worked or search effort declines as the firing tax rises, because the relative value of employment falls relative to unemployment (Hopenhayn and Rogerson 1993, Alvarez and Veracierto 2001). Ljungqvist (2001) provides a comprehensive overview of all these different mechanisms and a quantitative analysis of the net effect of layoff taxes on unemployment in the different models.
capture the essence of all these constraints: the fact that the wage contract is set outside the individual firm-worker pair. Albeit crude, this modelling feature allows us to characterize how employment protection policies affect unemployment under different degrees of wage rigidity, roughly corresponding to each of these different institutions. We return on this point in section 3.5.

For this purpose, we develop a “stochastic matching” model with both endogenous separations and endogenous match formations where a match-specific productivity level is drawn first upon meeting and then periodically along the duration of the relationship. Firms and workers bargain over existing labor market rents every time a new shock hits the match. A natural two-tier wage setting arises in equilibrium, since upon meeting the employment protection laws are not binding (outsider jobs), whereas they become binding for incumbents as soon as they renegotiate the wage contract (insider jobs).

The first important result of the paper is that, independently of the degree of wage rigidity (and of its institutional source), the firing tax has always the same qualitative effects on the labor market equilibrium: a rise in the firing tax decreases unemployment incidence and increases unemployment duration, with ambiguous net impact on the unemployment rate.

The impact of the severance payment instead is not uniform, but it depends crucially on the bite of the wage rigidity. With full wage flexibility, the outsider-insider structure is the minimum requirement to obtain the traditional Lazear-neutrality result for the transfer component in search economies: wages for entry jobs adjust downward in order for outsider workers to prepay the right to the statutory severance payment they will earn once they turn insiders.

Next, we consider an economy where the wage is exogenously set for outsider jobs, while once insiders workers bargain individually with their firm. This economy is reminiscent of one where there is a statutory minimum wage which is binding only for the lowest-paid jobs—the entry jobs of the outsiders. The key implication of limiting the extent of downward wage flexibility at entry is that firms cannot make newly hired workers fully prepay the future transfer through lower initial wages, thus less jobs are created and unemployment duration increases. Maybe surprisingly, the effects on unemployment incidence are ambiguous and firms could end up firing more. The intuition of this result is that pure severance payments increase the outside option (the value of unemployment) for the insider worker at
the bargaining table. The worker can claim a higher wage which leads the firm to increase the productivity threshold at destruction. In this case, severance payments are always more detrimental than firing taxes on unemployment.

The case where the wage of outsider workers are fully flexible while insiders’ wages are fixed outside the firm-worker pair can capture the case of an economy where insider workers are represented by sector- or economy-wide unions bargaining in a centralized fashion. Severance payments have no direct effect on the job creation decision, as the firm can force the entrant outsider worker to fully prepay the future transfer, but they act like a tax on separation and delay firing of the insiders. Since job matches are longer, more jobs are created by firms. Both unemployment incidence and duration falls and so does unemployment, unambiguously.

Thus, the key conclusion is that different degrees of wage rigidity (and different institutional settings behind them) induce different real effects of severance payments on unemployment, potentially diverging from those of a firing tax. We show that only in an economy with wage rigidity across the board, a pure transfer acts exactly as a tax.

The approach of this paper, whereby rather than modelling EPL as a separation tax we search for allocative effects of the pure transfer in economies with market imperfections is followed also by Alvarez and Veracierto (2001) and Guell (2000). Alvarez and Veracierto examine quantitatively the insurance role of severance payments in an economy where the unemployment risk is uninsurable, whereas 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.4

The rest of the paper is organized as follows. In section 2 we outline the stochastic matching model used for the theoretical analysis and in section 2.1 we list the key equations and define the stationary equilibrium. We start by studying how the labor market equilibrium is affected by the policies in the case of full wage flexibility in section 3.1, then we move to the cases where the wage rigidity binds for outsiders in section 3.2. Next, we analyze the case where the wage is exogenously set for insiders in section 3.3, and finally we consider an economy with full wage rigidity in section 3.4. Section 3.5 briefly discusses how these

4The mechanism functions as follows: 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.
different regimes of wage rigidity can be interpreted in light of the existing labor market institutions. Section 4 concludes the paper and Appendix 2 contains all the proofs.

2 The Model

In this section we present our economic environment, which builds on the “stochastic job matching” pioneered by Jovanovic (1979), and recently 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 $\alpha$ 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 continuous and differentiable cumulative distribution function $F(x)$ with 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 are successfully matched 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 arrival rate $\lambda > 0$. Conditional on $\lambda$ striking, the value of the match is drawn from the same distribution $F(x)$ and 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 two types of employment protection policies. First, a tax $T > 0$ which is imposed on the firm upon job separation and is therefore dissipated outside the match.\(^5\) Second, a severance payment $S > 0$ which represents a pure transfer from the firm to the worker upon job separation.

**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. 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 $\lambda$ strikes).\(^6\) The EPL policies imply a two-tier wage 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 $\lambda$ strikes for the first time. At this point the match has moved into an “insider” phase where job termination policies are active and affect the pairs’ threat points in the Nash bargaining. In addition, we consider situations where for some groups of workers the wage is not determined by bargaining, but institutionally set outside the individual firm-worker pair at an exogenous level $\omega$. The presence of a minimum wage, industry or occupation-wide unions, national collective bargaining can lead to such outcome: we return on the relation between particular institutions and wage rigidity in Section 3.5.

Some remarks on the model sketched above are in order. First, 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.\(^7\)

Second, the reader might be more accustomed to the Mortensen and Pissarides (1994) model where the number of vacancies is endogenous, and so are the meeting probabilities,\(^5\)\(^6\)\(^7\)

---

\(^5\)The results of the paper do not depend on whether the tax is rebated to the households or wasted, thus for the sake of simplicity we make the latter assumption.

\(^6\)Cahuc and Zylberberg (2002) point out that if the productivity of the match is not publicly observable, the wage renegotiation cannot be enforced by an external party, thus a renegotiation will take place only if it is mutually advantageous. This is one of many ways in which the model can be allowed to display “endogenous” wage rigidity, whose degree will potentially depend on the various employment protection policies in place. In the Conclusions we develop this point.

\(^7\)See Alvarez and Veracierto (2001), Bertola (2001), and Pissarides (2002) for studies of the insurance properties of EPL policies.
but all meetings are transformed into matches that begin with the highest productivity. Our stochastic job matching model has fixed meeting probabilities for workers, but it has a free entry condition (the price \( q \) is bid up until expected profits are zero) and it has an endogenous entry margin which operates through a reservation productivity. It turns out that this model is simpler to analyze in presence of a two-tier wage structure, and maintains all the key features of the Mortensen and Pissarides model.

Third, 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, such structure is the minimum requirement to allow the market to “undo” the mandatory severance payments. 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.

Finally, notice that we are sidestepping the issue of the conversion of temporary contracts into permanent ones, since when \( \lambda \) strikes for the first time, the worker simultaneously acquires her insider status and the right to Employment Protection policies. 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. \(^8\)

In the next section, we start by describing the key equations of the model in the benchmark case of full wage flexibility, and we define the stationary equilibrium of such an economy.

\(^8\)It is straightforward to extend the model to allow for separations during the outsider status (it is enough to add a different Poisson process for the productivity shocks during the outsider status). In earlier work (Garibaldi and Violante 2000) we have used this more general model: all the key results 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.
2.1 Equilibrium

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:

\begin{align}
  rV &= -q + \alpha \left( \frac{U}{V} \right) \left\{ \int_{R_o}^{x} J_o (z) dF (z) - [1 - F (R_o)] V \right\}, \\
  (r + \lambda) J_k (x) &= x - w_k (x) + \lambda \int_{R_i}^{x} J_i (z) dF (z) - \lambda F (R_i) (T + S), \quad k = o, i \\
  (r + \lambda) W_k (x) &= w_k (x) + \lambda \int_{R_i}^{x} W_i (z) dF (z) + \lambda F (R_i) (U + S), \quad k = o, i \\
  rU &= \alpha \left\{ \int_{R_o}^{x} W_o (z) dF (z) - [1 - F (R_o)] U \right\},
\end{align}

where the subscripts $o$ and $i$ stand respectively for outsider and insider status, and where $w_o (x), w_i (x)$ are 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 in making their joint 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 $R_i$).

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 outsider reads

\begin{equation}
  (1 - \beta) [W_o (x) - U] = \beta [J_o (x) - V],
\end{equation}

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

\begin{equation}
  (1 - \beta) [W_i (x) - (U + S)] = \beta [J_i (x) - (V - T - S)],
\end{equation}

where the threat point of the firm is now reduced by the firing tax and the severance payment, but only the latter enters the worker’s threat point, since the firing tax is dissipated outside...
the pair.\footnote{In some cases, 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.} We are now in a position to formally define the equilibrium of our economy.

**Definition (Stationary Equilibrium):** A stationary equilibrium with given policies $(S, T)$ 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:

- there is free entry in the matching market, thus $q = \alpha(u) \int_0^\infty \max\{J_o(z), 0\} dF(z)$, and $V = 0$;
- the optimal reservation strategy for job creation implies $J_o(R_o) = 0$;
- the optimal reservation strategy for job destruction implies $J_i(R_i) + T + S = 0$;
- outsider and insider wages are determined, respectively, by (5) and (6);
- the value functions $(J_o, J_i, W_o, W_i, U)$ are determined by equations (2) – (4);
- the equilibrium balanced flow condition in the labor market implies $u \alpha [1 - F(R_o)] = (1 - u) \lambda F(R_i)$.

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 thus, in turn, 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 $(T + S)$, 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 Nash bargaining. Finally, the labor market is in equilibrium when the
outflow from unemployment, at rate $\alpha [1 - F(R_o)]$ equals the inflow into unemployment, at rate $\lambda F(R_i)$, with equilibrium unemployment given by

$$u = \frac{\lambda F(R_i)}{\lambda F(R_i) + \alpha [1 - F(R_o)]}.$$  \hfill (7)

The first step in the characterization of the equilibrium is Lemma 1, which provides an explicit solution for the wage functions.

**Lemma 1 (Wage rules):** The equilibrium wage rules for outsiders and insiders are given by

$$w_o(x) = \beta x + (1 - \beta) rU - \lambda (S + \beta T),$$  \hfill (8)

$$w_i(x) = \beta x + (1 - \beta) rU + r (S + \beta T),$$  \hfill (9)

**Proof.** See Appendix. ■

For a given productivity level $x$, insider wages are always strictly larger that outsider wages as long as $S > 0$ or $T > 0$, since $w_i(x) = w_o(x) + (r + \lambda) (S + \beta T)$. In other words, the two-tier system emerging from the dual bargaining problem is nontrivial only in presence of the policies. In this case, the firm uses the downward wage flexibility to make the outsider worker prepay the whole severance payment and a share $\beta$ of the firing tax.

The following proposition characterizes the stationary equilibrium and gives necessary and sufficient conditions for existence and uniqueness of an equilibrium where both reservation productivities $R_i$ and $R_o$ are in the interval $(0, \bar{x})$, i.e. the equilibrium is interior.$^{10}$

**Proposition 1 (Equilibrium):** (i) The interior equilibrium can be fully characterized by the pair of reservation values $(R_o, R_i)$ which solve the system of two nonlinear equations

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

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

where

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

(ii) Upon existence, the equilibrium is always unique. (iii) If $T = 0$ then the equilibrium exists iff $\alpha \beta > \lambda$. If $T > 0$ then the equilibrium exists only if $\alpha \beta > \lambda$ and $T (r + \lambda) < \bar{x}$. 

$^{10}$A “corner” equilibrium might exist whereby firms set $R_i = 0$ but in this case firing costs are never binding, a feature that makes these allocations uninteresting for our analysis.
Proof. See Appendix. ■

The job creation (JC) equation is obtained from the optimal hiring condition $J_o(R_o) = 0$, whereas the job destruction equation (JD) is derived from the optimal firing condition $J_i(R_i) + T + S = 0$. 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 $\lambda$ 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 $rU$.\(^{11}\) The (JD) curve is negatively sloped in the $(R_o, R_i)$ space. To interpret the slope of the job destruction curve we proceed similarly. Along the exit margin, we have $J_i(R_i) + T + S = 0$. 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 $R_i$.\(^{12}\) An interesting implication of the (JC) and (JD) conditions is that the two reservation productivities are linked by the linear relationship

$$R_i = R_o - (r + \lambda) T,$$

from where it appears clearly that in absence of the tax, the two reservation values coincide, but otherwise firms are more lenient when it comes to the firing decision (i.e. $R_i < R_o$), as they are obliged to make a further payment contingent on separation.

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. To understand the conditions for existence of the equilibrium (consider first the case $T = 0$) examine the (JD) equation: since $R_o = R_i$, when $\alpha \beta < \lambda$ the equilibrium value of both reservation wages would be constrained at zero: the option value of keeping the worker (proportional to $\lambda$) is so much larger than her cost (proportional

\(^{11}\)Simple inspection of the value of unemployment shows that $rU$ is declining in $R_o$.

\(^{12}\)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 $R_i$. 

12
to $\alpha \beta$) that the firm hires any worker and never finds optimal to fire. In addition, when $T(r + \lambda) > \bar{x}$, the expected firing cost is larger than the maximum possible profits, so firms will not participate to the matching process and the economy will not be viable.

3 Comparative statics

At this point we can analyze the impact of employment protection policies on the labor market. We start from the full wage flexibility case described above and then we analyze one by one the other cases.

3.1 Full wage flexibility

We begin from the case of full wage flexibility. Two important conclusions emerge about the effects of the policies $(S, T)$ on the equilibrium allocations. First, with a two tier 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 which we have stated in Lemma 1. From (8), 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 $\lambda S$ 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.

Second, as already emphasized by Mortensen and Pissarides (1998), with a two-tier wage structure the firm induces the worker to initially prepay also part of the firing tax that eventually the firm itself will have to pay upon the destruction of the job. However, the two-tier structure can only neutralize a fraction $\beta$ of the firing tax which, therefore, has real effects described in the Lemma below.

Lemma 2 (Wage flexibility): With full wage flexibility, the severance payment $S$ is neutral on unemployment. A rise in $T$ shifts down both the (JD) and the (JC) curves: $R_i$ declines and $R_o$ increases, thus unemployment incidence declines, unemployment duration
increases, but the net effect on the unemployment rate is ambiguous.

Proof. See Appendix. ■

The fact that a more severe tax has ambiguous effects on equilibrium unemployment is the standard prediction of the EPL literature for matching models with wage flexibility (see Millard and Mortensen 1994, Mortensen and Pissarides 1999, and Pissarides 2000). It is not surprising that a heavier firing tax delays separation; maybe more surprising is that in this model a firing tax leads unambiguously to more demanding hiring standards on the firm’s side. A rise in $T$ has two effects on firms’ hiring policies. First, it decreases the profits from the match, so firms need the marginal worker they hire to be more productive; second, the separation tax prolongs tenures, and allows the firm to operate for longer, which tends to augment the present value of a job. However, in our model the direct effect always dominates this latter force. Figure 1 shows how the job creation and job destruction curves shift in the $(R_o, R_i)$ space.

3.2 Wage rigidity for outsiders

Suppose that the wage rigidity constraint is binding for the outsider workers, whereas wages for the insiders are still the outcome of the decentralized Nash bargaining, as in (9). The (JC) condition becomes

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

(12)

and the job destruction equation is given by

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

(13)

where we have made the dependence of $rU$ on the triple $(R_o, R_i, S)$ explicit. The novelty here is that the value of unemployment depends directly on the severance payment $S$, while it does not depend on the firing tax.\textsuperscript{13} The comparative statics with respect to $T$ and $S$ in this case are characterized in

Lemma 3 (Outsiders constrained): (i) When the outsider wage is fixed at $\omega$, a rise in $T$ has qualitatively the same comparative statics as in the previous case. (ii) A rise in

\textsuperscript{13}The derivations of the new (JC) and (JD) conditions and of the expression for $rU$ are in the Appendix, in the Proof of Lemma 3.
Instead shifts the (JC) curve down and the (JD) curve up, inducing a rise in $R_o$ and an ambiguous change in $R_i$. (iii) Given an equal increase in $S$ and $T$, the impact of the severance payment on unemployment is always larger than that of the separation tax. In particular a higher $S$ can increase unemployment.

**Proof.** See Appendix. ■

Consider first the firing tax $T$. Differentiating the (JC) and the (JD) conditions with respect to $T$ yields an unambiguous fall in $R_i$ with ambiguous effects on $R_o$, exactly as in the previous cases: the intuition for this result is that the firing tax $T$ does not enter directly in the value of unemployment $rU$ because it is paid outside the pair.

Consider now the pure transfer $S$. 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 $S$.

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 (13)– 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 increase in \( R_o \). We can conclude that the impact of a rise in \( S \) is unambiguously more detrimental on unemployment than a corresponding rise in \( T \).

### 3.3 Wage rigidity for insiders

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

\[
R_o - rU (R_o) + \frac{\lambda}{(r + \lambda)(1 - \beta)} \int_{R_i}^{\bar{R}} [1 - F(z)]dz - \lambda T = 0, \tag{14}
\]

\[
R_i - \omega + \frac{\lambda}{r + \lambda} \int_{R_i}^{\bar{R}} [1 - F(z)]dz + r (S + T) = 0, \tag{15}
\]

and the comparative statics with respect to the employment protection policies is characterized by

**Lemma 4 (Insiders constrained):** (i) When the insider wage is fixed at \( \omega \), a rise in \( T \) has qualitatively the same comparative statics as in the previous cases. (ii) A rise in \( S \) shifts down only the (JC) curve, inducing a fall in both \( R_o \) and \( R_i \). (iii) Given an equal increase in \( S \) and \( T \), the impact of the severance payment on unemployment is always smaller than that of the separation tax. In particular, a higher \( S \) reduces unemployment unambiguously.

**Proof.** See Appendix. ■

Since the wage is fully downward flexible for outsiders, \( S \) does not enter either the (JC) condition or 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 \( R_i \). 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 \( R_o \) falls. Since the tax has the usual comparative statics, we conclude that the tax has unambiguously worse implications for unemployment. More importantly, a larger severance payment will reduce unemployment, as it increases both the inflow into employment and the outflow from unemployment into new jobs. Figure 3 shows this result graphically.
3.4 Full wage rigidity

We now move to the polar extreme of full wage flexibility, where the wage constraint $\omega$ applies to every job in the economy. When we combine the equations in (2) – (4) with the assumption that wages are exogenously fixed at $\omega$, we arrive at the pair of equations (derived in the Appendix) which fully characterize the equilibrium:

\begin{align}
R_o - \omega + \frac{\lambda}{r + \lambda} \int_{R_i}^{x} [1 - F(z)] \, dz - \lambda(S + T) &= 0, \tag{16}
\end{align}

\begin{align}
R_i - \omega + \frac{\lambda}{r + \lambda} \int_{R_i}^{x} \left[1 - F(z)\right] \, dz + r(S + T) &= 0, \tag{17}
\end{align}

and lead to the following Lemma on comparative statics with respect to the two employment protection policies:

**Lemma 5 (Wage rigidity):** (i) With full wage rigidity, the severance payment $S$ and the firing tax $T$ have identical effects. A rise in either one decreases $R_i$ and increases $R_o$ with ambiguous net impact on unemployment. (ii) Moreover, the change in both reservation productivities following a rise in $T$ is larger than in the case of full wage flexibility.

**Proof.** See Appendix.

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 an additional tax on separations. Qualitatively the comparative statics are the same as for the firing tax. It can be proved that, following a rise in $T$, when wages are completely insulated from policies and productivity shocks, the separation rate decreases by a larger amount and the unemployment duration 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 $R_o$ by a smaller magnitude. This rise in $R_o$ leads to a decline in wages (through the equilibrium outside option $rU$) which compensate partially the firm from the increase in $T$ and allows her to decrease $R_i$ by a lower amount.

Interestingly, if we put together the implications of Lemmas 2, 3, 4, and 5 we can conclude that the comparative statics of the firing tax on the labor market equilibrium are extremely robust, and qualitatively they do not depend either on the existence or on the degree of
bite of wage constraints. On the other hand, severance payments have dramatically different effects according to the degree of wage rigidity in the economy: they are neutral with full flexibility, reduce unemployment when insiders’ wages are rigid, but they can increase unemployment when outsiders’ wages are subject to institutional constraints. In the next section we relate the nature of the wage rigidity in our model economy to various institutions.

3.5 Institutional sources of wage rigidity

What kind of labor market institutions can be at the origin of the different degrees of wage rigidity that we have discussed? Let us start from the model economy where wages for outsiders are taken as given by the individual firm-worker pair. Recall that outsider workers are defined in our model as those holding jobs without employment protection rights, i.e. temporary contracts. It is natural to think of this economy as one where a *minimum wage constraint* is binding for these low-paid jobs. Nearly all OECD countries have some form of national minimum wage setting arrangement in place, in accordance with several ILO conventions: currently, 17 countries have a statutory minimum wage while others (like Greece or Italy) have “contractual minima” established through the collective bargaining negotiations at the national level and enforced by unions (OECD Employment Outlook 1998, Table 2.1). These wage minima in general extend to all type of workers and all type of contracts, with the exception of only a few cases (e.g. Belgium) where such minimum wage agreements exclude trainees or apprenticeship. For example, the OECD reports that in Spain training and learning contracts must pay above the statutory minimum wage (OECD Employment Outlook 1998, Table 3.2). For relatively skilled outsider workers, the minimum wage constraint might not be binding, but 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. 30% of the insider wage in Greece, 60% in Spain, 80% in Italy and virtually 100% in Sweden).

Consider now the situation where the wage constraint binds for all insider workers, i.e.

---

14 Our question is formulated in the context of matching models. Here a caveat is needed: Ljungqvist (1998) 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.

15 See Erikson and Ichino (1995) for a detailed description of the contractual minimum wage for Italy. They report that the industry-level minimum, together with the national indexation system (scala mobile) amounts to 90% of the monthly compensation for the low-skill occupations and 60% for the high-skill ones (Erikson and Ichino 1995, Table 4).
those whose job is protected through institutional firing costs. Clearly, the most relevant source of wage rigidity in this case is collective bargaining by unions that takes place at a higher level than the individual plant. This is the case for virtually every European country. Iversen (1998) produced 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. The Scandinavian countries are those with highest centralization where national associations enforce contracts across sectors and regions. In countries like Italy and Belgium bargaining takes place mainly at the industry-level, whereas in the U.S. and the U.K. bargaining is very decentralized.

Thus, differential institutions across countries induce various degrees of wage rigidities. The U.S. and the U.K., with their highly decentralized bargaining process, would fit into the model economy with full wage flexibility of section 3.1. In these two economies, those industries where the statutory minimum wage bites strongly could fit better into the case where wage rigidity is only binding for outsiders (section 3.2). Italy and Sweden, where temporary contracts are exempt from firing penalties but must pay virtually the same wages agreed collectively for permanent contract would fit the opposite extreme of full wage rigidity of section 3.4. Economies like Greece or Belgium where collective agreements are quite centralized, but there is no statutory minimum wage and the wage discount on fixed-term contract is generous are closer to the model where wage rigidity is binding for insiders only (section 3.3).

4 Concluding remarks

Employment protection legislation includes both a tax component and a pure transfer component (severance payment). Since Lazear (1988, 1990) it is well established that without severe market 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.

In this paper we take no such shortcut and ask the following question: when bonding possibilities are limited by some form of wage rigidity, what are the real effects of severance
payments? Are they qualitatively comparable with the well known effects of firing taxes? This paper is a first step towards answering these questions. Our main conclusion is that only in the extreme case of full wage rigidity are the firing tax and the pure transfer exactly equivalent. In general, their effects differ. First, when the institutional wage rigidity binds “at entry”, like in the case of a minimum wage constraint, larger severance payments decrease job creation but, because they cannot be pre-paid by entrant workers, also increase the outside option (value of unemployment) of insider workers who bargain individually with the firm. The resulting higher wages can induce the firm to destroy more jobs, a conclusion that differs greatly from the standard impact of firing taxes. Second, when the institutional wage rigidity binds “at exit”, like in the case of a union that sets collectively the wage for all insider workers, the transfer can be fully pre-paid by the worker at entry so job creation is unaffected, and acts like a separation tax for insiders. In this case, a mandatory severance payment will increase employment.

Our analysis shows therefore that the implicit assumption made by the existing literature that the impact of severance payments in the presence of contractual frictions is exactly as that of firing taxes is in general incorrect. We argue that this result should motivate the literature to explore in greater details the interactions of pure transfers upon separation with the specific labor market institutions at the origin of wage rigidity, rather than focusing on the tax component alone. We are aware that the main shortcoming of the paper is the admittedly naive way we interpret wage rigidity institutions such as minimum wages, unions and collective bargaining. This is just a first step in, what we think is, the right direction: future work should incorporate explicit rules of behavior for such institutions and study how the degree of wage rigidity chosen by the institution is in turn affected by the strictness of employment protection policies.
Appendix 1: Firing cost decomposition in the Italian legislation

In what follows we provide estimates of the transfer and tax components in the statutory firings cost for Italy, one of the countries with the strictest Employment Protection Legislation (OECD, 1999). In the Italian legislation, an employer-initiated separation is legitimate only when it satisfies a “just clause”. The Italian civil law (st. n 604/1966, sect. 3) foresees that individual dismissal is 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 heading involves events which are outside the employee’s control, while the second case requires misconduct 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 separation is ruled fair, or if the worker does not appeal the firing decision, the legislation does not impose any firing cost to the firm. 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.

Specifically, we consider a situation where an employer-initiated individual separation against a blue-collar worker with average tenure 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 trial in Italy). First of all, the worker should 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 should 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. Finally, all the legal costs should be paid by the firm. Thus, if we let $n$ be the number of months that it took to reach a

---

16 The union to whom the worker is affiliated usually pays all the legal costs in this case.

17 With respect to 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. For collective dismissals, the firing procedure is more complicated, since firms are obliged to undergo a full consultation with the unions before the collective dismissal can be put in place.
court decision, \( w \) the gross monthly wage, \( \tau^s \) the social security contributions, \( \tau^h \) the health insurance contribution, \( \phi \) the penalty rate on foregone contributions, \( sp \) the mandatory severance payments for unfair dismissal and \( lc \) the total legal cost, the firing costs when the worker opts for the severance payment over reinstatement (this happens in over 95 percent of the cases) is

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

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

\[
S = nw + \alpha \tau^s nw + sp,
\]

where \( \alpha \) is the share of the social security contributions that is rebated to the worker in the form of increased future pensions. The tax component is

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

Table I provides an estimate of the level of \( FC \) as well as of the shares of \( T \) and \( S \) in the total firing costs. The estimate suggests that the transfer component of the total firing costs varies from 66 to 76 percent, depending on how large is the share of social security contributions that are transformed into new pension rights – in which case such payroll contribution should be counted as transfer inside the match. Table I presents two extreme scenarios, corresponding respectively to \( \alpha = 0 \) and \( \alpha = 1 \). In each case it is clear that the transfer component is much larger than the tax component.

The above computation is based on the ex-post firing cost, once the case has been taken to court and the judge has reached the verdict. Obviously, ex-ante the firm does not know with certainty whether any given individual dismissal will be appealed by the worker, and whether the separation will be ruled legitimate. If we ignore discounting, and let \( p_a \) be the probability of appeal and \( p_u \) the probability that the firing is ruled unfair, the ex-ante expected firing cost is

\[
\tilde{FC} = p_a[(1 - p_u)C_L + p_u(nw + (\tau^s + \tau^h + \phi)nw + sp + lc)] + (1 - p_a)C_{NA},
\]

where \( C_L \) is the firing costs incurred by the firm when the judge rules the firing legitimate and \( C_{NA} \) is cost incurred when the worker does not appeal the firm decision. Since, as we explained above, in the Italian legislation \( C_L = C_{NA} = 0 \), the expected transfer component is

\[
\tilde{S} = p_a p_u (nw + \alpha \tau^s nw + sp)
\]
Table I

<table>
<thead>
<tr>
<th></th>
<th>Symbol</th>
<th>Total</th>
<th>Transfer Tax</th>
<th>Transfer Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\alpha = 1$</td>
<td>$\alpha = 0$</td>
<td>$\alpha = 1$</td>
</tr>
<tr>
<td>Foregone Wages</td>
<td>$nw$</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Health Insurance</td>
<td>$\tau^hw$</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Social Security Contributions</td>
<td>$\tau^sw$</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Sanctions for Delayed Payments</td>
<td>$\phi w$</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Legal Costs</td>
<td>$lc$</td>
<td>6</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Severance Payments $^a$</td>
<td>$sp$</td>
<td>15</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>Total (monthly wages) $^b$</td>
<td></td>
<td>41</td>
<td>31</td>
<td>10</td>
</tr>
<tr>
<td>Share</td>
<td></td>
<td>100</td>
<td>76</td>
<td>24</td>
</tr>
</tbody>
</table>

$^a$ Worker opts for severance payment rather than reinstatement

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

$^b$ $S = nw + (\alpha\tau^s + \phi)nw + sp$

$^b$ $T = [(1 - \alpha)\tau^s + \tau^h]nw + lc$

Source: Authors’ calculations based on Ichino (1996)

while the expected tax component is

$$\tilde{T} = p_a p_u [(1 - \alpha)\tau^s nw + (\tau^h + \phi)nw + lc].$$

Guell (2002), using data based on actual court sentences, suggests that the probability of appeal is $p_a = 0.32$ while the probability of the layoff being ruled unfair is $p_u = 0.52$. With these probabilities, using the estimates of Table I, $\tilde{FC}$ is just below 7 monthly wages. However, for the sake of our analysis, what matters is the fact that the share of the transfer and tax components are independent of the actual estimates of $p_a$ and $p_u$, since as clear from equations (19) and (20), such probabilities enter only in a multiplicative fashion. In other words, while the level of the expected firing costs depend crucially on these probabilities, the distribution of the costs in terms of taxes and transfer does not.

Finally, one should recall that most employer-initiated separations do not end up in court since firms and workers may well find a satisfactory settlement 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 Nash fashion on the settlement, the joint maximization problem
will solve
\[
\max_S \left[ \hat{S} - p_u S \right] \beta \left[ -\hat{S} + p_u (S + T) \right]^{1-\beta},
\]
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 \( \hat{S} = p_u (S + \beta T) \) which is an amount larger than the expected transfer the worker would receive, but smaller that the total cost the firm would pay in case the firing is ruled unfair. The intuition is that a fraction \( \beta \) of the tax becomes part of the settlement. This explains why, whenever the two parties roughly agree on the probability distribution of outcomes in the trial, they end up settling out of court. For the purpose of our analysis, it is important to remark that in this case the entire firing cost for the firm is a \textit{transfer} to the dismissed worker.
Appendix 2: Proofs

Proof of Lemma 1 (Wage Rules).

To obtain the outsider wage (8), start from the sharing rules (5) and multiply both sides by \((\lambda + r)\). Next, substitute into (5) the expressions for \((r + \lambda) J_o(x)\) and \((r + \lambda) [W_o(x) - U]\) obtained from (2)–(4). 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 \(W_i(x) - U = \beta \Omega(x) + \beta T + S\) and \(J_i(x) = (1 - \beta) \Omega(x) - \beta T - S\) into the Nash rule (5) to arrive at

\[
\beta [x - w_o(x) - \lambda F(R_i) T - \lambda S] = (1 - \beta) [w_o(x) - rU + \lambda S] + \beta \lambda [1 - F(R_i)] T,
\]

which yields the expression for the outsider wage in (8). Following similar steps, one arrives from (6) to (9).

Proof of Proposition 1 (Equilibrium).

(i) From the definition of the equilibrium, recall that the job creation condition is defined as \(J_o(R_o) = 0\), which can be written as

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

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

\[
J_i(x) = (1 - \beta) \Omega(x) - \beta T - S,
\]

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

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

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

\[
\Omega(\bar{x}) = \int_{R_i}^{\bar{x}} \Omega'(z) dz - T = \int_{R_i}^{\bar{x}} \frac{1}{r + \lambda} dz - T.
\]
The equilibrium job destruction condition is defined as \( J_i(R_i) = -(T + S) \). After some simple manipulation, which involves equation (21) and an integration by parts similar to the one above, one arrives at

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

Substituting the wage rules found in Lemma 1 out of equations (22) and (23), one arrives at the (JC) and (JD) conditions in the Proposition. 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 (5), one has \( W_o(x) - U = \beta \Omega(x) \). Substituting this expression into (4), 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.

(ii) We start by proving that the (JC) and (JD) curves have different slopes on \([0, \bar{x}]\). Thus, given existence of an interior equilibrium, the equilibrium will be unique. Once we recognize that there is a negative relationship between \( rU \) and the entry reservation value \( R_o \) (by simple differentiation, it immediately follows that \( \frac{\partial U}{\partial R_o} < 0 \)), standard partial differentiation shows also that the (JC) condition is upward sloping while the (JD) condition is downward sloping, so that

\[
\left. \frac{\partial R_i}{\partial R_o} \right|_{JC} > 0 \quad \left. \frac{\partial R_i}{\partial R_o} \right|_{JD} < 0.
\]

(iii) To determine the conditions for existence of the interior equilibrium, it is convenient to work with the following pair of equations

\[
R_i - R_o + (r + \lambda) T = 0,
\]

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

where the first equation is obtained by subtracting (JC) from (JD), and the second equation is the (JD) condition. The first condition plots a line in the \((R_o, R_i)\) space with positive slope equal to one and intercept \(- (r + \lambda) T\). Thus, this line has value \( R_i = 0 \) for \( R_o = (r + \lambda) T \) and \( R_i = \bar{x} - (r + \lambda) T \) for \( R_o = \bar{x} \). Consider now the (JD) curve. For \( R_o = \bar{x}, R_i < 0 \).
Hence, given that the (JD) curve has negative slope, to prove that the two lines do cross in the \([0, \bar{x}]\) interval, we need to prove that at the point \(R_o = (r + \lambda) T\) the (JD) condition implies a strictly positive value for \(R_i\). Since the left-hand side of the (JD) curve is increasing in \(R_i\), it is enough to verify that

\[
\frac{\alpha \beta}{r + \lambda} \int_{(r+\lambda)T}^{\bar{x}} [1 - F(z)]dz - \frac{\lambda}{r + \lambda} \int_0^{\bar{x}} [1 - F(z)]dz - rT > 0.
\]

(24)

Condition (24) sets a parametric restriction which is sufficient for existence. When \(T = 0\) this condition simplifies to \(\alpha \beta > \lambda\), which becomes a necessary condition when \(T > 0\). Clearly when \(T > 0\), we need also to impose \((r + \lambda) T < \bar{x}\) to have some hope that the two curves cross in the set \((0, \bar{x})\). As implied by the Proposition, in general the smaller is \(T\), the smaller is the difference between \(\alpha \beta\) and \(\lambda\) necessary to satisfy (24).

**Proof of Lemma 2 (Wage flexibility)**

To characterize the comparative statics of \((R_o, R_i)\) with respect to \(T\), start from partially differentiating the job creation condition (JC) by also using the linear relation between the reservation productivities in (11) to arrive at

\[
dR_o + \frac{\alpha \beta}{r + \lambda} [1 - F (R_o)] dR_o - \frac{\lambda}{r + \lambda} [1 - F (R_i)] [dR_o - (r + \lambda) dT] - \lambda dT = 0,
\]

which yields

\[
\frac{dR_o}{dT} = \frac{(r + \lambda) \lambda F (R_i)}{r + \lambda F (R_i) + \alpha \beta [1 - F (R_o)]} > 0.
\]

A similar approach on the job destruction condition gives

\[
\frac{dR_i}{dT} = \frac{- (r + \lambda) r F (R_i)}{r + \lambda F (R_i) + \alpha \beta [1 - (R_o)]} < 0.
\]

**Proof of Lemma 3 (Outsiders constrained)**

(i) and (ii) Since \(\omega\) is binding for the marginal outsider by assumption, but the insider wages are unconstrained, the job creation condition will be

\[
R_o - \omega + \lambda \int_{R_i}^{\bar{x}} J_i (z) dF (z) - \lambda F (R_i) (T + S) = 0.
\]
Using the Nash bargaining rule for insiders to write $J_i(z)$ as a function of the surplus function $\Omega(z)$ and differentiating by parts, one arrives at

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

which is (12) in the main text. The (JD) condition in (13) is derived exactly as in the case with full wage flexibility, but the expression for $rU$ is now different. From (4), we have that

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

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

$$(r + \lambda) [W_o(\omega) - U] = \omega + \lambda \int_{R_i}^{x} [W_i(z) - U] dF(z) + \lambda F(R_i) S - rU,$$

$$= \omega + \lambda \int_{R_i}^{x} [\beta \Omega(z) + S + \beta T] dF(z) + \lambda F(R_i) S - rU,$$

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

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 $\Omega(R_i) = -T$. Putting all together, we arrive at an expression that defines implicitly $rU$ as a function of $(R_o, R_i, S)$, i.e.

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

The comparative statics of $rU$ with respect to $R_o, R_i$ and $S$ are straightforward and give $\frac{drU}{dR_o} < 0, \frac{drU}{dR_i} < 0$ and $\frac{drU}{dS} > 0$. Returning to the (JC) and the (JD) curves, one can observe first that they have the usual slopes. The (JC) curve shifts downward exactly in the same way as $T$ or $S$ increase. From the (JD) curve

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

it is immediate to see that following a rise in $T$ the job destruction curve shifts down, whereas a larger $S$ shifts the curve upward.
(iii) These different shifts imply that if we compare an increase of $S$ to an increase in $T$, in the former case $R_i$ will fall by a smaller amount (and could potentially increase), while $R_o$ will increase by a larger amount. It follows that the former policy change can be more detrimental for unemployment.

**Proof of Lemma 4 (Insiders constrained)**

(i), (ii), (iii) Consider the value of a job for an insider firm

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

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

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

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

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

(25)

in the expression above, we obtain (15) as in the main text. Notice that the (JD) curve is horizontal in the $(R_o, R_i)$ space. Consider now the value of an outsider job evaluated at $x = R_o$ such that $J_o(R_o) = 0$, i.e.

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

Using (8) to substitute out the wage, and using (25) in the integration by parts, we arrive at the new (JC) condition (14) 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 (4) for the full flexibility case. The comparative statics and the other conclusions of Lemma 4 follow easily from standard partial differentiation.

**Proof of Lemma 5 (Wage rigidity)**

(i) We begin by deriving conditions (16) and (17) which are the reduced form of the model when wages are rigid and are necessary for the comparative statics. Consider the value of a job for an outsider firm

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

29
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 \((r + \lambda) J_i (\bar{x}) = \int_{R_i}^{\bar{x}} dF(z) - (T + S)\), we obtain (16) in the main text.

Consider now the value of a job for an insider firm:

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

Evaluating that expression at \( x = R_i \), and integrating by parts, we arrive at

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

where we have used the fact that \( J_i (R_i) = -(T + S) \). Substituting

\[
J_i (\bar{x}) - J_i (R_i) = \int_{R_i}^{\bar{x}} J_i' (z) \, d(z) = \frac{1}{r + \lambda} \int_{R_i}^{\bar{x}} \, dz
\]

in the expression above, we obtain (17) in the main text.

From straightforward differentiation of (16) and (17), together with the implied linear relation \( R_i = R_o - (r + \lambda) (S + T) \), one can show that under full wage rigidity,

\[
\frac{dR_o}{dT} = \frac{dR_o}{dS} = \frac{(r + \lambda) \lambda F(R_i)}{r + \lambda F(R_i)} > 0,
\]

\[
\frac{dR_i}{dT} = \frac{dR_i}{dS} = \frac{-(r + \lambda) r F(R_i)}{r + \lambda F(R_i)} < 0.
\]

(ii) A simple comparison of these derivatives and the derivatives in the Proof of Lemma 2 yields the last part of Lemma 5.
References


Cahuc, P. and A. Zylberberg (1999); “Redundancy payments, incomplete contracts, unemployment and welfare”, mimeo, Universite Paris 1.


Galdon-Sanchez, J. and M. Guell (2000); “Let’s go to court! Firing costs and dismissal conflicts”, Industrial Relations Sections, Princeton University, working paper n. 444.


Pissarides, C. A. (2002); “Consumption and savings with unemployment risk: Implications for optimal employment contracts,” mimeo, London School of Economics.
Figure 1: The Job Creation and Job Destruction curves, plotted in the \((R_o, R_i)\) space, before and after an increase in the firing tax \(T\) in an economy with full wage flexibility. The rise in \(T\) increases unemployment duration \((R_o\) rises\) and decreases unemployment incidence \((R_i\) falls\) with ambiguous net impact on equilibrium unemployment.
Figure 2: 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. The rise in $S$ increases unemployment duration unambiguously ($R_o$ rises) and, as in this case, could also raise unemployment incidence ($R_i$ rises), thereby increasing equilibrium unemployment. In this case severance payments can have more adverse effect on unemployment than firing taxes.
Figure 3: The Job Creation and Job Destruction curves, plotted in the \((R_o, R_i)\) space, in an economy where insiders’ wages are constrained. The severance payment \(S\) shifts only the JD curve downward towards the new equilibrium \(E'\), thus it reduces unemployment unambiguously. The firing tax \(T\) shifts down also the JC curve towards \(E'_T\), hence its effect on unemployment are more adverse than the severance payment.