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# Understanding the Determination of Severance Pay: Mandates, Bargaining, and Unions*

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## Abstract

A substantial share of severance payments derives from private contracts or collective agreements. In this paper, we study the determination of these payments. We analyze joint bargaining over wages and severance payments in a search-and-matching model with risk-averse workers. Individual bargaining results in levels of severance pay that provide full insurance, but also depend on unemployment benefits and job-finding rates. Unions also choose full insurance. Because their higher wage demands reduce job creation, this requires higher severance pay. Severance pay observed in eight European countries, to which we calibrate the model, lies between predictions from the bargaining and union scenarios.

*Keywords*: Bargaining; severance pay; unemployment insurance; unions
*JEL classification*: *E*24; *J*32; *J*33; *J*64; *J*65

## I. Introduction

Job termination can have important welfare consequences for workers. As a result, arrangements for severance pay exist in many countries around the

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world. These arrangements differ substantially. In some countries, such as Canada and Spain, severance pay is government-mandated. In others, such as Japan and the United States, it is reached through private bargaining. In yet other countries, it is partly government-mandated and partly reached through bargaining (e.g., Belgium, France, Germany, and Italy). In countries where arrangements for severance pay are reached privately, this can occur through individual contractual arrangements, or through collective bargaining with unions.[1]

The existing literature on severance pay has mainly considered government-mandated severance pay.[2] However, severance pay reached through collective or private agreements is quantitatively important. For instance, using data from Massachusetts in the United States in which 86 percent of workers were covered by a severance pay agreement, Kodrzycki (1998) shows that a typical arrangement features severance pay of one week's wage per year of service. Assuming a replacement rate of unemployment insurance (UI) of 50 percent, this implies that total severance pay receipts are higher than maximum potential UI receipts for workers with more than 13 years of tenure. On average, severance pay amounts to 43 percent of maximum available UI receipts for displaced workers in the sample of Kodrzycki (1998).

If privately reached severance pay agreements are important, this raises the question of why publicly mandated regimes exist, and how the levels of severance pay they impose compare with the ones that would come out of private arrangements. Therefore, the main aim of this paper is a theoretical and quantitative analysis of private bargaining over severance pay. We conduct this analysis in a standard Diamond–Mortensen–Pissarides (DMP) model with bargaining not only over wages, but also over severance pay. This set-up then allows us to assess how counterfactual, simulated estimates of privately bargained severance pay compare with observed, government-mandated levels.

As already alluded to above, collective bargaining cannot be neglected when analyzing the determination of severance pay. The evidence presented in Parsons (2005a,b,c) shows very clearly that severance pay arrangements differ substantially by unionization status of the employee. There is also evidence that severance payments are indeed negotiated by unions (Millward *et al*., 1992), and that, because of the complexity of employment protection legislation, unions are able to obtain higher firing costs for their members (Colonna, 2008a,b). Thus, an additional contribution of this paper is to

[1]See Holzmann *et al*. (2012), particularly Annex B, for a classification of countries by type of severance pay arrangement, and see Laga (2012) for some country specific details.
[2]An important exception, which we discuss below, is Fella and Tyson (2013).

analyze union behavior in this context. This turns out to be important for understanding the arrangements in several countries.

Before delving into the theoretical analysis, we discuss evidence on severance pay in Europe (Section II). In doing so, we do not limit ourselves to popular measures, such as those from the World Bank and the OECD, which only cover legally mandated severance pay. Instead, we focus particularly on negotiated components of severance pay resulting from bargaining. Of course, privately bargained severance pay might not be observed in countries where legally mandated levels exceed those that would result from private negotiation. For these cases, our model can provide an indication of which counterfactual arrangements could prevail in the absence of legal provisions.

To analyze bargaining over severance pay, we build a matching model in the manner of Mortensen–Pissarides with endogenous job destruction and risk-averse workers, and we add (i) unions as in Delacroix (2006), and (ii) bargaining over wages and severance payments as in Booth (1994, 1995). A first theoretical result shows that a worker and a firm bargaining over both wages and severance pay opt for a level of severance pay that gives the worker full insurance. This arises because the risk-neutral firm can insure the risk-averse worker. The level of severance pay required for this decreases with the UI replacement rate and the job-finding rate. Expressed relative to average completed tenure, it also depends on the job-destruction rate.

A second theoretical result shows that a monopolistic union that chooses wages and severance pay to maximize the value of employment, taking firms' reactions as given, also chooses full insurance. How much surplus the union can extract is limited by the equilibrium reaction of job creation to higher wages and severance pay.

In order to provide quantitative results, we calibrate the model to a set of eight continental European economies that feature varying levels and types of arrangements for severance pay. We then first use the calibrated model to compare outcomes from bargaining to union behavior, taking severance pay as given. We then perform a number of quantitative counterfactual experiments on severance pay using the calibrated model. These can be grouped into two sets of exercises, one aiming to understand the effect of varying severance pay, and another aiming to provide an indication of what levels of severance pay would be bargained privately. This second set can serve as a benchmark to which legislated levels of severance pay can be compared.

The first set of exercises indicates that exogenously eliminating mandated severance pay increases job destruction but also increases job creation, and thus has an ambiguous effect on unemployment. This is in line with results from the literature, in particular Blanchard (2000) and Ljungqvist (2002). In calibrated economies, we find that the change

in unemployment depends on its initial level. In settings with individual bargaining over wages, where unemployment for observed levels of severance pay is relatively low, the unemployment rate increases following the elimination of severance pay. This is because the resulting rise in job destruction dominates the increase in job creation. The opposite occurs in economies where monopolistic unions set wages, and unemployment is higher.

Bargaining over severance pay leads to levels of severance pay providing workers with full insurance. Firms are compensated for this expense by wages that are slightly lower than those in a situation without severance pay. Job destruction decreases compared with a case where severance pay is not available, but so does job creation. Again, job destruction dominates when benchmark unemployment is low. Unions also choose full insurance. This requires them to set substantially higher levels of severance pay than those bargained individually, as they need to insure not only higher wages, but also the longer unemployment spells that come about as higher wages reduce job creation.

Quantitatively, levels of severance pay implied by the bargaining setting are close to those observed in countries with low levels of mandated severance pay. Levels set by unions are closer to those observed in countries with high levels of mandated severance pay. Only in Italy, the country with the highest levels of severance pay in the sample, do the model results not bracket observed levels of severance pay. Quantitatively, the model performs very well, explaining between a third and half of the cross-country variation in severance pay. Thus, one way of understanding mandated levels of severance pay in most countries is that as an outcome of a political process – the analysis of which is beyond the scope of this paper – they align with the levels that would have been the result of private bargaining. Which type of bargaining comes closest to generating observed levels of severance pay depends on institutional characteristics of each country, and in particular wage bargaining arrangements and the importance, power, and scope of unions.

With an exception discussed below, the existing boy of literature on severance pay essentially has ignored negotiated severance pay and studied government-mandated severance pay only. The results of this literature have been fairly mixed.[3] Blanchard (2000) finds that severance pay increases firing costs, which reduces flows from employment to unemployment. At the same time, it reduces the reverse flow by making job creation more costly, leading to an uncertain overall effect. In addition, he points out that severance pay clearly contributes to labor market dualism. Several

[3] See the recent publication by the World Bank for a comprehensive review (World Bank, 2012).

authors have argued that firing costs – and, with these, severance pay – can affect productivity and growth. Hopenhayn and Rogerson (1993) show that firing costs induce costly misallocation. Bertola (1994), Poschke (2009), and Raurich *et al*. (2015) show that firing costs can affect growth through their effects on firm entry and exit and on worker flows, respectively. Alvarez and Veracierto (2001) find a small insurance role and large side effects of severance payments. While they can affect welfare positively, this is essentially through general equilibrium effects, and not through providing insurance, as presumably intended by the legislator. Samaniego (2006) argues that firing costs can reduce employers' incentives to adopt new technologies, with a negative effect on economic growth or output. Cingano *et al*. (2010) and Conti and Sulis (2016) provide supportive evidence. Finally, the interaction between unions and severance pay was first described theoretically in Booth (1995) within the framework of the right to manage bargaining. An important result of that paper is that severance pay is efficiency-improving compared with bargaining over wages alone.

Empirically, Nickell and Layard (1999) find a positive effect of employment protection on aggregate growth. However, this effect disappears once differences in country levels of productivity are controlled for. Soskice (1997) and Belot *et al*. (2007) find that strict dismissal regulations can increase productivity by increasing job security, job tenure, and work effort, and by making workers more likely to invest in firm-specific human capital. The studies with probably the cleanest identification of the effects of firing costs are Autor *et al*. (2004, 2007), even though the firing restriction implied in the US context they consider is rather small compared with firing costs imposed by the legislator in other countries. These authors find that firing costs exert a significant but modest negative effect on productivity by distorting production choices towards more capital deepening. They also find reduced employment flows and firm entry rates. Finally, Bassanini *et al*. (2009) and Cuñat and Melitz (2012) show that employment protection has the strongest effect in sectors where it is most binding, as a result of more volatile firm-level productivity.

Two recent papers cover similar topics. The paper closest to ours is that of Fella and Tyson (2013), who build an equilibrium matching model with savings and incomplete markets, and contrast the optimal provision of severance pay bargained by the model's agents to mandated levels. The key difference to our paper is that Fella and Tyson do not address the role of unions. Our results suggest that this important feature of European labor markets is key for understanding mandated severance pay arrangements in most countries. Thus, integrating unions into the analysis is an important step beyond the contribution of Fella and Tyson (2013), and this helps us to understand the origin of very high levels of severance pay observed in some countries. From the perspective of law and economics, Boeri *et al*.

(2017) argue that mandatory severance pay is optimal in the presence of wage deferrals when there is moral hazard and the firm cannot commit not to fire non-shirkers. In addition, these authors document the importance of the discretion of judges in interpreting the law and effectively deciding levels of severance pay (see also our Section II).

Finally, it should be mentioned that our analysis abstracts from a couple of relevant features of European labor markets that go beyond the scope of our analysis. First is labor market dualism, where the labor market is segmented between some workers who have permanent contracts with severance pay, and others on temporary contracts without it. Such segmentation is important in Spain and Italy, and is also often discussed in France, but it is of lesser concern in Germany and the Nordic countries. Temporary contracts allow for easier job destruction, and should also ease job creation. Thus, they might limit the aggregate effects of severance pay in permanent contracts. Our model abstracts from the duality of the labor market (i.e., all workers are under the same contract). In some sense, we present a world with a single contract as promoted by Bentolila *et al*. (2012b), Cahuc (2012), and Dolado (2017), amongst many others in Europe (see also references therein). We discuss below how this abstraction might affect our quantitative findings. Second, Bentolila *et al*. (2012b) argue that workers on temporary contracts can be viewed as outsiders. They are in a different bargaining position compared with insiders, who can benefit from mandated severance pay to bargain for higher wages. Anticipation of this might reduce entry wages and the welfare of labor market entrants. This implies that mandated severance pay has additional effects not captured in our model, where there are no temporary contracts. In particular, our analysis abstracts from distributional effects. For the case of bargaining or union setting of both wages and severance pay, this issue is likely to be less important, at least if wages and severance pay are set for the same time horizon.

The rest of the paper is organized as follows. In Section II, we present facts on the levels and origins of severance pay across countries, and we also discuss the role of unions. In Section III, we describe the economic environment of our model, as well as the individual problems and equilibrium. In Section IV, we provide theoretical results. The calibration and quantitative results can be found in Section V. Finally, in Section VI, we evaluate the performance of our model in explaining differences in severance pay across countries. We conclude in Section VII.

## II. Data: Severance Pay and Unions across Countries

Before starting our theoretical and quantitative analysis, we give a short overview of severance pay practices in a set of countries, and we discuss

evidence on how unions affect them. Because there already is a broad body of literature on severance pay (see above), we concentrate on novel aspects, in particular the importance of privately negotiated severance pay. While the analysis in the paper centers on continental European economies, the focus on negotiated severance pay leads us to begin by considering the situation in the United States. This is the country where negotiated severance pay arrangements have been documented in the greatest detail. Clearly, such agreements can vary across firms and are thus harder to document than legally mandated severance pay provisions. Although there are no federal US laws that regulate severance pay – state laws are analyzed by Autor *et al*. (2004, 2007) – severance pay provisions are a reasonably common part of labor contracts in the United States.[4] Information on coverage, trends in coverage, and coverage by type of firm or employee is provided by Bishow and Parsons (2004) and Parsons (2005a,b,c, 2012a,b).[5] Publications such as Venn (2009) and Holzmann and Vodopivec (2012) also mention such arrangements.

The work by Parsons and co-authors show that severance pay arrangements began in the 1930s and expanded in the period 1954–1970, especially in manufacturing. In 2001, they covered 26 percent of the US full-time work force, according to the Employment Cost Index (ECI) published by the Bureau of Labor Statistics (BLS).[6] A key pattern in the data documented by Parsons and co-authors is that union workers are more likely to be covered, even in the same work place, resulting in a coverage rate of 30–35 percent for unionized workers and 15–20 percent for non-unionized workers.[7] This confirms the finding in Pencavel (1991) that 39.2

[4]For instance, McDonald's has a corporate severance pay plan for managers and "Shared Restaurant Support Employees" (including part-time ones) calling for severance pay of two weeks' pay per year of tenure, with a minimum and a maximum that depend on the level of employment. See the filing at the Securities and Exchange Commission (SEC): http://www.sec.gov/Archives/edgar/data/63908/000119312506105121/dex10o.htm.

[5]The Bureau of Labor Statistics defines severance pay as "monetary allowance paid by employers to displaced employees, generally upon permanent termination of employment with no chance of recall, but often upon indefinite layoff with recall rights intact. Plans usually graduate payments by length of service." The payment can be lump sum or periodic for some time. Triggers can vary, but typically it is separation initiated by the employer through no fault of the worker. This is different from supplemental unemployment benefits (SUB), which are conditional on unemployment.

[6]Many plans only provide severance pay coverage for employees above some minimum level of tenure. Together with lower levels of coverage in small firms, this goes some way towards explaining the partial coverage observed in the data. Median tenure in 2008 was 4.2 years according to BLS data. It is highest for older workers, in manufacturing, and for management, professional, and related occupations. If all firms had contracts specifying severance pay coverage only after five years of tenure (clauses like this exist, but the distribution of these minima is unknown), overall severance pay coverage would be below 50 percent.

[7]Other factors that matter but go beyond the scope of our analysis in this paper are establishment size and occupation. Coverage is substantially above average for professional and administrative

percent of workers covered by collective bargaining contracts in 1980 were covered by severance pay clauses.

Information on the design of plans comes from private sources. For example, ambitious recent surveys of 925 organizations in 2001, 958 in 2008, and 653 in 2011 were conducted by the consulting firm Lee Hecht Harrison (see Lee Hecht Harrison, 2001, 2008, 2011). Just as Kodrzycki (1998) and Parsons (2005c), they find that the benefit schedule in the most common plan offers a week of pay for each year of service, often up to a service or benefit maximum. Pita (1996) reports in another study that arrangements are similar in collectively bargained agreements. Payments can be higher for senior executives and are sometimes conditional on age or title. Recall that while a week of pay per year of service might not appear much, severance pay can exceed maximum available unemployment benefits for workers with long tenure. Given short typical unemployment durations in the United States, it is quantitatively relevant even for lower-tenure workers.

In Europe, legally mandated severance pay dominates, but is often complemented by negotiated components. Comparative information is available from several sources, most importantly the OECD and the World Bank. The Employment Protection Legislation (EPL) database provided by the OECD (2013) contains a measure of notice periods and severance pay for no-fault individual dismissals of workers with a variety of levels of firm tenure.[8] Similar information is provided by the World Bank in its Doing Business survey (World Bank, 2012). In both cases, estimates are based on legal provisions, applied to an illustrative firm. (In the case of Doing Business, this is a grocery store with 60 employees – a fairly large business.) They might, in addition, include fees for lawyers, for example.

A different approach to measurement is taken by Laga, another private consulting firm, which ran a survey of firms.[9] The firm conducted a first survey in 2009 and updated it in 2012 with information from 25 countries (Laga, 2012). Like the OECD and the World Bank, Laga collects measures for dismissals of employees with certain, specified levels of firm tenure.[10] Compared with the other two sources, the key difference is that the study aims to measure the average cost that an employer has to pay to dismiss

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occupations (42 percent) and clerical and sales workers (29 percent), and lower for blue-collar and service workers (16 percent). A larger share of workers (36 percent) is covered in large establishments, compared with only 16 percent in small establishments.

[8]The OECD has country-by-country snapshots that are more detailed than in OECD (2013) at http://www.oecd.org/els/emp/oecdindicatorsofemploymentprotection.htm.

[9]Another different approach is taken by Abowd and Kramarz (2003) and Kramarz and Michaud (2010), who analyze French firm-level data on actual hirings and firings.

[10]Additional variables that are considered are the employee's age, salary, and composition of salary (base versus bonus).

an employee and reach a final settlement on the dismissal file. This implies two key differences compared with the legally mandated level of severance pay, as documented by the OECD and the World Bank. First, a firm might decide to pay an additional settlement amount on top of mandated severance pay, to avoid the need to go to court. An obvious reason for this is that going to court entails additional costs and unforeseeable random events. For instance, court proceedings can be lengthy and can, in some cases, even lead to reinstatement of the employee (see more detail below).[11] How important such *ex post* settlements are essentially depends on the legal environment, namely severance pay rules and the behavior of courts. Such payments are thus almost directly attributable to the law, and can therefore be considered part of mandated severance pay. Laga also collects information on severance pay arrangements that are privately negotiated *ex ante*, when a labor contract is signed. Clearly, such private commitments go beyond legal mandates.

Given the differences between studies, it is instructive to compare the measures of OECD (2013), World Bank (2012), and Laga (2012). Figures 1 and 2 show total severance pay for workers with 5–7 and 10–11 years of tenure, respectively. The data shown are the sums of mandated severance pay and payments in lieu of notice. This is important as some countries (e.g., Belgium) only specify a notice period. In practice, this is often replaced by a payment. For workers with low tenure, World Bank data show levels of severance pay below five months' pay. The Laga data exhibit levels of 5–10 months' pay, with the exception of France (lower) and Italy (much larger).

The differences between the two data sets are mostly due to the two special features of the Laga study just discussed.[12] First, firm-reported severance pay substantially exceeds the mandated level because of a considerable negotiated severance pay component, which is not statutorily required, but often is part of contracts. This is particularly important in the case of Norway, but also present in both Germany and Sweden. Secondly, effective severance pay can be much larger than legal mandates due to settlements made to avoid court proceedings. This is particularly clear in

[11] From Laga (2012): "The main technique of employment protection legislation is that dismissals need to be justified. The employers have to explain why they dismiss a particular employee. The reason for dismissal must be stated in the actual notice or the employer has to submit the reason upon the employee's request. This reason must also be fair and objective. In some countries, the legislation even limits the reasons which the employer may use to justify a dismissal. If the employer cannot provide a valid reason for dismissal, then severance pay or another form of compensation, in some countries even reinstatement, can be ordered by the courts by way of sanction."

[12] In the case of Belgium, there is an additional difference. This occurs because legal provisions in Belgium differed by occupation until January 2014. Laga reports provisions for white-collar workers, whereas those from the World Bank are for blue-collar workers.

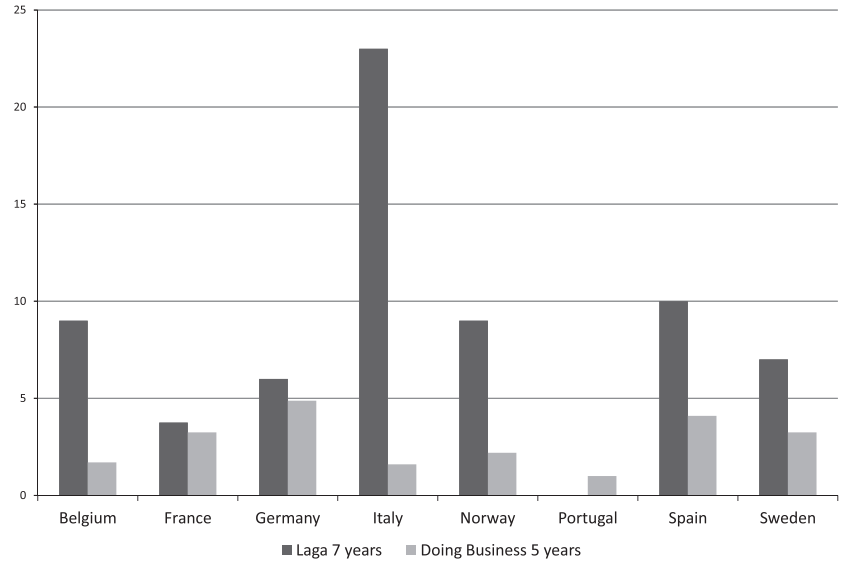


*Fig. 1.* Total severance pay (in months of earnings) for workers with five to seven years of tenure

*Sources*: Laga (2012), and Doing Business (2013).

*Notes*: Numbers reported here and below are the sum of indemnities and indemnities paid in lieu of notice. (Typically, companies prefer paying out equivalents to notice time rather than keeping fired employees around for a long period of time.)

the case of Italy, in line with evidence on the role of courts reported in Boeri *et al*. (2017). These authors show that Italian judges have substantial discretion in interpreting the law on dismissals. They also decide whether a dismissal is deemed fair or unfair, and even determine whether a layoff is of an economic or disciplinary nature. Unfair dismissals can cost a firm more than fair dismissals for two reasons. First, as illustrated in Figure 3, which shows OECD data on severance pay for a worker with 20 years of tenure, severance pay due after an unfair dismissal dwarfs that for regular dismissals. In the case of Italy, for example, total compensation following an unfair dismissal amounts to five times that for a regular dismissal. In addition, an unfair dismissal can be sanctioned by the reinstatement of the worker in the firm. As a consequence, firms facing large judicial discretion need to propose steep settlements to actually carry out dismissals (see Boeri *et al*., 2017). Not surprisingly, in light of this, Bassanini and Garnero (2013) find that the probability of reinstatement is a key aspect of employment protection legislation across OECD economies.

The picture is very similar at higher levels of tenure. Comparing Figures 1 and 2, it is clear that mandated levels of severance pay increase

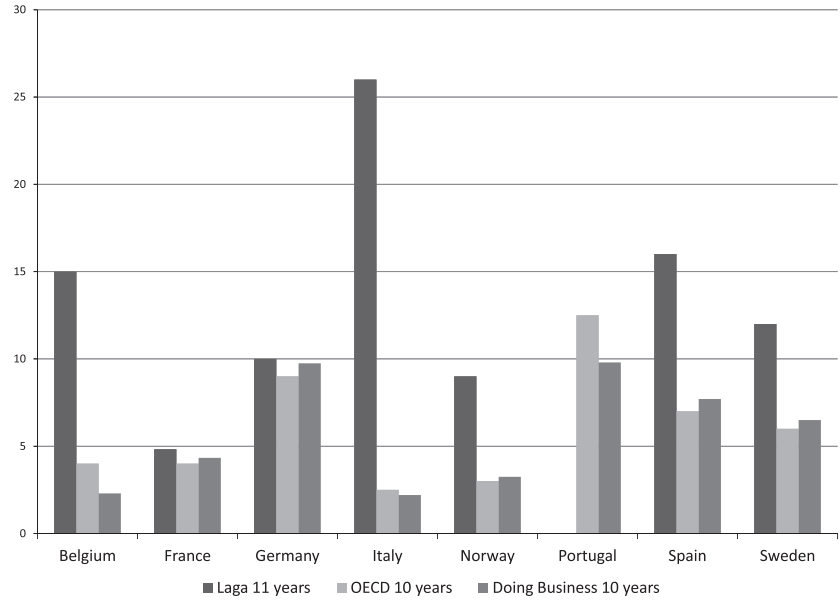


*Fig. 2.* Total severance pay (in months of earnings) for workers with 10–11 years of tenure
*Sources*: Laga (2012), Doing Business (2013), and OECD (2013).
*Note*: Laga data not available for Portugal.

slightly with tenure according to all data sources. Moreover, levels reported by the OECD and the World Bank are very similar, and their relation to the levels reported by Laga is also very similar to that visible in Figure 1.

Finally, severance pay provisions are heavily influenced by unions not only in the United States but also in some European countries. In practice, this is particularly common for notice periods (OECD, 2013). In France, for instance, collective agreements can provide for longer notice periods or more favorable tenure conditions compared with the legal minimum. In Italy, the length of the notice period varies across collective agreement. In most collective agreements (e.g., collective agreements of metal workers, tourism industry, textile workers, chemical workers, trade industry, food industry) notice lies within the following range: a worker receives between 10 and 75 days for tenure between nine months and four years, and from 30 to 180 days at 20 years' tenure. In Germany, in contrast, notice periods are not modified by collective agreement and therefore are equal for all workers. Finally, Millward *et al*. (1992) look at British industrial relations and find that about half the establishments bargaining with unions over wages also bargain over the size of redundancy pay. This has been confirmed more recently by Colonna (2008b), who gives an additional reason for unions to have an effect on severance pay: the complexity of employment

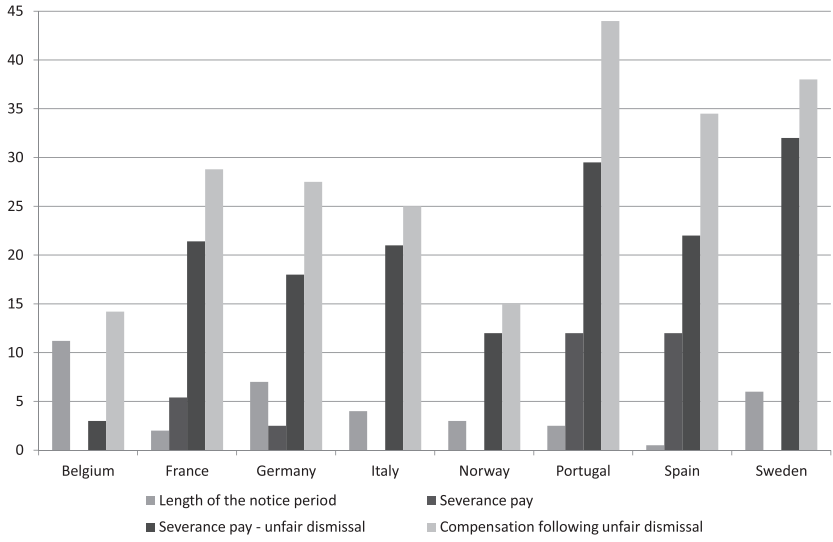


*Fig. 3.* Severance pay at 20 years of tenure for fair and unfair dismissals (in months of earnings)

*Source*: OECD (2013).

*Notes*: The amount of severance pay due depends on whether a dismissal is considered unfair or not. Severance pay and notice period are cumulative. "Compensation" is the sum of actual severance and severance in case of unfair dismissal. The definition of the unfair dismissal used by the OECD is the following: "Unfair: dismissals reflecting discrimination on grounds of race, religion, age, gender, etc., including when these factors bias selection during redundancies. Exercise or proposed exercise of rights under careers leave, maternity leave, parental leave, adoption leave or minimum wage legislation."

protection legislation favors a role for unions, as workers are better off being represented in *ex post* negotiations.

Given this effect of unions on severance pay, we briefly report information on union membership and coverage across the countries we are analyzing. Figure 4 shows that, in the United States, both union membership and collective bargaining coverage are low compared with European countries. Within Europe, France, Italy, Portugal, and Spain exhibit a low level of union density, but a high level of collective bargaining coverage. Belgium, Norway, and Sweden exhibit high union density as well as high collective bargaining coverage, and Germany allies a low union density with an intermediate level of coverage.

The economic literature on unions has documented that, in many situations, the level of coverage matters more than membership for the effect of unions on the labor market; see, for instance, Cahuc *et al*. (2014, Chapter 7, and references therein). Figures 1–4 also suggest a positive association between union coverage and the level of severance pay, with three exceptions: Sweden, Norway, and France all have high levels of

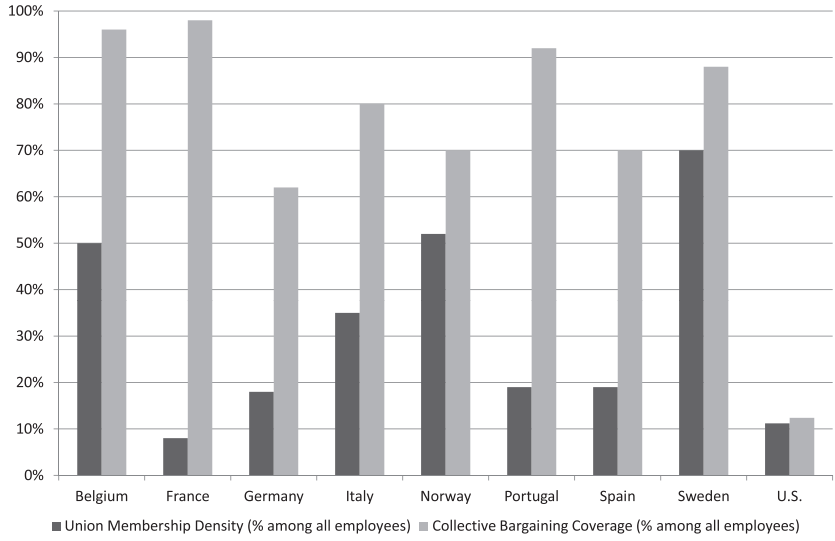


*Fig. 4.* Union membership and collective bargaining coverage in 2013
*Sources*: Data about the United States are from http://www.Unionstats.com, while data for European countries are from the European Trade Union Institute and are available at http://www.worker-participation.eu/National-Industrial-Relations/Compare-Countries.

coverage, combined with low levels of severance pay. Our results below suggest that, for Sweden and Norway, this can be explained by the high job-finding rates in these countries. In France, the unions and the employer organizations jointly manage the UI system within Unédic (a joint association governed by private law). This arrangement implies a very high collective bargaining coverage. Severance pay, in contrast, is set by law and is mostly mandated, not negotiated.[13] It might be that, as a consequence of this arrangement, French unions focus on providing insurance to their workers via the UI system rather than via severance pay. This could explain the weak link between the level of union coverage and severance pay in France.

To summarize our brief tour of severance pay arrangements around the world, we find that in addition to mandated severance pay, negotiated provisions for severance pay in contracts are common in several countries. These countries have in common that mandated levels of severance pay are relatively low. This suggests that in other countries with higher levels of mandated severance pay, negotiated provisions cannot be observed, as mandated levels exceed those that would be chosen by bargaining parties.

[13] Institutional details on France can be found in Laga (2012).

In addition, there is evidence that unions affect severance pay levels. In what follows, we use a model of bargaining over wages and severance pay to infer counterfactual levels of negotiated severance pay for these countries. We can then assess how close observed, mandated levels are to these counterfactual negotiated levels. This analysis can help us to understand, in addition, why there are such substantial differences in mandated severance pay across countries.

## III. A Model of Bargaining over Severance Pay

Time is continuous. The economy is populated by a unit continuum of workers who live forever. They derive utility from consumption $c$, according to the period utility function[14]

$$u(c) = \frac{c^{1-\sigma} - 1}{1 - \sigma}. \tag{1}$$

They discount future utility using a discount rate $\rho > 0$. Workers can be either employed, earning a wage $w$, or unemployed, receiving unemployment benefits $b$.

A fraction $\zeta_u$ of workers are members of a union, with the fractions of non-unionized workers denoted by $\zeta_n = 1 - \zeta_u$. As in Delacroix (2006), unions are sectoral (i.e., there is a part of the economy where all jobs are unionized, and a part where this is not the case).

The consumption good is produced in firms. Each active firm employs one worker. New firms decide whether to be active in a unionized or a non-unionized sector. There is free entry into all these segments. Firms then proceed to hire a worker in the labor market by posting a vacancy at a flow cost of $\kappa$. Descriptions of bargaining and of how vacancies are filled follow below. Output of a firm is $xz$, where $x$ is the firm's productivity and $z$ is aggregate productivity. Firms start their life with $x = 1$. After that, there is a flow probability $\lambda$ that productivity changes. The new level of productivity is drawn from a distribution $\mathcal{X}$ with *pdf* that is uniform on $[0, 1]$. If productivity becomes too low, the firm might want to shut down. We denote the reservation productivity level at which this happens in sector $j$ by $R_j$. Firing a worker entails a severance payment of $\alpha \geq 0$ monthly wages to the worker.

New firms need to recruit workers, and unemployed workers need to look for jobs. They meet on a labor market where workers and vacant jobs

[14]Time subscripts are omitted where this does not risk confusion.

are matched. The number of matches formed is given by a standard constant returns matching function as

$$M_j = A u_j^{\mu} v_j^{1-\mu}, \tag{2}$$

where $u_j$ is the mass of unemployed workers in sector $j$, and $v_j$ is the mass of vacancies in that sector. Defining labor market tightness $\theta_j = v_j/u_j$, a firm's probability of filling a vacancy in sector $j$ is then $M_j/v_j \equiv q_j$, and an unemployed worker's probability of finding a job is $M_j/u_j \equiv \theta_j q_j$. Let the unemployment rate of workers in the whole economy be $u$. Then, $\sum_j \zeta_j u_j = u$.

When an unemployed worker and a hiring firm meet, they bargain about the wage and the severance payment. The way this occurs depends on whether a worker is a member of a union or not. Unions directly set a wage and a severance payment, taking firms' responses as given. Non-unionized workers individually engage in Nash-bargaining with the firm, where the worker's power in the bargaining process is given by $\eta$. Wages and severance payments are *not* renegotiated if match productivity changes.

To write down the value functions of employed and unemployed workers, we need to decide how to model severance pay. To do so, we make two simplifying assumptions. First, to rule out an effect of asset holdings on bargaining, we abstract from saving. Second, to deal with severance pay in the absence of saving, we assume that upon receipt of a severance payment, a dismissed worker buys an annuity that pays for as long as the unemployment spell lasts. For a severance payment of $\alpha w$, the actuarially fair annuity payout is $(r + \theta q)\alpha w$.[15]

Then, we denote total income of an unemployed worker by $b_\alpha \equiv b + (r + \theta q)\alpha w$. A second important modeling choice concerns which value function the severance payment enters – that of an employed worker or that of an unemployed worker. As severance pay is part of the benefits that come with a job, it is natural that they enter the value of a job to a worker.[16]

[15] With saving, a worker would want to have a falling consumption profile over the unemployment spell. Dealing with this, however, would introduce heterogeneity in assets across workers coming from the different durations of unemployment spells. This would also affect bargaining and make solving the problem much harder. Forcing workers to accept a constant consumption profile in unemployment is slightly restrictive but still allows for the full insurance role of severance pay. Therefore, it should not affect our results much. Moreover, with an assumption of constant search intensity, as is typical in DMP-type models, the availability of the annuity has no incentive effects in terms of search intensity. Finally, Fella and Tyson (2013) solve the potential complications raised by the possibility of saving by allowing it, but imposing an assumption that rules out wealth effects in bargaining.

[16] A side effect of this is that it does not enter a worker's outside option when bargaining with a new employer. Unless a worker's assets strongly affect bargaining, this is not very restrictive.

### *Value Functions*

*Workers*. The value of an unemployed worker is

$$rU_j = u(b) + \theta_j q_j (W_j - U_j). \tag{3}$$

The value of an employed worker is

$$rW_j = u(w_j) + \lambda \mathcal{X}(R_j) \left[ \frac{u(b_{\alpha_j}) - u(b)}{r + \theta_j q_j} - (W_j - U_j) \right], \tag{4}$$

where $j \in \{n, u\}$ denotes whether the worker is unionized (indexed $u$) or not (indexed $n$). A job loss occurs with probability $\lambda \mathcal{X}(R_j)$ and implies that the worker loses $W_j$ and gains $U_j$, augmented by the value of receiving income of $b_{\alpha_j}$ and not just $b$ for the duration of the unemployment spell.

*Firms*. The value of a vacancy for a firm in sector $j$ is given by

$$rV_j = -\kappa + q_j [J_j(1) - V_j]. \tag{5}$$

The free entry condition implies that this value must equal zero. Note that free entry also implies that firms are indifferent between entering the union and the non-union sector. Using this condition, it is possible to obtain the value of a job to an entering firm:

$$V_j = 0 \quad \forall j \Rightarrow J_j(1) = \frac{\kappa}{q(\theta_j)}. \tag{6}$$

The value of a job of productivity $x$ is given by

$$rJ_j(x) = xz - w_j + \lambda \left[ \mathcal{X}(R_j)(V_j - \alpha_j w_j) + \int_{R_j}^{1} J_j(y)\, \mathrm{d}\mathcal{X}(y) - J_j(x) \right]. \tag{7}$$

Firms destroy jobs if their value is negative, so the least productive surviving job has productivity $R_j$ such that

$$J_j(R_j) = -\alpha_j w_j. \tag{8}$$

*Unemployment*. By equating flows into and out of unemployment for each type, unemployment rates by type are

$$u_j = \frac{\lambda \mathcal{X}(R_j)}{\lambda \mathcal{X}(R_j) + \theta_j q_j}. \tag{9}$$

Moreover, $\sum_j u_j \zeta_j = u$.

*Bargaining*. A union's problem is to

$$\max_{w,\alpha} W_u, \tag{10}$$

subject to optimal behavior by firms.[17]

For non-unionized workers, the bargained wage and severance payment solve the Nash-bargaining problem

$$\max_{w_n,\alpha_n} (W_n - U_n)^{\eta}[J_n(1) - V_n]^{1-\eta}. \tag{11}$$

For comparison, we also consider a union that cannot monopolistically set compensation packages, but that simply enhances the bargaining power of workers.

*Equilibrium*. A stationary equilibrium consists in value functions $W_j$ and $U_j$ for workers, value functions $J_j(x)$ and $V_j$ for firms, wages $w_j$, severance payments $\alpha_j$, job-destruction thresholds $R_j$, and labor market tightness in each sector $\theta_j$ such that

1. the value functions $W_j$, $U_j$, $V_j$, and $J_j(x)$ solve equations (4), (3), (5), and (7);
2. $w_u$ and $\alpha_u$ solve the unions' problems given in equation (10);
3. $w_n$ and $\alpha_n$ solve the bargaining problem between non-unionized workers and firms given in equation (11);
4. $R_j$ solves equation (8);
5. $u_j$ are given by equation (9); and
6. $\theta_j$ are consistent with $u_j$ and are stationary.

## IV. Theoretical Analysis

In this section, we solve the bargaining problem and that of the monopolistic union, and we show the general equilibrium effects of severance pay.

[17]Quantitative results are similar if the union cares about both employed and unemployed workers in the union sector, with an objective function $(1 - u_u)W_u + u_u U_u$. Note that the objective function $(1 - u_u)W_u$, which at the surface appears plausible, implies that the union assigns a value of zero to unemployment. This will in general be wrong and, depending on the utility function, can be an overstatement or an understatement. This objective function thus implies implausible union behavior, such as reducing wages to drive $u$ to zero in a case where $W_u \gg 0$, even if $U_u$ is close to $W_u$ and far from zero.

### *Bargaining over Wages and Severance Pay*

Solving the bargaining problem shows that the presence of severance pay allows for full insurance. This is possible because firms are risk neutral and thus are willing to absorb the uncertainty workers face. The first-order conditions of equation (11) with respect to $w$ and $\alpha$ are

$$\frac{\eta}{W-U}[u'(w)+\lambda R\alpha u'(b_\alpha)]=\frac{1-\eta}{J}(1+\alpha\lambda R) \tag{12}$$

and

$$\frac{\eta}{W-U}u'(b_\alpha)=\frac{1-\eta}{J}, \tag{13}$$

where we omit the $n$ subscripts for conciseness. Combining these implies

$$u'(w)=u'(b_\alpha), \tag{14}$$

(i.e., full insurance). This also implies

$$\eta J=(1-\eta)\frac{W-U}{u'(w)}. \tag{15}$$

Without the possibility of severance pay, the same sharing rule arises. With severance pay, workers "pay" for their insurance through a reduced wage (see the following subsection on equilibrium effects). This implies higher $u'(w)$ and, because of this higher marginal utility, a larger effective weight of workers in the bargaining problem, giving them a larger share of the surplus than without severance pay. (Comparing equilibria, $J$ could actually fall with the introduction of severance pay.)

### *Equilibrium Effects*

If there were no severance pay ($\alpha = 0$), then equilibrium would correspond to that of the standard Mortensen–Pissarides model. There, the free entry condition yields a job-creation (JC) curve and bargaining yields a wage curve. Here, these curves are given by equations (6) and (15), respectively. In $(\theta, w)$-space, the JC curve is downward sloping and the wage curve is upward sloping. The intersection pins down a unique equilibrium $(\theta, w)$ pair.

These same curves can be drawn for any fixed $\alpha$. Raising $\alpha$ shifts both curves down (see Figure 5, and see the Online Appendix for further details of the argument). The JC curve shifts down because at given $\theta$, lower wages are required for an entering firm to break even if there is severance pay. As introducing $\alpha$ reduces the firm's but not the worker's surplus, the wage curve must also shift down for equation (15) to hold. The wage curve shifts down less than the JC curve, implying a fall in tightness. In equilibrium,

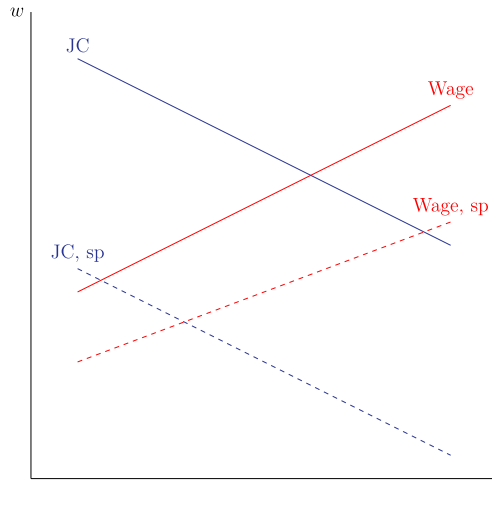


*Fig. 5.* JC (blue) and wage (red) curves with (dashed) and without (solid) severance pay [Colour figure can be viewed at wileyonlinelibrary.com]

lower tightness implies lower $J(1)$ due to free entry. At the old tightness, the bargained wage is too high to allow for entry, so the new tightness must be lower. Or the other way round, at the old tightness and the wage given by the JC condition, the firm's surplus is unchanged but workers might lose – thus, it cannot be that wage curve shifts down so far.

Do employers charge workers an actuarially fair "price" for the insurance they provide? The cost to the firm of providing severance pay is an eventual payment of severance pay. With discounting, the expected cost is $\lambda R \alpha w/(r + \lambda R)$. The benefit is that they pay a wage that is $\Delta w$ lower every period until match dissolution. The expected benefit then is $\Delta w/(r + \lambda R)$. If insurance were actuarially fair, then the expected cost and benefit would be equal, or

$$\frac{\Delta w}{w} = \alpha \lambda R. \tag{16}$$

In our quantitative results, it turns out that workers pay less than this. This is possible because of bargaining combined with free entry: while "actuarially unfair" insurance should drive the insurer out of the market, in this setting it just reduces the number of active insurers.[18]

[18]This is an accounting view of what is actuarially fair. In the model, an economic view matters: severance pay, even if compensated by a lower wage, affects firm value through the effect on a

### *Unions and Severance Pay*

Next, we consider the levels of wages and severance pay chosen by a monopolistic union. In this section, we focus on the case where the monopolistic union sets both wages and severance pay unilaterally, taking firms' reactions to its choices into account. In the quantitative analysis, we also consider the case where the union only sets wages, and the case of a union that cannot act as a monopolist, but simply has higher bargaining power than workers.

We assume that the union cares only about employed workers, so its objective function is $W_u$. (In the following, we again suppress sector subscripts for conciseness.) It maximizes this objective by choosing $w$ and $\alpha$, taking into account how firms' vacancy posting and separation decisions react to its choices. That is, the union internalizes the effects of its choices on the productivity threshold $R$ and on market tightness $\theta$. Thus, the union's problem is to maximize $W_u$, given in equation (4), subject to equations (6), (7), and (8).

The problem can be solved by appropriately rewriting the union's objective function (see the Online Appendix) and taking first-order conditions with respect to $w$ and $\theta$. These conditions are

$$e\,u'(w) + (1-e)\,u'(b_\alpha)\left[(r+\theta q)\alpha + \alpha w\frac{\partial \theta q}{\partial w}\right] + \frac{\partial e}{\partial w}[u(w)-u(b_\alpha)] = 0 \quad (17)$$

for the choice of $w$, and

$$(1-e)\,u'(b_\alpha)\left[(r+\theta q)w + \alpha w\frac{\partial \theta q}{\partial \alpha}\right] + \frac{\partial e}{\partial \alpha}[u(w)-u(b_\alpha)] = 0 \quad (18)$$

for $\alpha$, where

$$e \equiv \frac{r+\theta q}{r+\theta q+\lambda R}.$$

As $r$ goes to zero, $e$ converges to the fraction of time an infinitely lived agent spends in employment, or $1-u$. Both conditions clearly show the union's trade-off: higher $w$ or $\alpha$ are valued, but generate two equilibrium effects. First, by reducing tightness and thus raising the duration of unemployment, higher $w$ or $\alpha$ reduce the flow value $(r+\theta q)\alpha w$ of any given severance payment. Second, they affect the duration of employment, as captured by $e$.

The solution to this problem is given in the following lemma.

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firm's behavior. "Fair" severance pay would then be such that firm value is unaffected, that is, on the new (new $\alpha$) JC curve. We show results for this below.

**Lemma 1.** *The monopolistic union chooses full insurance ($w = \beta_\alpha$) and chooses w such that*

$$r + \theta q = -\alpha \frac{\partial \theta q}{\partial a}. \tag{19}$$

*An alternative, less condensed statement giving optimal $\alpha$ as a function of parameters and other equilibrium variables is in equation (18) in the Online Appendix.*

*Proof*: See the Online Appendix. □

With full insurance, utility in employment and unemployment are identical, eliminating the first cost of higher wages. The second cost remains, limiting how much match surplus the monopolistic union can extract. From this perspective, one can think of the union's problem as which fraction of the surplus to extract, via wage setting, while maintaining a level of severance pay that achieves full insurance for any wage. As shown in the quantitative analysis below, the level of severance pay required for full insurance can increase rapidly in the wage. The reason is that insuring higher wages requires higher $\alpha$ not only because the flow value of unemployment, $b$, is fixed, but also to compensate for the reduction in tightness and associated longer unemployment spells resulting from higher $w$. However, these higher levels of severance pay in themselves also negatively affect job creation. At some point, the union cannot extract further surplus because the flow value of severance pay has reached a maximum: increasing $\alpha$ further, as required to insure a further wage increase, would reduce tightness so much that the flow value of severance pay would actually decline. This is the point at which equation (19) holds.

Note that it is because of the union setting severance pay, and choosing full insurance, that we can obtain the expression in equation (19) pinning down $\alpha$, and thus the limits on surplus extraction by the union. Otherwise, optimal surplus extraction would simply be governed by the first-order condition with respect to $w$ in equation (17), which is more cumbersome.

## *A Rough Calculation*

Full insurance implies that bargaining parties choose severance pay such that $b_\alpha = w$, no matter the mode of bargaining. Using $b_\alpha = b + (r + \theta q)\alpha w$ and defining $b = \rho w$, this implies that full insurance $\alpha = (1 - \rho)/(r + \theta q)$. Clearly, optimal $\alpha$ decreases in the job-finding rate. Measured per year of service, it increases in the separation rate.

Taking a typical UI replacement rate of 60 percent, an annual interest rate of 4 percent, and a typical continental European monthly job-finding rate of 6 percent (Elsby *et al*., 2013), this yields full-insurance severance

pay of 6.7 months' wages. Given a typical monthly unemployment inflow rate of 0.6 percent (i.e., typical expected job duration of 14 years), this implies average severance pay of two weeks per year of service. Using numbers more fitting for the US economy (i.e., a replacement rate of 50 percent, a job-finding rate of 56.5 percent, and a separation rate of 3.6 percent) implies average severance pay of 0.9 months, or one and a half weeks per year of service, close to the typical contractual severance pay arrangements reported by Parsons (2012a).

The US and European numbers are not far apart. The reason is that the job-finding rate and separation rate closely covary positively across countries (see, e.g., figure 1 of Elsby *et al*., 2013), exercising opposite effects on the full-insurance severance pay arrangement when measured per year of service.

## V. Quantitative Analysis

In this section, we calibrate the model to eight continental European economies. We then assess union behavior, when severance pay is not a choice, under two assumptions about the union objective function. Next, we examine what happens when mandatory severance pay is eliminated. With parameters describing the functioning of each country's labor market in hand, we then attempt to understand determinants of actual policies by computing counterfactual severance pay arrangements for each economy and comparing them with the ones that are observed.

### *Calibration*

We calibrate the model by setting a set of parameters to values commonly used in the literature, and by choosing the remaining parameters to match a set of informative data moments for a set of eight countries. The first set of parameters is assumed to be common across countries, while the second set differs across countries, in line with cross-country variation in the targets. The countries we consider in the analysis are Belgium, France, Germany, Italy, Norway, Portugal, Spain, and Sweden. These are the four largest (in terms of GDP) Eurozone members, plus four countries (Belgium, Portugal, Norway, and Sweden) that differ substantially in labor market dynamics both from each other and from other Eurozone members.[19] This selection of countries, while based on data availability, results in a broad set of fairly heterogeneous economies, with the common thread that severance pay plays a role in them. For tractability, we assume that parameters are identical in

[19]Note that Norway and Sweden are not part of the Eurozone.

the union and non-union sectors of each economy, and we calibrate the non-union sector, under the assumption that the data are generated in the same way.

The first set of parameters we choose is common across countries. First, we choose the time period to be a month. Given that the maximum observed monthly job-finding rate in our data set is 38.5 percent (Norway) and that the cross-country average is much lower (13.2 percent), this is an appropriate choice of frequency. We set the monthly interest such that the yearly interest rate equals 4 percent. We set the coefficient of relative risk aversion $\sigma$ to 2, well in the middle of the range typically considered in the literature.

In the labor market, we set the matching efficiency $A$ to unity in each country. This is a normalization. We set the elasticity of the matching function with respect to unemployment, $\mu$, to 0.5, in line with the estimates reported in Petrongolo and Pissarides (2001). For workers' bargaining power $\eta$, we also adopt a value of 0.5.

On the firm side, we set initial match productivity $1 \cdot z$ to 10, and continue to assume that the distribution of shocks, $\mathcal{X}$, is uniform in the range $[0, 1]$. Finally, for the benchmark economy, we take severance pay $\alpha$ from the data described above, and assume that firms and workers bargain only over wages.[20]

Finally, we calibrate the shock arrival rate $\lambda$, the vacancy posting cost $\kappa$, and the flow value of unemployment $b$ to match three targets for each country: the unemployment rate, the job-finding rate, and the UI replacement rate. Table 1 gives an overview of data moments, model moments, and a few additional relevant statistics. Key target moments are from Elsby *et al*. (2013) and from the OECD. (See the table notes for detail on our sources.)

All target moments vary substantially across the eight economies considered here. The average unemployment rate over the sample period varies from lows of 4.1 percent in Norway and 4.3 percent in Sweden, to a high of more than 15 percent in Spain. Job-finding rates vary similarly, from high rates of almost 40 percent monthly in Norway and almost 30 percent in Sweden, to rates of 4–7 percent per month in the remaining economies. Job-destruction rates also vary by a factor of 3, from low rates of 0.4 percent per month in high severance pay economies such as Belgium and

[20]See Table 1 for the exact values used. In choosing the most appropriate values among those reported above, we adopt two criteria. First, above, we report values of severance pay for different levels of tenure. To choose among these, we consult average completed job tenure as implied by the job-destruction rate and we choose severance pay for the closest value of tenure. Second, we consider only the component of severance pay that is mandatory, that is, either directly implied by law or implied by laws together with the functioning of the judicial system.

Table 1. *Country statistics, data, and model*

| Country | Calibration targets: data moments | | | Calibration targets: model moments | | | Other country statistics | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Unempl. rate (%) (1) | Job-find. rate (%) (2) | UI repl. rate (%) (3) | Unempl. rate (%) (4) | Job-find. rate (%) (5) | UI repl. rate (%) (6) | SP at average completed tenure (7) | Job-destr. rate (%) (8) | Union mem. rate (%) (9) | Union coverage (%) (10) |
| Belgium | 6.1 | 7.3 | 59 | 5.8 | 7.0 | 69.9 | 15 | 0.4 | 50 | 96 |
| France | 8.1 | 7.7 | 67 | 8.1 | 7.7 | 69.3 | 5 | 0.7 | 8 | 98 |
| Germany | 8.3 | 6 | 70 | 8.3 | 6.0 | 71.1 | 6 | 0.5 | 18 | 62 |
| Italy | 9.8 | 4.3 | 70 | 9.5 | 4.2 | 77.0 | 26 | 0.4 | 35 | 80 |
| Norway | 4.1 | 38.5 | 70 | 4.1 | 38.5 | 71.0 | 2 | 1.6 | 52 | 70 |
| Portugal | 6.2 | 6.3 | 76 | 6.2 | 6.4 | 73.7 | 8 | 0.4 | 19 | 92 |
| Spain | 15.4 | 6.3 | 72 | 15.1 | 6.2 | 78.8 | 10 | 1.1 | 19 | 70 |
| Sweden | 4.3 | 29.2 | 60 | 4.2 | 28.5 | 71.8 | 4 | 1.2 | 70 | 88 |

*Sources*: Elsby *et al*. (2013) for the average unemployment rate, job-finding and job-destruction rates, covering periods from the late 1970s/early 1980s to 2010, with slight variation in coverage across countries. The UI replacement rate is the net replacement rate in the initial phase of unemployment in 2012, for an average earner in a one-earner married couple with two children, excluding cash housing assistance or other "top ups". The data are available in the OECD Tax-Benefit models at http://www.oecd.org/social/soc/benefitsandwagesoecdindicators.htm.

*Notes*: All flow rates are monthly. Severance pay (SP) is also in units of monthly earnings. UI stands for unemployment insurance. Severance pay, union membership, and coverage rates are as described in Section II.

Portugal, to rates of 1.2–1.6 percent per month in the more dynamic labor markets of Norway and Sweden. The high Spanish average unemployment rate clearly results from the combination of a typical continental European low job-finding rate with a high job-destruction rate that would be more typical of a dynamic Scandinavian labor market. UI replacement rates vary much less across countries, and range from about 60 to about 70 percent in the initial period of unemployment. (While they might be lower later on, these reductions come only after relatively long periods in most countries, and never in some. See the OECD source for details.)

The model matches targets fairly well overall, in particular the unemployment rate and the job-finding rate. The only exception is the UI replacement rate in a few model economies, in particular Spain, where the model has difficulty generating high enough unemployment rates (and, indirectly, job-destruction rates) without using replacement rates that exceed those provided by the UI system. The calibrated UI replacement rates in these cases can be interpreted as including other sources of income, such as family transfers, or increased leisure in unemployment on top of UI benefits. They can also capture the effect of labor market dualism, which implies that in a segment of the labor market where temporary contracts are used extensively, there is little or no employment protection, implying high job destruction and thus unemployment inflow rates for workers in this market segment. This market segment is large in some countries, such as Spain and Italy (see also Bentolila *et al*., 2012a). Bercause we do not explicitly model this segment, the calibration picks up its effect on unemployment via a relatively high value of $b$.[21]

Column 8 of Table 1 reports the observed job-destruction rate. The model job-destruction rate is related to the unemployment rate and the job-finding rate through the Beveridge curve. Because these two moments fit well, the model generally also fits the job-destruction rate well.

The calibration also fits non-targeted moments well. For instance, on average across countries, about half of the steady-state change in unemployment in response to a productivity change is due to changing job destruction, similar to the numbers documented by Elsby *et al*. (2013). The model cross-steady-state semi-elasticity of wages of new hires with respect to the unemployment rate is, on average, 1.9 percent. There is no evidence for this statistic for all European countries, but Carneiro *et al*. (2012) and Martins *et al*. (2012) report elasticities of wages of new hires of 1.8–2.7 percent for Portugal. (The model number for Portugal is 2.8

[21] In principle, one could also expect job creation to be high for workers on temporary contracts. As a result, the effect of the existence of this segment on the unemployment rate is ambiguous, as higher job creation could compensate for the effect of higher job destruction. In practice, the effect of easier job destruction appears to dominate.

Table 2. *Country-specific calibrated parameters and model-implied match survival threshold R*

| Country | $\lambda$ | $\kappa$ | $b/z$ | $R$ |
|---|---|---|---|---|
| Belgium | 0.013 | 5350.7 | 0.378 | 0.344 |
| France | 0.016 | 3709.4 | 0.391 | 0.409 |
| Germany | 0.010 | 6269.4 | 0.437 | 0.513 |
| Italy | 0.014 | 7581.4 | 0.426 | 0.318 |
| Norway | 0.044 | 316.5 | 0.398 | 0.376 |
| Portugal | 0.007 | 5477.9 | 0.486 | 0.582 |
| Spain | 0.029 | 2546.3 | 0.448 | 0.375 |
| Sweden | 0.034 | 516.2 | 0.399 | 0.365 |

percent.) The model thus provides a good picture of job flows across the calibration countries, something that is essential for evaluating the effects of changes in severance pay.

Calibrated parameters are shown in Table 2. They differ substantially across countries. This is most striking for the shock arrival rate $\lambda$ and the vacancy posting cost $\kappa$. Because of the different economic structures of the eight countries considered here, combined with differences in labor market institutions, it is not surprising that such differences should exist. To name an example, higher observed job-destruction rates, such as those in Norway or Spain, translate into higher calibrated shock arrival rates $\lambda$. Note that the levels of the vacancy posting costs $\kappa$ are not meaningful because they depend on the normalization of $A$. Because that normalization is common, they can be compared across countries though. It is clear that they covary closely (negatively) with the worker job-finding rates shown in Table 1. Finally, the table shows income in unemployment, $b$, as a fraction of the output of a new match. As the wage is only a fraction of that output, the model UI replacement rate is higher than this ratio, as is clear in Column 6 of Table 1.

The last column of Table 2 shows $R$, the minimum match productivity required for survival. This also differs substantially across countries.[22] This highlights how observed job-destruction rates depend on both the shock arrival rate and the match termination decision. For example, while shocks arrive less frequently in Germany compared with Belgium, the survival threshold is higher, implying that the resulting job-destruction rates are similar. France has a higher shock arrival rate than Italy, and also a higher survival threshold. Both factors together imply a larger job-destruction rate

[22]Apart from worker flows, this also translates into differences in average match productivity, which increases in $R$. These are not the focus of this paper.

in France. The differences in $R$ arise from firm behavior, and reflect both differences in severance pay and in the cost of hiring.

The model thus replicates job flows in a broad set of European labor markets reasonably well, although in a few cases it needs to resort to values of the UI replacement rate above those implied by the UI system in order to match observed unemployment rates. With the calibrated parameters in hand, we can move on to the next step and analyze union wage setting behavior in this model.

### *Union Behavior*

To analyze union behavior, we contrast the calibrated benchmark economies – the non-union sector, where wages are determined by bargaining – with the union sector, under two assumptions on union behavior. For now, we keep severance pay fixed at the level in the benchmark economy, and we take it to be exogenous.

We consider two types of union behavior. First, we consider a monopolistic union, as analyzed in the subsection on unions and severance pay in Section IV. Here, the union can set the wage unilaterally. Firms then decide to post vacancies optimally and terminate jobs optimally, taking this wage and mandated severance pay as given. As above, we assume that the union cares only about employed workers, so its objective function is $W_u$. Secondly, we follow Açıkgöz and Kaymak (2014) and consider a union that bargains with firms, but has higher bargaining power than workers bargaining alone. To simplify the presentation of results, we show the effects of unions for two economies (France and Spain) with very different levels of severance pay only. They are qualitatively and even quantitatively similar for the other economies.

Table 3 shows results for these cases. With bargaining, workers obtain slightly more than half of the output of a new match.[23] Slightly more than a third of matches are destroyed when receiving a new productivity draw. Unemployment, job destruction, and job creation are as in the data, as parameters were chosen to match these.

A union that maximizes $W_u$ charges a substantially higher wage, so workers keep two-thirds to three-quarters of the output of a new match. As a consequence, 60–70 percent of matches are destroyed when receiving a new shock (they become unprofitable at such high wages, and remain so for long enough to warrant destruction), and tightness is much lower. This results in much higher unemployment and much lower job-finding rates.

These changes are easy to understand in the context of the usual DMP framework. Job destruction in our framework turns out to depend only on

[23] Recall that we assume that the wage is constant throughout the lifetime of a match.

Table 3. *Union behavior (exogenous severance pay): selected countries*

| Outcome | France | | | Spain | | |
|---|---|---|---|---|---|---|
| | Bargaining | Monop. union | Bargaining power union | Bargaining | Monop. union | Bargaining power union |
| $w/z$ | 0.564 | 0.749 | 0.637 | 0.569 | 0.677 | 0.619 |
| $R$ | 0.409 | 0.699 | 0.537 | 0.375 | 0.573 | 0.475 |
| $\theta$ relative to benchmark | 1.000 | 0.165 | 0.573 | 1.000 | 0.163 | 0.593 |
| $u$ (%) | 8.1 | 26.9 | 13.2 | 15.1 | 40.1 | 22.5 |
| Job-destruction rate (%) | 0.7 | 1.1 | 0.9 | 1.1 | 1.7 | 1.4 |
| Job-finding rate (%) | 7.7 | 3.1 | 5.8 | 6.2 | 2.5 | 4.8 |

*Notes*: In each panel, the first column shows benchmark results. The second column shows the monopolistic union maximizes $W_u$ by choosing the wage rate, which firms take as given. The third column shows wages are bargained, but workers' bargaining power is set to 0.65 (instead of 0.5 in the benchmark) to reflect union power. Job-destruction and job-finding rates are monthly rates.

the wage, and not on tightness, as $J(R)$ does not depend on tightness. Job creation, given a wage, declines in $R$, as higher $R$ implies that matches are shorter lived. At the same time, job creation is also declining with the wage. As the union asks for a higher wage, this higher wage implies higher $R$, and thus lower tightness, both directly and indirectly because of the change in $R$.

Note that this union does not care directly about the level of unemployment. Of course, it does indirectly care about it, as the value of employment $W_u$ depends on both the value of unemployment and the job-destruction probability. Yet, if $U_u$ is not too low, the union is willing to trade off a higher probability of job destruction for higher value jobs.

Finally, we consider a union that is not monopolistic, but only enhances worker's bargaining power. We set $\eta = 0.65$, resulting in a wage that is about 10 percent higher than in the bargaining case.[24] The higher wage leads to more job destruction, lower tightness, and a lower job-finding rate. Unemployment increases, but much less than for the monopolistic union, as the job-finding rate still remains relatively high. Worker value $W_u$ of course increases, as the effect of the higher wage outweighs that of a longer unemployment duration.

## *Effect of Mandated Severance Pay*

Next, we explore the effect of exogenously mandated severance pay on wage bargaining and on union wage setting. For this, we evaluate the

[24]The union wage premium differs across countries, and is the subject of ongoing research. Selection into/out of union jobs/firms makes it hard to identify. Açıkgöz and Kaymak (2014) find an average union wage premium of 20 percent for the United States, controlling for individual characteristics but not for selection on unobservables. Estimates are lower when selection is takin into account.

Table 4. *Effect of eliminating severance pay: selected countries*

| Outcome | France | | | Spain | | |
|---|---|---|---|---|---|---|
| | Bargaining | Monop. union | Bargaining power union | Bargaining | Monop. union | Bargaining power union |
| Benchmark = 1 | | | | | | |
| $w/z$ | 1.019 | 1.013 | 1.022 | 1.086 | 1.092 | 1.108 |
| $R$ | 1.093 | 1.042 | 1.072 | 1.361 | 1.219 | 1.310 |
| $\theta$ | 1.034 | 1.429 | 1.104 | 1.103 | 2.122 | 1.233 |
| Percentage point difference from benchmark | | | | | | |
| $u$ | 0.56 | −2.62 | 0.23 | 3.62 | −4.19 | 3.01 |
| Job-destruction rate | 0.06 | 0.05 | 0.06 | 0.40 | 0.37 | 0.43 |
| Job-finding rate | 0.13 | 0.61 | 0.29 | 0.31 | 1.14 | 0.53 |

*Notes*: Results are relative to those in Table 3, for the same bargaining mode for each country. Notes from that table apply.

effect of eliminating any type of severance pay in two countries: France (low severance pay) and Spain (high severance pay). Results are shown in Table 4.

Severance pay discourages match dissolution, so eliminating it leads to higher $R$ and slightly higher job destruction under all types of wage determination. This change is small where severance pay was small to begin with (France), but is large in Spain, where severance pay is larger. (Here, the job-destruction rate changes by almost half a percentage point, from 1.1 to 1.5 percent per month for the bargaining case.) Eliminating severance pay also raises the value of jobs and thus job creation. As a consequence, it raises tightness under all types of wage determination. Because the presence of mandated severance pay reduces wages, eliminating it results in wage gains. These are very substantial at close to 10 percent for the economy with a high level of mandated severance pay (Spain).

The effect of eliminating severance pay on unemployment is ambiguous. This is in line with the ambiguous effect of firing costs on employment in general equilibrium models shown, for example, in Hopenhayn and Rogerson (1993) and particularly in Ljungqvist (2002). The reason is that while eliminating severance pay encourages job creation, the effect on job destruction outweighs this in most cases. In our calibrated economies, eliminating severance pay does not reduce unemployment in any single case when wages are bargained. In the case of a monopolistic union, however, eliminating severance pay reduces unemployment in all cases. The reason for this is that in these high-wage economies, job-finding rates are very low, so that increasing them has a powerful effect on the unemployment

Table 5. *Bargained severance pay: selected countries*

| Outcome | France | | | Spain | | |
|---|---|---|---|---|---|---|
| | Bargaining | Monop. union | Bargaining power union | Bargaining | Monop. union | Bargaining power union |
| Severance pay | 3.9 | 17.7 | 6.3 | 3.7 | 12.2 | 6.1 |
| Benchmark = 1 | | | | | | |
| $w/z$ | 1.005 | 0.940 | 0.992 | 1.052 | 0.980 | 1.039 |
| $R$ | 1.024 | 0.851 | 0.976 | 1.228 | 0.949 | 1.121 |
| $\theta$ | 1.000 | 0.494 | 0.959 | 1.079 | 0.863 | 0.953 |
| Percentage point difference from benchmark | | | | | | |
| $u$ | 0.17 | 3.94 | −0.04 | 2.27 | 0.51 | 2.50 |
| Job-destruction rate | 0.02 | −0.17 | −0.02 | 0.25 | −0.09 | 0.17 |
| Job-finding rate | 0.00 | −0.93 | −0.12 | 0.24 | −0.18 | −0.11 |
| Severance pay comparison | | | | | | |
| Benchmark | 5 | | | 10 | | |
| Bargaining | 3.8 | | | 3.7 | | |
| Full insurance (partial equilibrium) | 3.8 | | | 3.7 | | |

*Notes*: Results are relative to those in Table 3, for the same bargaining mode for each country. Severance pay is measured in months of earnings.

rate. In addition, $R$ increases less with the elimination of severance pay in the monopolistic union case, as it already starts from a high base.

## *Bargaining over Severance Pay*

The calibration uses levels of severance pay as they are legislated, or as they affect firms through laws combined with the judicial system. As shown in Section II, it is also common in some countries to see *ex ante* negotiated severance pay. In this section, we ask the following question. What level of severance pay would bargaining workers or a union choose when bargaining/choice is over both the wage and the level of severance pay? Results are shown in Table 5.

Bargaining workers in the model economy calibrated to France choose to receive four months' wages as severance pay. As this is slightly less than the benchmark level, it allows them to negotiate a slightly higher wage. The lower level of severance pay leads to a small increase in job destruction and unemployment.

While bargained severance pay is very close to the observed level of severance pay for France, this is not the case for Spain. There, bargaining

workers choose much lower severance pay than in the benchmark. This allows them to obtain 5 percent higher wages. Of course, with lower severance pay, job destruction rises. Tightness changes little, as higher wages compensate for the effect of lower severance pay. As a result, the job-finding rate increases only slightly, and the unemployment rate increases as a result of the increase in job destruction.

In both cases, the level of severance pay chosen by workers is the level that offers full insurance in the model economy. It is perhaps surprising that in the calibration for Spain, bargained severance pay is essentially identical to that for France. This result arises because the slightly lower Spanish job-finding rate (6.2 percent compared to 7.7 percent) is compensated for by a larger flow value of unemployment. As a result, the level of severance pay that achieves full insurance is similar in both countries.[25]

The line labeled "Full insurance" in the lower part of the table shows how much severance pay would be required to give unemployed workers full insurance in partial equilibrium, taking the benchmark wage rate and tightness as given. (This is essentially identical to an exercise conducted in Fella and Tyson (2013).) In both countries, the difference between general and partial equilibrium results is small. (The largest difference is in Germany, at 5.3 (general equilibrium) versus 4.6 (partial equilibrium).) The reason is that if bargaining results in, for example, lower severance pay, it will also result in higher wages and market tightness (see equilibrium effects in Section IV). The two changes have countervailing effects on the amount of severance pay required for full insurance.

Interestingly, actual severance pay exceeds full insurance levels in the model in both countries. In the next section, we study how our model can help us understand observed levels of severance pay.[26,27]

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[25]To the extent that the high level of $b$ in Spain picks up labor market dualism, as discussed above, one might expect the full insurance level of severance pay in Spain to be understated here. However, even if $b$ were identical in Spain and France, the bargained level of severance pay in Spain would still be 3.7 months' wages, as higher tightness (and thus shorter unemployment duration) compensates for the reduction in $b$.

[26]In contrast to our results, Fella and Tyson (2013) conclude that, in many countries, mandated levels lie below their model's optimal provision prescription, even for some economies with high levels of mandated severance pay. This conclusion is mostly because of differences in the data used. The job-finding rates we use in our calibration are from Elsby *et al*. (2013). These authors use the entire distribution of unemployment durations as reported in the OECD unemployment duration database (https://stats.oecd.org) for all available years up until 2009 to compute monthly job-finding rates. Fella and Tyson (2013) compute job-finding rates using the database of labor market indicators compiled by Nickell *et al*. (2002), which is based on annual data up to 1999. In many cases, they obtain substantially lower job-finding rates.

[27]The model does not include incentive considerations that would give rise to a dependence of severance pay on length of service, and therefore it cannot address this feature of the data. Furthermore, the model does not explain why only some contracts feature severance pay.

At this point, two important remarks are in order. First, it is important to realize that when markets are incomplete, severance pay does not simply act like deferred wages.[28] Severance pay provides insurance against job loss, and therefore helps to complete markets.

Second, whether the option to bargain over severance pay harms firms depends on the point of comparison. With bargaining over severance pay, firms always do at least as well as in the benchmark economy with mandated severance pay. This is because bargaining results in lower values of severance pay. Firm value is highest in an economy with no severance pay, and bargaining only over wages.

A monopolistic union demands three to four times as much severance pay as individually bargaining workers. This is what is required to obtain full insurance, given the high wage rates demanded by the union. Severance pay needs to rise to cover a larger gap between $w$ and $b$, and to compensate for the lower market tightness, which makes unemployment spells last longer, so that more resources are required to bridge them. In France, the monopolistic union's severance pay demand lies far above the actual level, while in Spain, it exceeds it slightly. This higher severance pay demand goes along with a lower wage demand compared with the union that only sets wages. Again, the lower wage does not entirely compensate firms for the cost of providing severance pay.

As in the bargaining case, higher severance pay leads to lower $R$ and thus less job destruction. At the same time, it reduces the value of vacancy posting, and thus implies lower tightness and a much lower job-finding rate. The latter dominates the reaction of unemployment, which is larger with severance pay.

One can decompose the union's severance pay demand to compare it with the bargaining outcome. With the union's wage demand, which is almost 25 percent larger than the bargained wage, but tightness from the bargaining outcome, full insurance requires $\alpha = 12.3$ for France. With the wage rate from the non-union sector, but the much lower tightness from the union sector, full insurance requires $\alpha = 5.9$. Compare this with the union's choice of $\alpha = 17.7$, and the bargained $\alpha = 4$. That is, 60 percent of the union's higher severance pay demand is required to insure the higher wage, and 40 percent to insure for the resulting longer unemployment duration. This ratio is very similar in all calibrated economies.

Finally, a union that just raises workers' bargaining power also chooses severance pay that provides full insurance. At the wage levels that this union achieves, this implies higher (lower) severance pay than observed in

[28]This is particularly clear in the model used here, where workers cannot save and severance pay can be annuitized, but it goes through as long as markets are incomplete.

France (Spain). In return for higher (lower) $\alpha$, this union accepts slightly lower (higher) $w$ compared with the case where this union only bargains over the wage.

Because bargaining parties choose to institute severance pay when they can, it is clear that some level of severance pay can be welfare improving. How much severance pay is desired clearly depends on the gap between $W$ and $U$, and on the expected duration of unemployment. In economies with high job-finding rates (e.g., the bargaining economy), positive but low levels of severance pay are optimal. In economies with low job-finding rates (e.g., the monopolistic union economy), substantially higher levels can be optimal. Comparing countries, the French job-finding rate is slightly higher than the Spanish one, while its calibrated income in unemployment is slightly lower. The first difference tends to favor lower severance pay in France compared with Spain, while the second difference pushes in the other direction. As a consequence, bargained levels of severance pay in the two countries resulting from the model are almost identical.

### *Severance Pay and Worker Welfare*

As has already been discussed, bargaining over severance pay can increase worker welfare noticeably, in particular when unemployment duration is large and when the values of employment and unemployment differ substantially. Given that mandated severance pay in many European countries substantially exceeds the level that is given as the bargaining outcome by the model, there is a question about how this "excess severance pay" affects workers' welfare.

As bargaining is joint, the bargained wage is the wage that maximizes match surplus conditional on the choice of $\alpha$. Therefore, the bargained wage is the same, no matter whether a certain level of $\alpha$ is bargained or imposed. Thus, the results reported for exogenously changed severance pay in Table 4 and for bargained severance pay in Table 5 are comparable.

When mandated severance pay exceeds levels that would be bargained, it leads to a lower wage rate, less job destruction, and less job creation. The overall effect on unemployment is negative in most cases ($u$ decreases). Worker welfare $(1 - u)W + uU$ still declines, as the gains from shorter unemployment spells do not compensate for lower wages.

Quantitatively, the welfare effects of severance pay in our calibrated economies are substantial. Compared with the benchmark with mandated severance pay, the increase in welfare from bargaining corresponds to that achieved by a perpetual increase in consumption between almost zero (France) and 2 percent (Italy), keeping $\theta$, $R$, and $u$ constant. Compared with a situation without severance pay, the gain lies around 2 percent of per period consumption, with a low of 1.1 percent in Portugal and a high

of 3.4 percent in Spain. Welfare losses can thus arise from both too high and too low levels of severance pay.

## VI. Explaining Severance Pay across Countries

Above, we have presented and quantified a set of theories of optimal severance pay. In this section, we compare the quantitative predictions of the model with observed levels of severance pay in order to assess how much of the cross-country variation the model can explain. It should be noted that, in doing so, we are very parsimonious in the use of information, as we only allow for differences across countries in three variables (unemployment, the job-finding rate, and the UI replacement rate), of which one varies little, to drive differences in predictions.

Results are shown in Figure 6.[29] It is clear that apart from a few countries (Norway, France, and Germany), the level of severance pay implied by the model with bargaining lies substantially below observed levels. In contrast, the level implied by the monopolistic union model lies substantially above observed levels, except for Norway, Sweden, and Spain, where it is close, and Italy, where it lies below the observed level. For most countries, the level predicted by the model in which the union serves to boost the bargaining weight of the workers lies close to the observed level; this fails only for Italy and Belgium, and to a lesser extent for Spain.

More formally, the $R^2$-values of bivariate regressions of observed severance pay on the three model-implied measures are 61 percent for the bargaining model, 42 percent for the monopolistic union model, and 33 percent for the bargaining power union model. The model can thus account for a substantial fraction of the variation in the data. Given the simplicity of the model and the limited degree of cross-country variation in model inputs, this can be seen as a good performance of the model.

The predictions of the model can also give some information on potential institutional determinants of observed severance pay legislation. In economies with low severance pay (Norway to Germany), legislated severance pay is not far from values that could be arrived at in bilateral agreements. In economies with intermediate to high values of severance pay (Portugal to Belgium), bargained levels are much lower than observed ones. This suggests that unions played a role in influencing legislation, as

[29]A similar figure, but without reference to unions, is shown in Fella and Tyson (2013). The difference is that here the model is recalibrated for each country separately to obtain predictions for optimal severance pay under the various scenarios, whereas in Fella and Tyson (2013) the exercise is partial equilibrium and uses observed job-finding rates and replacement rates. Thus, it does not take into account that changing severance pay policies or agreements will lead to changes in these variables.

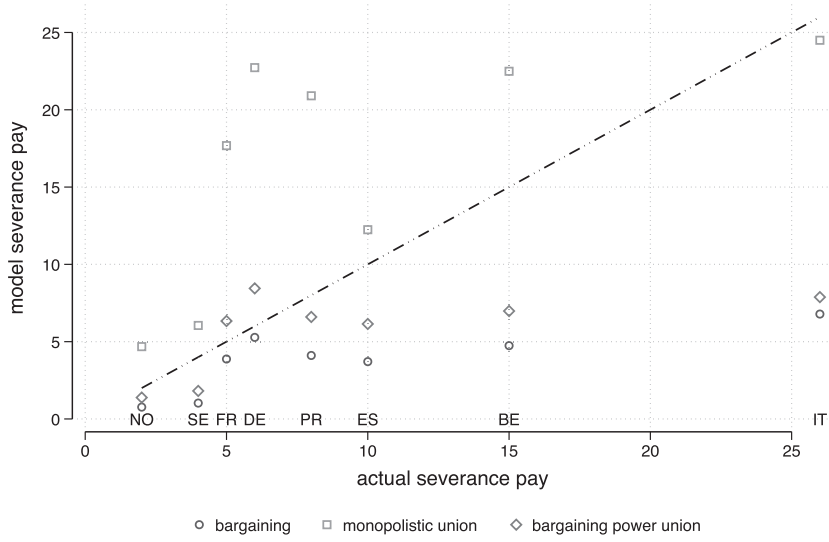


*Fig. 6.* Actual and model-implied severance pay across eight continental European countries
*Notes*: The figure shows actual and model-implied severance pay (as shown in Table 3 for France and Spain only), using the calibration shown in Tables 1 and 2. The diagonal line is the 45-degree line.

observed values are close to those that unions would prefer. Finally, Italy constitutes somewhat of an outlier. In a sense, according to the figures by the OECD and the World Bank cited above, severance pay is not very high in Italy. Yet effectively it is, as court action can make dismissals extremely costly. Surprisingly, it makes dismissals even more costly than even a monopolistic union would find optimal.

## VII. Conclusion

We have shown in a simple model of bargaining over severance pay that risk-averse workers and risk-neutral firms have an incentive to agree on severance pay providing full insurance. This is also the case when workers are represented by a union. Levels of bargained severance pay predicted by the model are close to those found in reality. Model predictions also show an important role for unions in the process, suggesting that observed levels of mandated severance pay might have been the outcome of a political process, where unions pushed for high severance pay in some countries but not others.

While our analysis has abstracted from potential distortions caused by severance pay, it also suggests substantial benefits, in particular from the

low levels of severance pay as would be bargained between private actors in the economies we analyze. When severance pay can complete markets, it does not simply constitute deferred wages. At the same time, excessive levels of severance pay clearly are not welfare-improving.

This analysis has ignored several potentially important theoretical issues, which we leave for future research. First, the case for severance pay would be weaker in a model that allows for saving by workers. In this case, severance pay awards would also affect subsequent job search behavior, as in Alvarez and Veracierto (2001). In practice, the workers who would benefit most from severance pay – consumption-poor job losers – also have very low savings, indicating that the effect of neglecting saving in the analysis might be limited. Secondly, severance pay typically increases with tenure. This suggests that it might be an optimal reaction to incentive problems within the firm, as suggested by Boeri *et al*. (2017). The effect of optimal within-firm severance pay in general equilibrium remains to be explored. Thirdly, in practice, in countries with substantial levels of privately bargained severance pay, coverage is incomplete and differs a lot across firms. It is particularly low in small firms. This can arise if credit-constrained firms are forced to hold provisions against potential severance pay liabilities. The interaction of credit constraints and optimal severance pay remains to be explored. Finally, when only some workers are covered by severance pay provisions, labor markets can segment, as observed in, for example, Spain and Italy. Addressing the effects of the resulting labor market dualism is an active research area (see references in the Introduction).

## Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

**Online Appendix**

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