Understanding Severance Pay Determination: Mandates, Bargaining, and Unions *

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Abstract

While most of the literature on employment protection has focused on government-mandated severance pay, it has recently been documented that a substantial share of severance payments derives from private contracts or collective agreements. This paper studies the determination of these payments. We analyze the problem of joint bargaining over wages and severance payments and examine the impact of unions on these choices. To do so, we use a search and matching model with risk averse workers, in which we assume that workers may be unionized and that bargaining is over wages and severance pay. Bargaining results in levels of severance pay providing full insurance, which depend on the generosity of unemployment benefits and on the job finding rate. Unions opt for higher levels of severance pay given that their higher wage demands imply reduced job creation. Calibrated to 8 European economies, the model predicts bargained levels of severance pay which are close to those found in reality.

Keywords: Severance pay; Unions; Bargaining; Diamond-Mortensen-Pissarides models

JEL Class.: E24, J32, J33, J64, J65

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1 Introduction

Job termination can have important welfare consequences for workers. As a result, severance pay arrangements exist in many countries around the world. These arrangements differ substantially. In some countries, like Canada or Spain, severance pay is government-mandated. In others, like Japan or the US, it is reached through private bargaining. In other countries yet, it is partly government-mandated and partly reached through bargaining (e.g. Belgium, France, Germany, Italy). In countries where severance pay arrangements are reached privately, this can occur through individual contractual arrangements, or in 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, Kodrzycki (1998) shows, using data from Massachusetts in which 86% of workers were covered by a severance pay agreement, that a typical arrangement features severance pay of one week's wage per year of service. Assuming a 50% replacement rate of unemployment insurance, this implies that total severance pay receipts are higher than maximum potential unemployment insurance receipts for workers with more than 13 years of tenure. On average, severance pay payouts amount to 43% of maximum available unemployment insurance receipts for displaced workers in her sample.

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 to the ones that would come out of private arrangements. The main aim of this paper therefore is a theoretical and quantitative analysis of private bargaining over severance pay. We conduct this analysis in a standard Diamond-Mortensen-Pissarides (DMP hereafter) model with bargaining not only over wages, but also over severance pay. This setup then allows assessing how counterfactual, simulated estimates of privately bargained severance pay compare to 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. An additional contribution of this paper thus is to analyze union behavior in this context. This turns out to be important for understanding arrangements in several countries.

[1] See Holzmann, Pouget, Vodopivec, and Weber (2012), particularly Annex B, for a classification of countries by type of severance pay arrangement, as well as Laga (2012) for some country specific details.

[2] An important exception, which we discuss below, is Fella and Tyson (2013).

Before delving into the theoretical analysis, we discuss evidence on severance pay in Europe (Section 2). In doing so, we do not limit ourselves to existing measures like those from the World Bank and the OECD, which only cover legally mandated severance pay, but particularly focus on negotiated components of severance pay resulting from bargaining. Of course, privately bargained severance pay may 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 *à la* Mortensen–Pissarides with endogenous job destruction and risk averse workers, and add *(i)* unions as in Delacroix (2006), and *(ii)* bargaining over wages and severance payments as in Booth (1994). 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 unemployment insurance (UI) replacement rate and the job finding rate. Expressed relative to average completed tenure, it also depends on the job destruction rate.

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. The calibrated model is able to match the country data well, especially unemployment rates, job finding rates, and, as a consequence, job destruction rates. This is although we only allow three parameters to differ from country to country. We find that these parameters indeed differ considerably across countries. Despite the overall good fit of the model, the calibration exercise also reveals an interesting tension: In some countries, in particular Belgium, Italy and Spain, the model requires a somewhat higher UI replacement rate than that reported by the OECD to match observed unemployment rates, given the job finding rate. Our analysis thus provides further insights into differences in the functioning of labor markets across these economies. We then first use the calibrated model to compare outcomes from bargaining to union behavior, taking severance pay as given. This reveals that even when the unemployed enter the union's objective function, unions set a higher wage than that bargained individually by workers. This results in higher unemployment, as the job finding rate decreases and the job destruction rate increases.

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 unions set wages.

Bargaining over severance pay leads to levels of severance pay providing workers with full insurance. Firms get compensated for this expense by wages that are slightly lower than those in a situation without severance pay. Job destruction decreases compared to a case where severance pay is not available, but so does job creation. Again, the former dominates when benchmark unemployment is low. Unions choose to set substantially higher levels of severance pay than those bargained individually. This is optimal for them due to the lower job finding probabilities caused by their high wage demands.

Two additional remarks are in order at this point. First, why would firms agree to bargain over severance pay, and not only over wages? To answer this question, we also consider a setting with bargaining over severance pay under the condition that firms do not lose relative to a situation with wage bargaining only. Even in this situation, positive levels of severance pay are agreed. This illustrates clearly the welfare gains that can be reaped from adding severance pay to the set of bargaining instruments. Second, this result highlights that with incomplete markets, severance pay amounts to more than just deferred wages. It completes markets for workers, and thus raises welfare.

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 33% and 46% of the cross-country variation in severance pay. One way of understanding mandated levels of severance pay in most countries thus 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 literature on severance pay essentially has ignored negotiated severance pay and studied government-mandated severance pay only. 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 authors have argued that firing costs, and with them severance pay, can affect productivity and growth. Hopenhayn and Rogerson (1993) show that firing costs induce costly misallocation. Bertola (1994), Poschke (2009), and Raurich, Sánchez-Losada, and Vilalta-Bufí (forthcoming) show that firing costs can affect growth through their effect 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, Leonardi, Messina, and Pica (2010) and Conti and Sulis (2010) provide supportive evidence.

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, Boone, and Van Ours (2007) find that strict dismissal regulations can increase productivity by increasing job security, job tenure, work effort, and making workers more likely to invest in firm specific human capital. The studies with probably the cleanest identification of the effect of firing costs are Autor, Donohue, and Schwab (2004) and Autor, Kerr, and Kugler (2007), even though the firing restriction implied in the U.S. context they consider is rather small compared to 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, Nunziata, and Venn (2009) and Cuñat and Melitz (2012) show that employment protection has the strongest effect in sectors where it is most binding, due to more volatile firm-level productivity.

Two recent paper cover similar topics. The paper closest to ours is Fella and Tyson (2013). These authors build an equilibrium matching model with savings and incomplete

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

markets and contrast the optimal provision of severance pay bargained by the models agents to mandated levels.[4] 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. Integrating unions into the analysis thus is an important step beyond Fella and Tysons (2013) contribution and helps to understand the origin of very high levels of severance pay observed in some countries.

Taking a law and economics perspective, Boeri, Garibaldi, and Moen (2014) 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 2).

The rest of the paper is organized as follows. Section 2 presents facts on levels and origins of severance pay across countries, and also discusses the role of unions. Section 3 describes the economic environment of our model, as well as the individual problems and equilibrium. Section 4 provides some theoretical and first quantitative results. The calibration and full quantitative results can be found in Section 5. Finally, we evaluate the performance of our model in explaining differences in severance pay across countries in Section 6, and then conclude.

2 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 discuss evidence on how unions affect them. Since there already is a broad literature on severance pay (see above), we will 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 may 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, Donohue, and Schwab (2004) and Autor, Kerr, and Kugler (2007)), severance pay provisions are a reasonably common part

[4] In contrast to our results, these authors conclude that in many countries, mandated levels lie below their models optimal provision prescription, even for some economies with high levels of mandated severance pay. This conclusion is due to differences in the data used. The job finding rates Fella and Tyson use, which are drawn from the OECD unemployment duration database, are almost uniformly lower than our inputs, which come from Elsby, Hobijn, and Şahin (2013).

of labor contracts in the US.[5] 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).[6] Publications by the OECD (Venn 2009) and the World Bank (Holzmann and Vodopivec 2012) also mention such arrangements.

The work by Parsons and coauthors show that severance pay arrangements began in the 1930s and expanded in the period 1954-1970, especially in manufacturing. In 2001, they covered 26% of the US full-time work force according to the Employment Cost Index (ECI) published by the Bureau of Labor Statistics (BLS).[7] 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 to 35% for unionized and 15 to 20% for non-unionized workers.[8]

Information on the design of plans comes from private sources. For example, ambitious recent surveys of respectively 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 (2005a), 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 may not appear much, severance pay can exceed maximum available unemployment benefits for workers with long tenure. Given short typical unemployment durations in the US, it is quantitatively relevant even for lower-tenure workers.

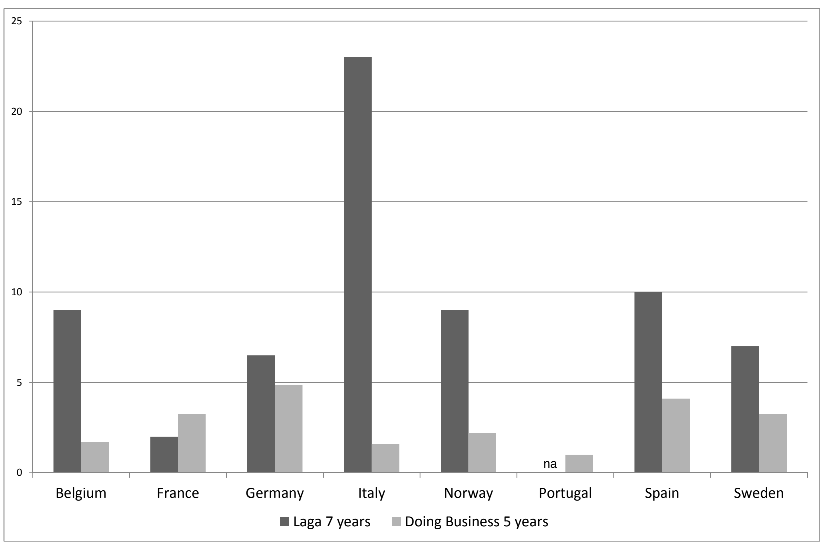
[5]For instance, McDonald's has a corporate severance pay plan for managers and "Shared Restaurant Support Employees" (including part time ones) calling for severance pay of two weeks' pay per year of tenure, with a minimum and a maximum that depend on the level of employment. See the filing at the SEC: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

[6]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 may 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.

[7]Many plans only provide severance pay coverage for employees above some minimum level of tenure. This, together with lower levels of coverage in small firms, 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 5 years of tenure (clauses like this exist, but the distribution of these minima is unknown), overall severance pay coverage would be below 50%.

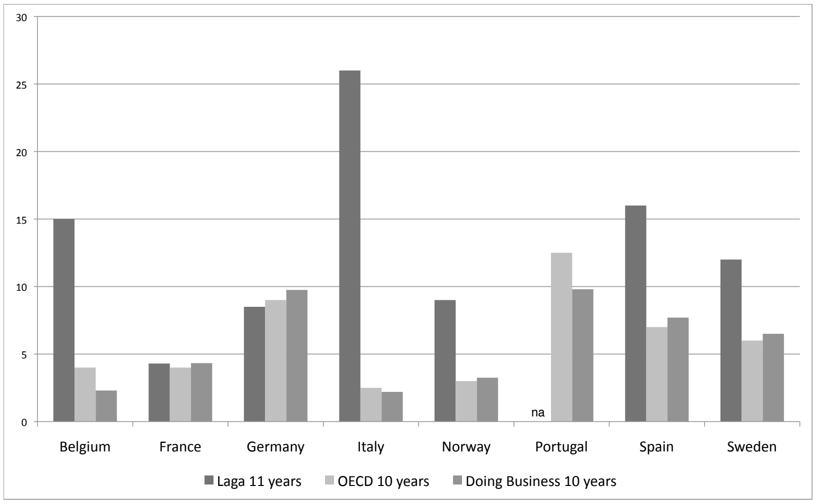
[8]Other factors that matter but go beyond the scope of our analysis in this paper are establishment size and occupation. Coverage is substantially above average for professional and administrative occupations (42%)

Figure 1: Total Severance Pay (in months of earnings) for workers with 5 to 7 years of tenure - Doing Business (2013) and Laga (2012)



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 long period of time.)

Figure 2: Total Severance Pay (in months of earnings) for workers with 10-11 years of tenure - OECD (2013), Doing Business (2013), and Laga (2012)



Laga data not available for Portugal.

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 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. Similar information is provided by the World Bank in its Doing Business survey (World Bank (2013)). In both cases, estimates are based on legal provisions. They may in addition include fees for e.g. lawyers.

A different approach to measurement is taken in a survey by Laga, another private consulting firm. 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.[9] Compared to the other two sources, the key difference is that the study aims to measure the average cost which an employer has to pay to dismiss an employee and reach a final settlement on the dismissal file. This implies two key differences compared to the legally mandated level of severance

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

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

pay as documented by the OECD and the World Bank. First, a firm may 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 may be lengthy and may in some cases even lead to reinstatement of the employee (see more detail below).[10] How important such ex post settlements are essentially depends on the legal environment, namely severance pay rules and the behavior of courts. Such payments thus are almost directly attributable to the law, and can therefore be considered part of mandated severance pay. Secondly, 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.

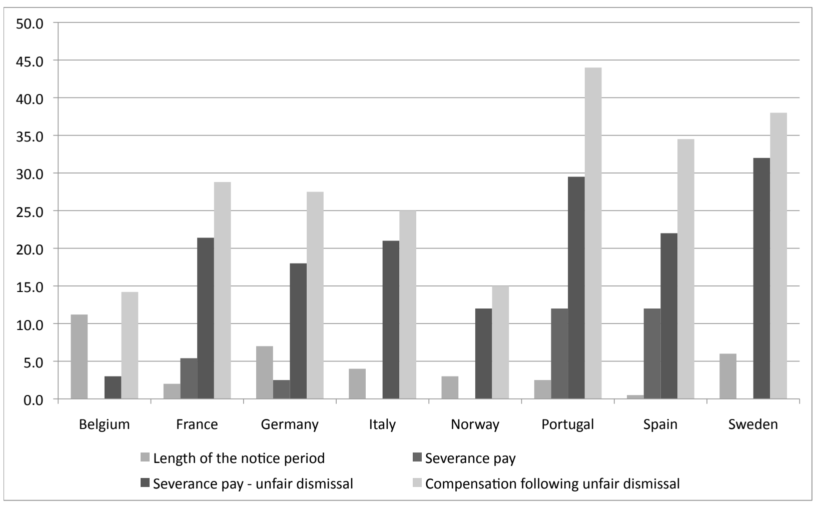
Given the differences between studies, it is instructive to compare the measures of OECD (2013), World Bank (2013) and Laga (2012). Figures 1 and 2 show total severance pay for workers with 5 to 7 and 10 to 11 years of tenure, respectively. The data shown is the sum of mandated severance pay and payments 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 5 months' pay. The Laga data exhibits levels of 5 to 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. Firstly, in the case of Norway, firm-reported severance pay substantially exceeds the mandated level due to a considerable negotiated severance pay component, which is not statutorily required, but often is part of contracts. In both Germany and Sweden, a (smaller) negotiated component is also typical.

Secondly, effective severance pay can be much larger than legal mandates due to settlements made to avoid court proceedings. This is particularly clear in the case of Italy, in line with evidence on the role of courts reported in Boeri, Garibaldi, and Moen (2014). 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 economic or disciplinary nature. Unfair dismissals may 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

[10] 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 employees 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."

example, total compensation following an unfair dismissal amounts to five times that for a regular dismissal. In addition, an unfair dismissal may be sanctioned by the reinstatement of the worker in the firm. As a consequence, firms facing large judicial discretion (see Boeri, Garibaldi, and Moen 2014) need to propose steep settlements to actually carry out dismissals. 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.[11]

Figure 3: Severance pay at 20 years of tenure, fair and unfair dismissals (in months of earnings)



Note: Source: OECD (2013). 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."

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 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 the previous Figure.

[11] There also is a substantial difference between the series in the case of Belgium. 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.

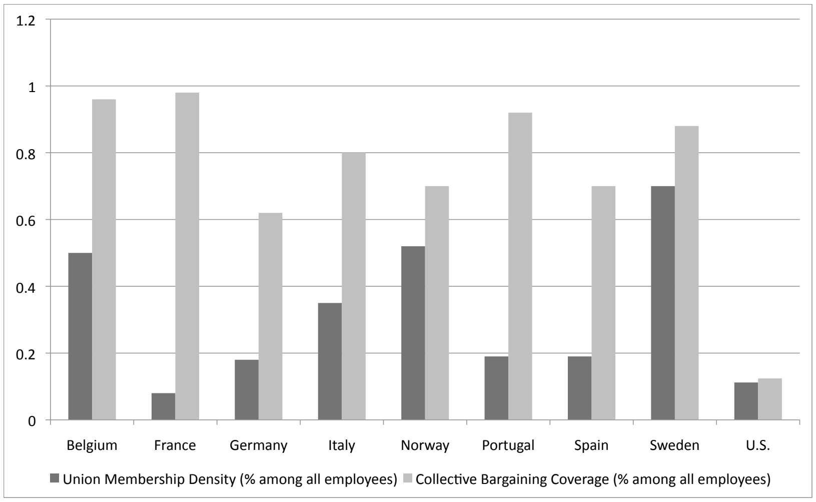
Finally, severance pay provisions are heavily influenced by unions not only in the US but also in some European countries. In practice, this is particularly common for notice periods (OECD 2013). In France, for instance, collective agreements may provide for longer notice periods or more favorable tenure conditions compared to the legal minimum. In Italy, the length of the notice period varies across collective agreement. In most collective agreements (e.g. collective agreement of metal workers, tourism industry, textile workers, chemical workers, trade industry, food industry) notice lies within the following range: a worker gets between 10 and 75 days between 9 months and 4 years tenure and 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.[12]

Given this impact 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 to 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.

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. In addition, there is evidence that unions affect severance pay levels. In what follows, we will 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 may help us understand, in addition, why there are such substantial differences in mandated severance pay across countries.

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

Figure 4: Union Membership and Collective Bargaining Coverage in 2013



Sources: Data about the U.S. 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.

3 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[13]

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

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 ζ_u of workers are members of a union, with the fractions of non-unionized workers denoted by $\zeta_n = 1 - \zeta_u$. As is 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 κ. Descriptions of bargaining and of how vacancies get filled follow below. Output of a firm is xz, where x is the firm's productivity, z aggregate

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

productivity. Firms start their life with $x = 1$. After that, there is a flow probability λ 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 may 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 look for jobs. They meet on a labor market where workers and vacant jobs 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 then is $M_j/v_j \equiv q_j$, 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 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 η. 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. Here, we decide to take assumptions that tend to make privately bargained severance pay more attractive for workers. These assumptions help us on other grounds, too. 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 him/her as long as the unemployment spell lasts. For a severance payment of αw, the actuarially fair annuity payout is $(r + \theta q)\alpha w$.[14]

[14]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 duration 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 and therefore 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

Then 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 or that of an unemployed worker. Since 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.[15]

3.1 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_{α_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:

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

rules out wealth effects in bargaining.

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

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. (See footnote 20 for a discussion of alternative union objective functions.)

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.

3.2 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 α_j, job destruction thresholds R_j, labor market tightness in each sector θ_j such that

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

4 Qualitative analysis

In this section, we show that the possibility of severance pay allows for insurance, but has general equilibrium effects beyond that.

4.1 Insurance

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 willing to absorb the uncertainty workers face. The first order conditions of (11) with respect to w and α 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 them 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 below). 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.)

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

Taking a typical unemployment insurance replacement rate of 60%, an annual interest rate of 4% and a typical continental European monthly job finding rate of 6% (Elsby, Hobijn, and Şahin 2013), this yields full-insurance severance pay of 4.5 months' wages. Given a typical monthly unemployment inflow rate of 0.6%, i.e. typical expected job duration of 14 years, this implies average severance pay of 0.33 months per year of service. Using numbers more fitting for the U.S. economy, i.e. a replacement rate of 50%, a job finding rate of 56.5% and a separation rate of 3.6% implies average severance pay of one week per year of service. This is essentially identical to typical contractual severance pay arrangements reported by Parsons (2012b). Note that the U.S. and "European" number are not far apart. The reason is that the job finding rate and separation rate closely covary positively across countries (see e.g. Elsby, Hobijn, and Şahin 2013, Figure 1), exercising opposite effects on the full-insurance severance pay arrangement when measured per year of service.

4.2 Equilibrium effects

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

These same curves can be drawn for any fixed α. Raising α shifts both curves down (see Figure 5). The job creation curve shifts down because at given θ, lower wages are required for an entering firm to break even if there is severance pay. As introducing α 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, 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 may 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 SP is an eventual payment of SP. The expected cost is $\lambda R \alpha w/(r + \lambda R)$. The benefit is that they pay a wage that is Δw lower every period until match dissolution. The expected benefit then is $\Delta w/(r + \lambda R)$ If insurance was actuarially fair, 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

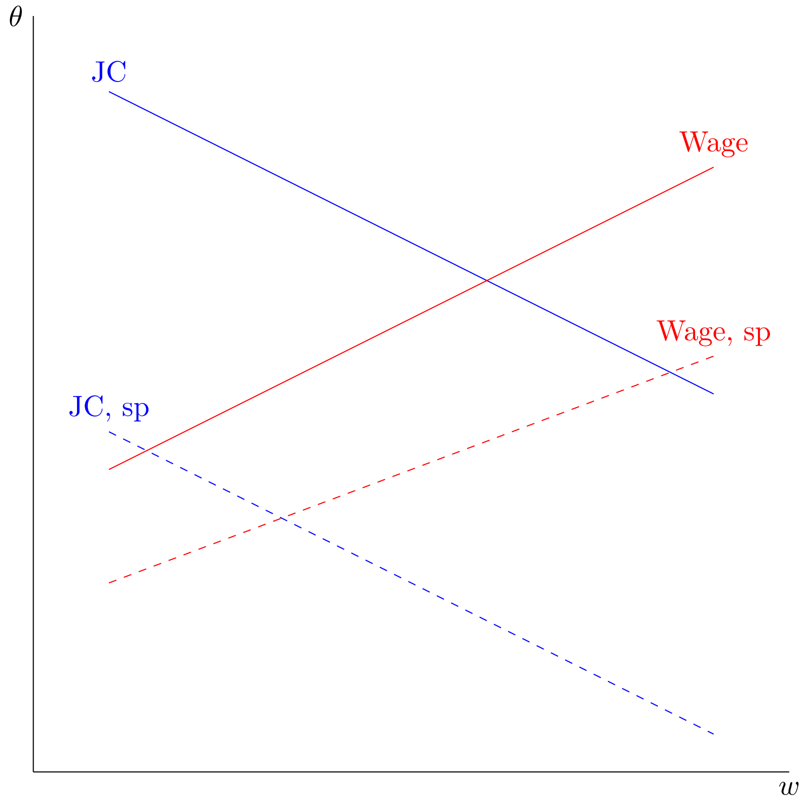


Figure 5: The JC (blue) and wage (red) curves with (dashed) and without (solid) severance pay.

insurers.[16]

5 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 four counterfactual severance pay arrangements for each economy and comparing them to the ones that are observed.

[16]This is an accounting view of what's 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 firm's behavior. "Fair" severance pay would then be s.t. firm value is unaffected, i.e. on the new (new α) job creation curve. We show results for this below.

5.1 Calibration

We calibrate the model by setting a set of parameters to commonly used values 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 will differ 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, which differ substantially in labor market dynamics both from each other and from other Eurozone members.[17] 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 the union and non-union sectors of each economy and calibrate the non-union sector, under the assumption that the data is 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% (Norway) and that the cross-country average is much lower (13.2%), this is an appropriate choice of frequency. We set the monthly interest such that the yearly interest rate equals 4%. We set the coefficient of relative risk aversion σ to 2, well in the middle of the range typically considered in the literature.

In the labor market, we choose the matching efficiency A in each country such that labor market tightness is unity in each calibrated benchmark economy. Given that the job finding rate equals $A\theta^{1-\mu}$, this requires setting A equal to the job finding rate. This is a normalization. We set the elasticity of the matching function with respect to unemployment, μ, to 0.5, in line with the estimates reported in Petrongolo and Pissarides (2001). For workers' bargaining power η, we also adopt a value of 0.5.

On the firm side, we set initial match productivity $1 \cdot z$ to 10, and continue assuming that the distribution of shocks, $\mathcal{X}$, is uniform on the range $[0, 1]$. Finally, for the benchmark economy, we take severance pay α from the data described above, and assume that firms and workers bargain only over wages.[18]

[17] Norway and Sweden are not part of the Eurozone.

[18] 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 choose severance pay for the closest value of tenure. Secondly, we consider only the component of severance pay that is mandatory, i.e. either directly implied by law, or implied by laws together with the functioning of the judicial system.

Finally, we calibrate the shock arrival rate λ, the vacancy posting cost κ and the value of unemployment b to match three targets for each country: the unemployment rate, the job finding rate (if this is matched, equilibrium tightness will indeed be unity for our choice of A above), and the unemployment insurance replacement rate. Table 1 gives an overview of data moments, model moments, and a few additional relevant statistics. Key target moments are from Elsby, Hobijn, and Şahin (2013) and from the OECD. (See the table note 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% in Norway and 4.3% in Sweden to a high of more than 15% in Spain. Job finding rates vary similarly, from high rates of almost 40% monthly in Norway and almost 30% in Sweden to rates of 4-7% per month in the remaining economies. Job destruction rates also vary by a factor three, from low rates of 0.4% per month in high severance pay economies like Belgium and Portugal to rates of 1.2 to 1.6% 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. Unemployment insurance replacement rates vary much less across countries, and range from about 60 to about 70% in the initial period of unemployment. (While they may 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, like e.g. Spain, where the model has difficulty generating high enough unemployment 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, like the family, or increased leisure in unemployment on top of UI benefits. The lower panel 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. Since these two moments fit well, the model generally also fits the job destruction rate well.

Calibrated parameters are shown in Table 2. They differ substantially across countries. This is most striking for the shock arrival rate λ and the vacancy posting cost κ. Due to 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, as those in Norway or Spain, translate into

Table 1: Country statistics, data and model

Calibration targets:

	data moments			model moments		
country	unem-ployment rate	job finding rate	UI replacement rate	unem-ployment rate	job finding rate	UI replacement rate
Belgium	0.061	0.073	0.59	0.059	0.071	0.704
France	0.081	0.077	0.67	0.081	0.077	0.681
Germany	0.083	0.060	0.70	0.083	0.060	0.700
Italy	0.098	0.043	0.70	0.096	0.042	0.773
Norway	0.041	0.385	0.70	0.041	0.385	0.710
Portugal	0.062	0.063	0.76	0.062	0.063	0.746
Spain	0.154	0.063	0.72	0.151	0.062	0.788
Sweden	0.043	0.292	0.60	0.042	0.288	0.719

Other country statistics:

country	severance pay at average completed tenure	job destruction rate	union membership rate	union coverage
Belgium	15	0.004	0.50	0.96
France	3	0.007	0.08	0.98
Germany	5	0.005	0.18	0.62
Italy	26	0.004	0.35	0.80
Norway	2	0.016	0.52	0.70
Portugal	8	0.004	0.19	0.92
Spain	10	0.011	0.19	0.70
Sweden	4	0.012	0.70	0.88

Notes: All flow rates are monthly. Severance pay is also in units of monthly earnings. UI stands for unemployment insurance. Sources: Elsby, Hobijn, and Şahin (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 rates 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 is available in the OECD Tax-Benefit models at `http://www.oecd.org/social/soc/benefitsandwagesoecdindicators.htm`. Severance pay, union membership and coverage rates as described in Section 2.

higher calibrated shock arrival rates λ. Note that vacancy posting costs κ are not directly comparable across countries, as matching efficiency A is normalized at different values across countries. Hiring costs expected by firms, which depend both on the vacancy posting cost and the vacancy filling probability $A\theta^{-\mu}$, vary across country in a way closely associated with 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. Since 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 the top

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

country	λ	κ	b/z	R
Belgium	0.014	23.4	0.378	0.283
France	0.018	21.3	0.371	0.387
Germany	0.023	16.0	0.350	0.218
Italy	0.014	10.9	0.428	0.285
Norway	0.044	46.9	0.398	0.366
Portugal	0.033	12.8	0.363	0.121
Spain	0.032	8.2	0.439	0.339
Sweden	0.035	42.6	0.400	0.343

panel of Table 1.

The last column of Table 2 shows R, the minimum match productivity required for survival. This also differs substantially across countries.[19] This highlights how observed job destruction rates depend on both the shock arrival rate and the match termination decision. For example, Spain and Portugal have very similar shock arrival rates, but very different job destruction rates due to their differences in R. These differences arise from firm behavior. Spanish firms, facing much lower expected hiring costs than Portuguese ones, are much quicker to destroy jobs. In other countries, like Belgium, the job destruction rate is much lower than in Spain despite similar match termination policies, due to a large difference in the shock arrival rate. Severance pay also plays a role. Consider Belgium and France. Both have similar job finding rates, so that the similar vacancy posting costs also translate into similar expected hiring cost for firms. Shock arrival rates are not too different either. However, French firms terminate 10% more jobs after arrival of a shock compared to Belgian ones, as they face much lower severance pay.

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.

[19] 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.

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

	France			Spain		
outcome	bargaining	monopolistic union	bargaining power union	bargaining	monopolistic union	bargaining power union
w/z	0.545	0.735	0.622	0.557	0.667	0.605
R	0.374	0.686	0.518	0.342	0.556	0.446
θ	0.997	0.204	0.558	0.975	0.196	0.529
u	0.081	0.263	0.140	0.151	0.393	0.240
job destruction	0.007	0.012	0.009	0.011	0.018	0.014
job finding	0.077	0.035	0.058	0.062	0.028	0.046

Notes: In each panel: First column: benchmark results. Second column: the monopolistic union maximizes W_u by choosing the wage rate, which firms take as given. Third column: 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 are monthly rates.

5.2 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 take it to be exogenous.

We consider two types of union behavior. First, we consider a monopolistic union. Here, the union can set the wage (and severance pay, if applicable). Firms then decide to post vacancies optimally, taking this wage as given. We assume that the union cares only about employed workers, so its objective function is W_u.[20] 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 a bit more than

[20] Results are similar if the union cares both about 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 over- or an understatement. This objective function thus implies implausible union behavior, like reducing wages to drive u to zero in a case where $W_u >> 0$, even if U_u is close to W_u and far from zero.

half of the output of a new match.[21] A bit more than a third of matches are destroyed when receiving a new productivity draw. Unemployment, job destruction and 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 almost three quarters of the output of a new match. As a consequence, almost three quarters 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 findings 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 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. However, it turns out that in this and other parameterizations, W_u and U_u are not far apart. As a consequence, 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 15% higher wage compared to the bargaining case.[22] 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.

5.3 The 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 effect of eliminating any type of severance pay in two countries, France (low severance pay) and Spain (very high severance pay). Re-

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

[22] The union wage premium differs across countries, and is 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% for the US, controlling for individual characteristics but not for selection on unobservable. Estimates are lower when selection is accounted for.

Table 4: The effect of eliminating severance pay, selected countries

	France			Spain		
outcome	bargaining	monopolistic union	bargaining power union	bargaining	monopolistic union	bargaining power union
benchmark = 100:						
w/z	100.7	100.3	100.7	108.8	109.8	111.3
R	105.1	101.8	103.4	142.1	123.9	134.9
θ	105.5	127.4	110.3	125.3	228.4	139.1
percentage point difference from benchmark:						
u	0.17	-1.94	-0.18	3.32	-4.62	2.53
job destruction	0.03	0.02	0.03	0.47	0.43	0.50
job finding	0.21	0.45	0.29	0.74	1.43	0.82

Notes: Results are relative to those in Table 3, column "bargaining" for each country. Notes from that table apply.

sults 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 large. (Here, the job destruction rate changes by half a percentage point, from 1.1% to 1.6% 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 and wages under all types of wage determination.

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 e.g. 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, resulting in larger unemployment. In our calibrated economies, eliminating severance pay does not reduce unemployment in any single case if workers bargain wages. It does so in two cases (France and Germany) when a union with higher bargaining power negotiates wages. 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 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.

5.4 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 2, it is also common in some countries to see ex ante negotiated severance pay. In this section, we ask the 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.

Table 5: Bargained severance pay, selected countries

	France			Spain		
outcome	bargaining	monopolistic union	bargaining power union	bargaining	monopolistic union	bargaining power union
bargained/chosen severance pay	4.0	17.8	6.6	3.6	11.2	5.9
benchmark = 100:						
w/z	99.6	93.4	98.0	105.4	98.9	104.4
R	97.8	82.6	93.4	127.2	97.1	114.6
θ	99.0	41.7	94.7	113.5	92.1	110.6
percentage point difference from benchmark:						
u	-0.13	5.03	-0.48	2.42	0.28	1.60
job destruction	-0.01	-0.22	-0.06	0.30	-0.05	0.21
job finding	-0.04	-1.23	-0.16	0.41	-0.11	0.24
severance pay comparison:						
actual	3			10		
bargaining	4.0			3.6		
no loss to firm	3.7			3.3		
full insurance (partial equilibrium)	4.0			3.2		

Notes: Results are relative to those in Table 3, column "bargaining" for each country. Notes from that table apply. Severance pay is measured in months of earnings.

Bargaining workers in the model economy calibrated to France choose to receive four months' wages as severance pay. To obtain this, they accept a slightly reduced wage. Severance pay then leads to less job destruction, but also to less vacancy posting and thus lower tightness and a slightly lower job finding rate. In terms of unemployment, the reduced job destruction rate dominates, so that unemployment declines. While bargained severance pay is very close to the observed level of severance pay for France, this is not the case for Spain. In the next section, we study how our model can help us understand observed levels of severance pay.[23]

Recall that unemployed workers receive an unemployment benefit of b. As shown above, the bargained value of severance pay gives workers full insurance; the sum of the unemployment benefit and the annuity value of severance pay yield the same consumption as wage income. Also in line with results above, this insurance is not actuarially fair in the sense that the expected reduction in the wage over the life of a match is not sufficient to compensate firms for the expected cost of severance pay. As workers have bargaining power, they do not bear the full cost of the insurance they receive.

From a worker's point of view, the economy with bargained severance pay is different in three respects: the worker obtains insurance, faces a lower wage, but also less unemployment. The last two effects come from the general equilibrium structure of the model. How important are these general equilibrium effects? 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, taking the wage rate and tightness as given. (This is essentially identical to an exercise conducted in Fella and Tyson (2013).) In the case of France, this yields exactly the same severance pay agreement (up to rounding) as the general equilibrium result. This is because the wage and tightness change little in response to changing severance pay from 3 months' earnings (as observed) to 4 months' earnings (the bargained amount). This result is completely in line with what Fella and Tyson (2013) find when they calibrate their economy to Portugal. The situation is different, however, when looking at a more extreme country like Spain (or Italy), where the bargained amount is much lower than the actually observed amount. As a consequence, at the bargained amount, wages and tightness are higher than in the calibrated Spanish economy. Since both of these changes are favorable to workers, the bargained amount of severance pay exceeds by some margin the partial equilibrium full insurance amount, which takes the lower benchmark levels of the wage and tightness as given.[24] This shows that using the general equilibrium structure of the model is important not only in evaluating how severance pay affects the economy (Ljungqvist 2002), but also in determining endogenously bargained severance pay.

The availability of insurance increases workers' welfare $(1-u)W + uU$. The increase in welfare varies by country and corresponds to that achieved by an increase in the wage between almost zero (Germany) and almost 7% (Italy), keeping θ, R and u constant.

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

[24] Our model calibrated to Italy yields the greatest difference between optimal severance pay and full insurance severance pay (5.8 vs 5).

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.[25] Severance pay provides insurance against job loss, and therefore helps to complete markets.

Second, the option to bargain over severance pay in itself does not harm firms. To verify this, we solve for the level of severance pay that solves the Nash bargaining problem under the additional constraint that firm value should be at least as high as in the corresponding benchmark economy. As shown in the row "no loss to firm" in the lower panel of Table 5, this constraint reduces bargained levels of severance pay only very slightly, illustrating the size of the gains accruing to workers. Bargaining over both wages and severance pay thus is not necessarily disadvantageous to firms, explaining why firms in some countries engage in it, as illustrated in Section 2 above.

A monopolistic union demands three to four times as much severance pay as individually bargaining workers. In France, this is far more than the actual level, while in Spain, it comes close to it. This higher severance pay demand goes along with a lower wage demand. 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.

Finally, a union that just raises workers' bargaining power also leads to higher severance pay. The remaining changes in outcomes are similar to the bargaining case. In this case, too, severance pay gives workers full insurance. This case closely resembles that of worker bargaining, except for the fact that it leads to severance pay further away from observed levels in the low-severance pay economy, and levels closer to it in the high-severance pay economy. In France, the union accepts a substantially larger wage reduction than workers in order to obtain a higher level of severance pay. In Spain, the bargaining union, like bargaining workers, benefits from positive general equilibrium effects in the form of higher wages and tightness that result from reduced severance pay.

Since 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 (like the bargaining economy), positive but

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

low levels of severance pay are optimal. In economies with low job finding rates (like 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 to 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. In the next section, we show results from a broader cross-country comparison, which reveal that bargaining severance pay can be much lower in some cases.

5.5 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, the question arises of how this "excess severance pay" affects workers' welfare.

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

As mandated severance pay exceeds levels that would be bargained, the wage rate decreases further, and job destruction declines. However, because of the cost of severance pay, job creation also declines. The overall effect on unemployment is negative in most cases (it decreases). Worker welfare $(1-u)W + uU$ still declines, as the beneficial effect of the reduction in unemployment is outweighed by the effect of the lower wage. Again, it is key for this that the values of work and unemployment are not too different, so small changes in the wage affect welfare more than small changes in the unemployment rate.

6 Explaining severance pay across countries

Up to here, 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.

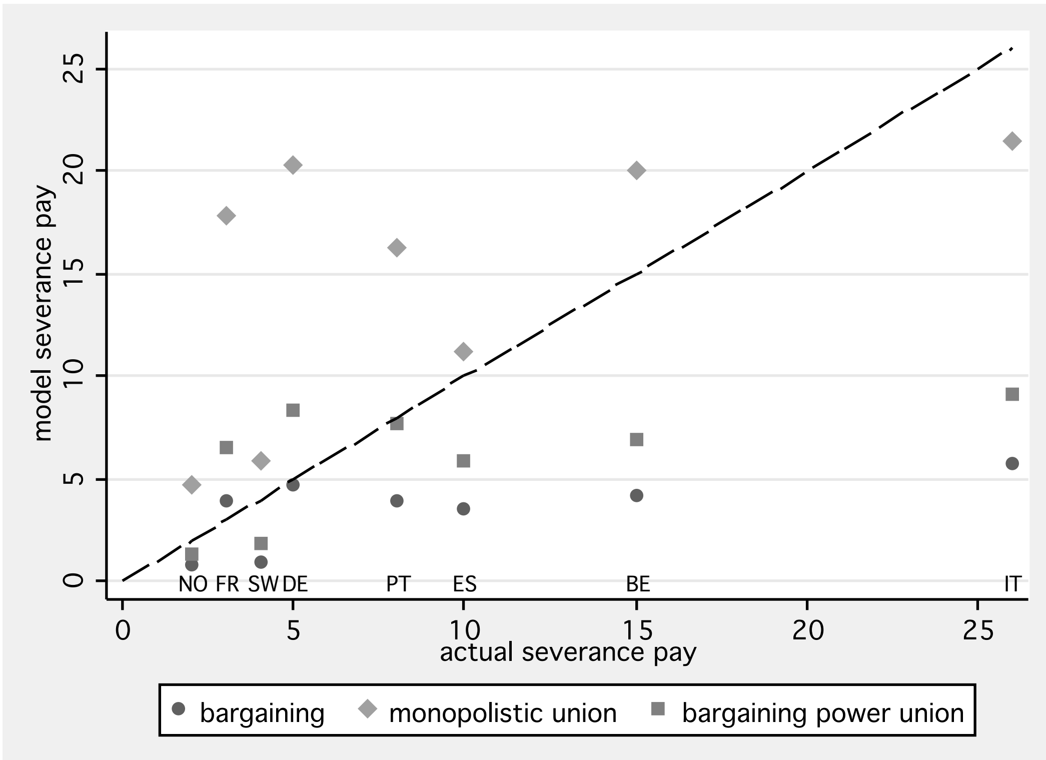


Figure 6: Actual and model-implied severance pay across eight continental European countries

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.

Results are shown in Figure 6.[26] 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

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

three model-implied measures are 46% for the bargaining model, 33% for the monopolistic union model, and 36% 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 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.

7 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 may have been the outcome of a political process, where unions pushed for high severance pay in some countries but not others.

While our analysis abstracted from potential distortions caused by severance pay, it also suggested 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 ignored several potentially important theoretical issues, which we leave for future research. Firstly, 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 may be limited. Secondly, severance pay typically increases with tenure. This suggests that it may be an optimal reaction to incentive problems within the firm, as suggested by Boeri, Garibaldi, and Moen (2014). 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 may arise if credit constrained firms would be forced to hold provisions against potential severance pay liabilities. The interaction of credit constraints and optimal severance pay remains to be explored.

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