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ABSTRACT

Cross-Skill Redistribution and the Tradeoff between Unemployment Benefits and Employment Protection*

We document the presence of a trade-off between unemployment benefits (UB) and employment protection legislation (EPL) in the provision of insurance against labor market risk. Different countries' locations along this trade-off represent stable, hard to modify, politico-economic equilibria. We develop a model in which voters are required to cast a ballot over the strictness of EPL, the generosity of UBs and the amount of redistribution involved by the financing of unemployment insurance. Agents are heterogeneous along two dimensions: employment status – insiders and outsiders – and skills – low and high. Unlike previous work on EPL, we model employment protection as an institution redistributing among insiders, notably in favour of the low-skill workers. A key implication of the model is that configurations with strict EPL and low UB should emerge in presence of compressed wage structures. Micro data on wage premia on educational attainments and on the strictness of EPL are in line with our results. We also find empirical support to the substantive assumptions of the model on the effects of EPL.

JEL Classification: J68, J65, D72

Keywords: employment protection, unemployment insurance, political equilibria

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1. Introduction

Unemployment benefits (UBs) and firing costs or, more broadly, employment protection legislation (EPL) are two ways of protecting individuals against the risks of job loss . While EPL protects those who already have a job, and does not impose any explicit tax burden, UBs generally provide insurance to a larger portion of the labor force and are financed by a tax imposed on labor income. OECD countries use different combinations of the two institutions. Plotted against each other, various measures of the two institutions point to the presence of a trade-off between EPL and UBs: those countries, which adopt stronger dismissal restrictions, tend to enjoy smaller unemployment insurance programs, and viceversa.

Countries' locations along this trade-off would seem to correspond to stable politico-economic equilibria. Stronger competitive pressures, as those arising in the context of so-called "globalization" and EMU-driven price transparency, call for a shift in the balance of the two institutions in favour of mobility-friendly UBs. Job-security oriented labor market institutions are indeed ill-suited to accommodate new demands for mobility and, more broadly, microeconomic adjustment (Bertola and Boeri, 2002). However, moving along the UB/EPL trade-off is proving very difficult. Reforms of EPL are generally confined to introducing "at the margin" more flexible contractual types, rather than modifying rules for workers who already have a permanent contract.

Why do different countries resort to alternative combinations of employment protection and unemployment insurance to protect the individuals against the risk of being unemployed? Why is it so difficult to move away from the different institutional configurations? This paper provides a politico-economic explanation of the observed trade-off between EPL and UBs, and of the cross-country variation in the use of the two policy instruments applying for the first time (to our knowledge) a multidimensional voting approach to endogenous labor market institutions theory. Our model bridges the gap between two streams of literature in the political economy of labor markets. On the

one hand, our environment is similar to that proposed by Wright (1986) to examine the unemployment insurance program. On the other hand, it draws on Saint-Paul (1996, 1999a, 1999b and 2000) in modeling choices over EPL.

The focus is on the conflict of interest between employed (insiders) and unemployed (outsiders). The transition between employment and unemployment is regulated by the unemployment inflow and outflow rates, which are affected by the degree of EPL. The model is further enriched by introducing a second degree of heterogeneity, and thus an additional conflict of interest. As in Acemoglu et al. (2001), workers differ in their skill level. In our model, skills affect the productivity of the agents and the unemployment inflow and outflow rates. High skill types earn higher wages and face a lower unemployment inflow rate than the low-skill types. However, high-skill types may contribute to the financing of UBs going mainly to low-skill types.

In our political economy model, voters are required to cast a ballot over the strictness of EPL, the generosity of unemployment benefits and its degree of redistribution, which determines the sharing of its costs between low-skill and high-skill types. Because of the multidimensionality of the issue space, the existence of a Condorcet winner of the majority voting game is not guaranteed. To overcome this problem, we concentrate on political equilibria induced by institutional restrictions, or structure-induced equilibria (see Shepsle,1979 and Persson and Tabellini, 2000). In our political system, the entire electorate votes simultaneously over the payroll tax financing unemployment benefits, the redistributive content of UBs and the strictness of employment protection; policy decisions are taken issue-by-issue. Although the median voter over each policy is typically – under sensible specifications – a low-skill individual, high-skill types can still "vote with their feet", by supplying more or less effort, depending on the extent of the cross-subsidisation of the low-skill types involved by the UB system. Hence, changes in the distribution of the population by skill level affect the UB/EPL policy mix, via economic channels, even if the identity of the pivotal political player, median voter, does

not change.

We show that UBs are more redistributive – that is, the high-skill types provide a higher contribution to the financing of the subsidies to the unemployed low-skill types – EPL is relatively low and UBs high, when wage differentials between high and low-skill types are sufficiently large. Thus, our model implies that countries with compressed wage structures (providing relatively low premia to education) have stricter employment protection regulations. Furthermore, a reduction in the elasticity of supply of the high-skill types modify the political economic equilibrium along the UB/EPL trade-off towards locations offering more unemployment insurance and lower costs of dismissals.

Our empirical strategy offers tests of the substantive assumptions of the model and on the effects of the compression of wage structures on the choice between EPL and UBs. We find support to our characterization of EPL as a policy protecting mainly the unskilled and we document that wage structures allowing for larger premia on education are associated with institutional configurations allowing for more UBs and less EPL. We also look at the policy experiments carried out in Europe in the 1990s and show that countries reforming EPL have reformed UBs precisely in the direction implied by our model. While we are aware of the fact that there may be other factors behind the UB/EPL trade-off, we consider these results as supportive of the empirical relevance of our model.

The paper proceeds as follows: Section 2 documents the trade-off and reviews the related literature, Section 3 presents the model and the economic environment. Section 4 develops the political system, and introduces the equilibrium concept. In section 5, we bring the model's main assumptions and its results to the data. Sections 6 concludes.

2. The UB/EPL trade-off

The theoretical literature assigning a welfare-enhancing role to labor market institutions suggests that unemployment benefits should be a close substitute for employment

protection. Both EPL and UB protect workers against uninsurable labor market risk. When severance payments and notice periods in case of dismissals are chosen optimally to maximize welfare of risk-adverse agents, then there is no role for unemployment insurance (Pissarides, 2001). These two institutions have also important design features in common. An experience-rated unemployment insurance scheme involves the same type (and possibly the same amount) of transfers from the employer to the employee than a severance pay or a statutory notice period in the event of a dismissal. The only difference is that in this case EPL would be paid in one installment, while UBs are generally provided throughout the unemployment spell, at least up to a maximum duration. The reform of the French unemployment benefit system recently advocated by Blanchard and Tirole (2003) exploits this substitutability between EPL and UBs: it involves an increase in the degree of experience-rating of the UB system, which confines EPL to a one-off monetary compensation for the job loss.

2.1. Cross-Country Variation

Figure 2.1 documents the aggregate trade-off between UB and EPL over 25 OECD countries, those for which we had comparable data on both institutional features. It displays, on the horizontal axis, an index of the strictness of employment protection compiled by the OECD (OECD, 1999) on the basis of an assessment of national legislations. The vertical axis indicates a measure of the generosity of unemployment benefits, namely the coverage of unemployment insurance and unemployment assistance (the fraction of unemployed receiving some form of UBs) times the average gross replacement rate in the first-year of receipt of unemployment benefits. Measurement problems are more serious in the case of the EPL index, as it draws on qualitative regulations. Another potential problem with the OECD overall EPL index is that it combines information on "regular" contracts and temporary contracts, while greater "flexibility at the margin" (hirings in temporary contracts) can actually insulate regular workers from labour mar-

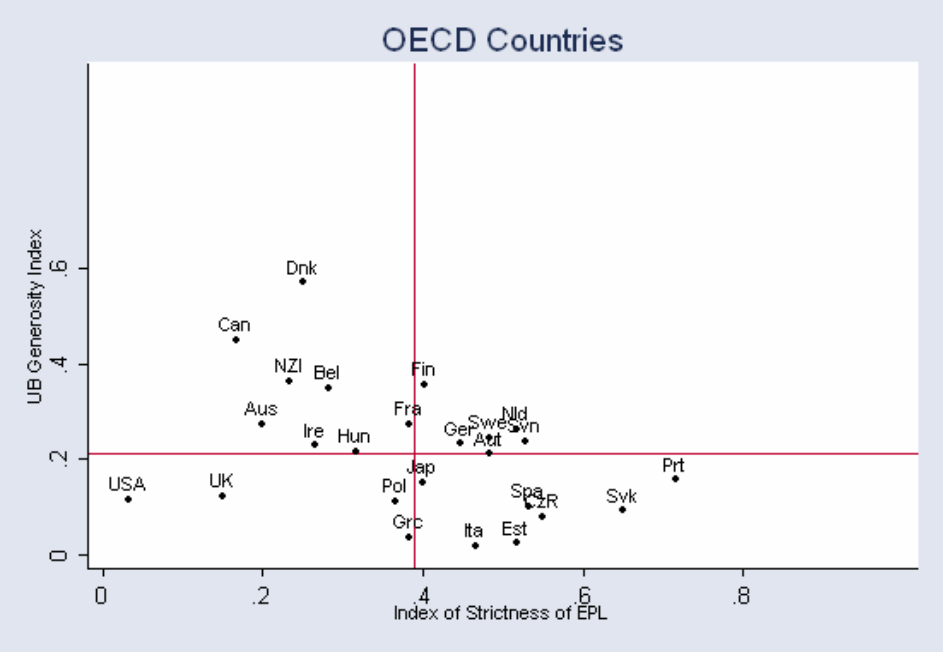

Figure 2.1:

ket risk, by creating a "buffer stock" employers can draw upon in case of adverse shocks (Bentolila and Dolado, 1994). Consequently, we decided to concentrate on the EPL sub-index on regular workers. Both EPL and UB measures are normalized to be in the 0-1 range where 1 denotes the most restrictive EPL or most generous UB provisions. Most countries are located in the first and in the third quadrant pointing to an inverse relationship between UB and EPL. The two relevant exceptions are the US and the UK, which display less UBs and EPL than a typical OECD country. The pairwise correlation of the two institutional features is -.39, which is statistically significant at 95 confidence levels.

A low coverage of UBs may also be associated with high youth unemployment rates – which tend to be positively correlated with EPL – as first-time job-seekers typically do

not qualify for UBs. However, the negative correlation between UB and EPL is *stronger* when concentrating on central age groups, whose unemployment rate was found, in many cross-sectional studies (e.g., see OECD, 1999), to be uncorrelated with EPL. This negative correlation holds also when choosing alternative measures of UB generosity, such as the *net* replacement rates in the first-year of unemployment insurance, which do not suffer from this potential endogeneity problem and again concentrating on central age groups. Table 1 displays the correlations of EPL with UB coverage and net replacement rates in the first 12 months of unemployment[1] as well as the product between replacement rates and coverage for the EU-15 countries (those covered by the European Community Household Panel, ECHP, our primary source in this case). Correlations are clearly stronger when considering the EU-15 countries, having – with the partial exception of the UK – other institutional features (e.g., high union coverage) in common.

Table 1 Alternative measures of the trade-off (late 1990s)

EPL correlated with	*Working-age population*	*Male prime-age (25 to 45)*
a. UB coverage	-.63**	-.71**
b. UB net replacement rate	-.34*	—
*a * b*	-.55**	-.66**
** significant at 99	* significant at 95	nr of observations =14

The trade-off has also been documented at the micro level. In particular, Boeri, Boersch-Supan and Tabellini (2001) found that individuals, who consider themselves to be protected by EPL, are less willing to purchase state-provided unemployment insurance and their willingness to pay for UBs is lower than in the case of individuals with a high subjective risk of job loss.

Thus, the trade-off is implied by economic theory and is visible at the micro-level. At the aggregate level, it is more apparent when concentrating on a subset of countries,

[1]Buti, Pench and Sestito (1998) also looked at the pairwise correlation between UB replacement rates and EPL strictness.

having other institutional features in common, as if we were moving *along* the same UB/EPL trade-off when focusing on countries similar on other domains, and *across* indifference surfaces otherwise.

2.2. A Stable Equilibrium

The presence of a trade-off between UBs and EPL was implicitly acknowledged by the EU Broad Economic Guidelines which state that Member States should "review employment contract regulations and, where appropriate, related costs, with the aim of promoting a proper *balance between flexibility and security*". Southern European countries have been repeatedly advised to "reform employment protection legislation" or to "make work contracts more flexible". These policy recommendations draw on second-best arguments in favour of combinations substituting EPL with UBs, e.g., moving towards the North-West of Figure 2.1. Both UB and EPL trade-off lower productive efficiency against ex ante distributional equity. In presence of stronger competitive pressures and at times of higher macroeconomic turbulence (Ljungqvist and Sargent, 2002), EPL is deemed to perform worse than unemployment insurance as the adjustment to new conditions is expected to require significantly more labor reallocation (Bertola and Boeri, 2002). Unemployment benefits are also preferable to EPL on the grounds that they allow workers to seek for jobs that are hard to get because they require more specialized skills (Acemoglu and Shimer, 2000).

However, moving along this trade-off is proving extremely difficult. An inventory of reforms available at the Fondazione Rodolfo Debenedetti website (www.frdb.org) suggests that reforms of employment protection have been parametric, involving mainly the introduction of new contractual types rather than reforms of existing ones, and enforced "at the margin", that is, only limited to new hires. This is confirmed by the updating of the OECD index of the strictness of employment protection for regular workers, displayed in Figure 2.2: the EPL for "regular" workers (workers with permanent contracts)

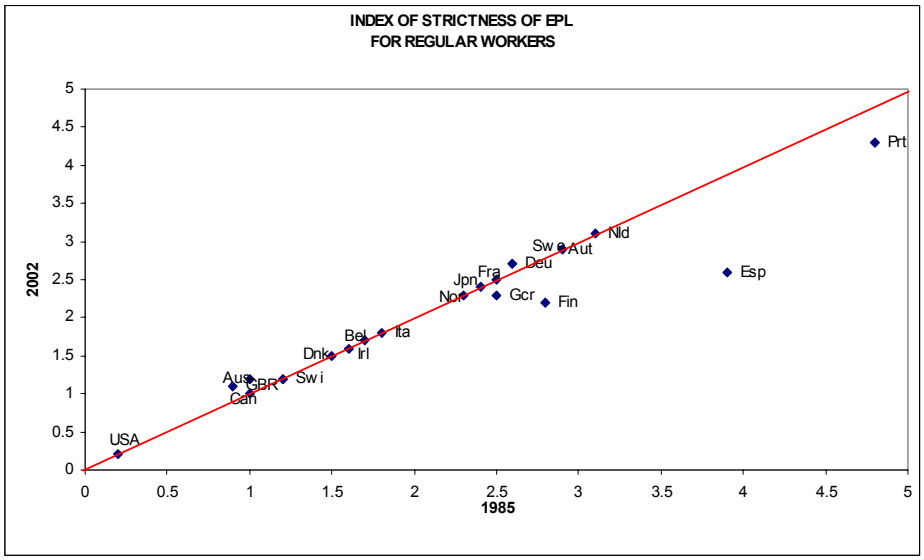

Figure 2.2:

has hardly changed at all in OECD countries over the period 1985-2002. The location of the different countries along the UB-EPL trade-off resembles a stable politico-economic equilibrium.

Characterizing these equilibria and understanding what drives countries' locations *along* and *across* the trade-offs is the task setup for the next section.

3. The Economic Model

Unlike previous work on EPL (e.g., Bertola, 1990; Saint-Paul, 1999a, 1999b and 2000), our theoretical perspective goes beyond the conflict between insiders and outsiders by considering also the redistribution operated by EPL among the insiders. Employment protection unavoidably involves some fixed-cost, e.g., those associated with procedural obligations of firms vis-a-vis the labor administration and workers' organizations. Legal costs of dismissals are also higher for low-skilled workers, who are more likely to sue

the employer for unfair dismissal. Thus, almost unavoidably EPL protects more the unskilled than the workers with higher earnings since the penalty, hence the deterrent, for the employer is higher when layoffs involve unskilled types. More importantly, it is just these fixed (or progressive) components of EPL which have more an impact on decision of firms. OECD (1999) as well as Bertola, Boeri and Cazes (2000) report correlations of labor market flows with several measures of the strictness of EPL: procedural obligations and costs of dismissals turn out to meaningfully interact with flows from employment to unemployment and vice versa, while the number of months of severance pay or the length of statutory notice periods rarely affect labor market stocks and flows. This is consistent with economic theory: as suggested by Lazear (1990), EPL regulations involving just transfers from employers to employee can be undone by bonding wage contracts.

3.1. The environment

In our economy, agents are infinitely long lived. In every period, they consume their current income, since, as in Wright (1986), we assume that no saving technology is available[2]. Preferences are defined over the infinite stream of consumption, c, through a utility function, $\sum_{k=t}^{\infty} \beta^{k-t} v(c_k)$, where β represents the subjective discount factor, and the instant utility function is assumed to be logarithmic: $v(c) = \ln(c)$.

Agents differ in their skill level. There are low and high skill types, l and h, and ρ^j is the fraction of the type-j workers in the population. Clearly, $\rho^h + \rho^l = 1$. Moreover, we assume that there are more low than high skill types, $\rho^h > \rho^h$. If employed, low skill workers earn a pre-tax real wage equal to w^l, whereas high skill workers earn $w^h = (1 + A)w^l$, with $A > 0$. Labor supply of the unskilled is rigid, hence will be normalized to one, ($l^l = 1$), while for the high-skill types, labor supply is given by $l^h = \left(w^h - \phi\right)^{1/\epsilon}$ where ϕ is a parameter, which measures the degree of redistribution within the UB

[2]This assumption greatly simplifies the analysis. Notice that the existence of perfect capital markets would be analogous to have risk neutral agents.

scheme, as defined at eq. (3.1) below. Only ϕ is subtracted from the gross wage as it represents the pure tax component of social security contributions. The elasticity parameter, ϵ, takes non negative values. For $\epsilon = 0$, the opportunity cost of working is constant (and normalized to unity), for larger values, the labor supply schedule becomes increasingly inelastic, and as ϵ tends to infinity it approaches a constant, also normalized to unity in this formalization.

In every period, agents may be either employed or unemployed. According to the existing literature, we refer to the employed as "insiders" and to the unemployed as "outsiders". The transition between the two states is regulated by a Markov process, with skill-specific transition probabilities. In particular, $F^j \in (0,1)$ is the probability that a type-j employed worker becomes unemployed (the unemployment inflow rate); and $H^j \in (0,1)$ is the probability that a type-j unemployed worker finds a job (the unemployment outflow rate). Our analysis concentrates on steady states. Thus, for each group of agents the unemployment rate is $u^j = F^j/\left(H^j + F^j\right)$, while the total unemployment rate is $u = u^l\rho^l + u^h\rho^h$. Clearly, we have that $\partial u^j/\partial F^j \geq 0$ and $\partial u^j/\partial H^j \leq 0$. Moreover, stability conditions for the unemployment rate require that $F^j < H^j \ \forall \ j$.

3.2. Labor Market Institutions

We consider two types of labor market institutions: i) an unemployment benefit (UB) program, which in every period taxes the labor income of the workers and provides a transfer to the unemployed; and ii) an employment protection legislation (EPL), which constraining unemployment inflow (and outflow) rates.

Unemployment Benefits (τ, ϕ) Our insurance program imposes a proportional tax, τ, on the labor income of the workers and awards to any type-j unemployed agent a transfer, b^j. Since $l^j w^j$ represents the labor income of a type-j worker, then $\alpha^j = b^j/l^j w^j$ is the replacement rate of the unemployment benefit to a type-j unemployed individual, which measures the generosity of the scheme to this type-j. The system is

budget balanced and thus the total amount of transfers to the unemployed equals total contributions:

$$b^l u^l \rho^l + b^h u^h \rho^h = \tau \left[l^l w^l \rho^l \left(1 - u^l\right) + l^h w^h \rho^h \left(1 - u^h\right) \right].$$

The financing of the UB scheme may entail some redistribution, from high to low skills individuals. We parametrize the degree of redistribution with $0 \leq \phi \leq 1$, and obtain the following expressions for the UB of the two types of workers:

$$\begin{aligned} b^l &= \tau \frac{w^l l^l \left(1 - u^l\right)}{u^l} + \tau\phi \frac{l^h w^h \rho_h \left(1 - u^h\right)}{u^l \rho_l} \\ b^h &= \tau \left(1 - \phi\right) \frac{l^h w^h \left(1 - u^h\right)}{u^h} \end{aligned} \tag{3.1}$$

For every type of agent, the UB depends on the tax rate, which defines the amount of resources channeled to the UB scheme, on the unemployment rate, which determines the share of contributors to and of recipients from the system, on the relative share of each type in the population and on their labor income.

The parameter ϕ characterizes the degree of redistribution between the two types of unemployed individuals. For $\phi = 0$, the unemployment benefit schemes for the two types are completely isolated, and the generosity of each system – as measured by the replacement rate, α^j – depends on each type unemployment rate, as in a pure insurance scheme, which takes into account the different probabilities of being unemployed of high and low-skill types. Hence, if the latter have a larger unemployment rate than the high ability, they get a lower replacement rate:

$$\alpha^l = \frac{\left(1 - u^l\right)}{u^l} < \frac{\left(1 - u^h\right)}{u^h} = \alpha^h.$$

Even when unemployment rates are decreasing by skill, however, low-skill unemployed individuals can still enjoy the same replacement rate of high-skill types, provided that $\phi = \phi^{RR}$, where ϕ is such that:

$$\alpha^l = \frac{\left(1 - u^l\right)}{u^l} + \phi^{RR} \frac{w^h \rho^h \left(1 - u^h\right)}{w^l u^l \rho^l} \left(w^h - \phi^{RR}\right)^{1/\epsilon} = \left(1 - \phi^{RR}\right) \frac{\left(1 - u^h\right)}{u^h} = \alpha^h.$$

Clearly, for $\phi > \phi^{RR}$, redistribution takes place from the high skill workers to the low skilled unemployed, since the replacement rate is higher for the latter group ($\alpha^l > \alpha^h$). This is the case more frequent in practice, as discussed below.

Finally, we impose the replacement rate to be less than one for both groups, $\alpha^j < 1$, in order for all agents to have an incentive to work, rather than to live off the unemployed benefit rolls.

Employment Protection Legislation (s) Labor markets may be regulated by norms protecting workers against the risk of job loss. As discussed above, economic theory and empirical evidence suggest that it is mainly procedural inconveniences to dismissals (mainly capturing the complexity of the procedures needed to issue a dismissal notice) and the relevance of litigation costs and any possible bias in the judicial enforcement process which affect labor market flows. These features of EPL involve fixed costs for the employers, which are deadweight from the standpoint of the employment relationship. Accordingly, in our stylized framework, we simply characterize EPL as a deadweight cost protecting only the low-skilled workers, while we disregard the existence of severance payments, and their possible role of insurance against unemployment risk.

In our model, the degree of EPL is thus measured by a parameter $s \in [0, 1]$, where $s = 0$ means no protection and $s = 1$ denotes maximum protection. As in Saint-Paul (1996 and 2000), we concentrate on the effects of EPL on unemployment inflow and outflow rates, a relationship on which there is little ambiguity in the empirical and theoretical literature. Consider the low skill types. A higher degree of EPL decreases the unemployment inflow rate, $F_1^l(s) \leq 0$, as widely documented by OECD (1999) and Boeri (1999). Consistently with empirical evidence reviewed in section 5, we assume that this effect is larger when the labor market is flexible ($s \simeq 0$) than under strict EPL[3], i.e., $F_{11}^l(s) > 0$.

[3]It can be shown (results can be provided upon request by the authors) that Mortensen and Pis-

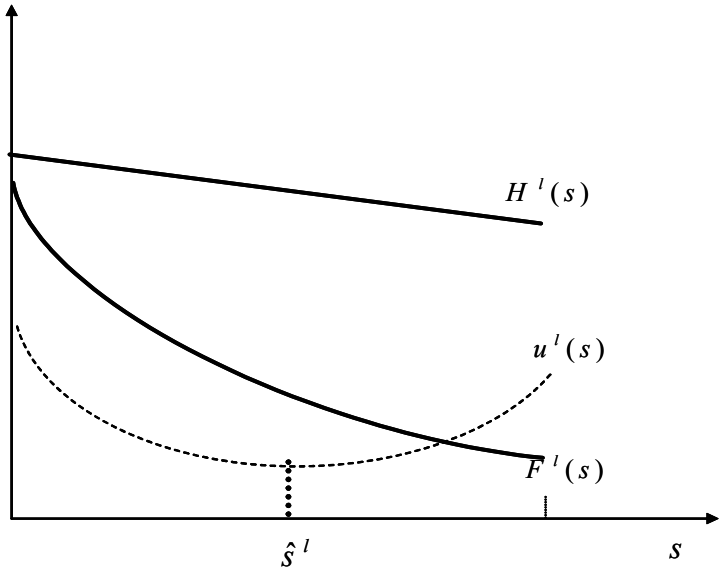

Figure 3.1: EPL and the Low-skill Types

Also the unemployment outflow rate is negatively related to the strictness of EPL, $H_1^l(s) < 0$, in accordance with empirical evidence (OECD, 1999) and with the implications of economic models of EPL (e.g., Bentolila and Bertola, 1990) which suggest that in rigid labor markets employers are less willing to hire workers in upturns, because they will not be able to dismiss them during downturns. Figure 3.1 summarizes the behavior of the low skill inflow and outflow rates as a function of the strictness of EPL. Notice that a trade-off arises since more EPL decreases the unemployment inflow of low skill types, while reducing their outflow. The overall effect on the unemployment rate is therefore ambiguous, as in standard equilibrium models of the labor market (Mortensen and Pissarides, 2001). Provided that unemployment inflows are negative and convex

sarides' (2001) equilibrium search model also yields a convexity of the reservation productivity (hence unemployment inflows) in EPL, provided that the matching function is specialised as a Cobb-Douglas. This model also implies a negative effect of EPL on unemployment inflows *and* outflows. In the case of outflows, however, it is not possible to establish a priori the sign of the second derivative.

in EPL, while unemployment outflows are linear (declining) in EPL, we expect unemployment to be decreasing for low levels of employment protection (as the effect on the inflow side dominates) and increasing for larger values of s (as the effect on the outflow side becomes relatively more important), as in Persson and Tabellini (2000), and to have an interior minimum[4] at $\widehat{s}^l$.

As discussed above, our notion of EPL is one of fixed, deadweight costs, protecting mainly the low-skill types. For analytical convenience, we investigate the case where EPL leaves the high types unaffected, i.e., F^h and H^h are constant in our model. Our results hold also when EPL is supposed to affect inflow and outflow rates of the skilled workers, provided that unemployment flows are less responsive for the high-skill types than for the low-skill individuals and the low-income insiders constitute a majority of the voters (see a companion paper, Boeri, Conde-Ruiz and Galasso, 2003).

Finally, consistently with a large body of empirical evidence on hazards from employment to unemployment and viceversa, we assume that the unemployment inflow rate is always higher for the low than for the high skill workers[5], $F^l(s=0) \geq F^h$, and that, for any degree of EPL, the unemployment outflow rate of the high skill workers is higher than the outflow rate of the low skill ones, $H^l(s) \leq H^h(s) \ \forall \ s$.

3.3. Individual Preferences

As in Wright (1986) and Pissarides (2001), in our model individuals cannot save to insure against the risk of becoming unemployed. Thus, in every period, the level of consumption for each skill type is entirely determined by her employment status. If

[4]The following assumptions are sufficient for the unemployment rate to have a minimum, although the unemployment rate needs not to be convex in s: (i) the inflow rate is decreasing and convex in the degree of EPL, $F_1^l < 0$ and $F_{11}^l > 0$, and (ii) that the outflow rate is a linear, non-positive function of the EPL, $H_1^l < 0$ and $H_{11}^l = 0$.

[5]This assumption mainly captures the difference in the job-to-job reallocation between low and high ability types. In fact, high ability types tend to have more job-to-job mobility and a lower unemployment inflow rate than the low-ability types. Additionally, high-ability workers have more firm specific human capital, which reduces incentives of employers to fire them. Evidence supporting this modeling strategy is also provided in Section 5.

employed, a type j agent consumes $(1-\tau)\,w^j l^j$; if unemployed, she consumes $b^j(s,\tau,\phi)$. It is useful to denote the difference in utility between the two labor market stata for a type-j agent as $\Delta v^j = v\left((1-\tau)\,w^j l^j\right) - v\left(b^j\right) > 0$. We can now characterize the indirect utility function with respect to the degree of EPL and UB. Let $V_i^j(s,\tau,\phi)$ denote the expected lifetime utility of a type-j agent when she is currently in state i. Then $V_O^j(s,\tau,\phi)$ is the expected lifetime utility of a type-j agent who is currently unemployed – an outsider – and $V_I^j(s,\tau,\phi)$ is the utility of a currently employed agent– an insider. Since the expected utility depends only on the state, and not on the date, we have that:

$$V_i^j(s,\tau,\phi) = \frac{\left(1-\theta_i^j(s)\right) v\left((1-\tau)\,w^j l^j\right) + \theta_i^j(s)\, v\left(b^j\right)}{(1-\beta)} \tag{3.2}$$

where

$$\theta_O^j(s) = \frac{1-\beta+\beta F^j}{1-\beta+\beta\left(F^j+H^j\right)} \tag{3.3}$$

represents the (discounted) proportion of time that a type-j agent who is currently an outsider will spend unemployed during her lifetime, while

$$\theta_I^j(s) = \frac{\beta F^j}{1-\beta+\beta\left(F^j+H^j\right)} \tag{3.4}$$

represents the (discounted) proportion of time that a type-j agent who is currently an insider will spend unemployed, and again $j = h, l$. Clearly, $\theta_O^j(s) > \theta_I^j(s)\ \forall j$. It is useful at this juncture to define the degree of EPL which minimizes the (discounted) time spent unemployed respectively by a low-skill insider and outsider[6]: $\widetilde{s}_I = \arg\min \theta_I^l(s)$ and $\widetilde{s}_O = \arg\min \theta_O^l(s)$. It is easy to see that $\widetilde{s}_O < \widehat{s}^l < \widetilde{s}_I$ – where $\widehat{s}^l$ is the degree of EPL which minimizes unemployment among low-skill types – since $\widetilde{s}_O$ and $\widetilde{s}_I$ take into account the current employment status of the agent. Figure 3.2 summarizes the behavior of $\theta_I^l(s)$, $\theta_O^l(s)$, and u^l with respect to s. Finally, notice that as β approaches 1, current

[6] Again, the assumptions on $F^l(s)$ and $H^l(s)$ – see footnote 4 – are sufficient for $\theta_I(s)$ and $\theta_O(s)$ to have a minimum, albeit not to be convex.

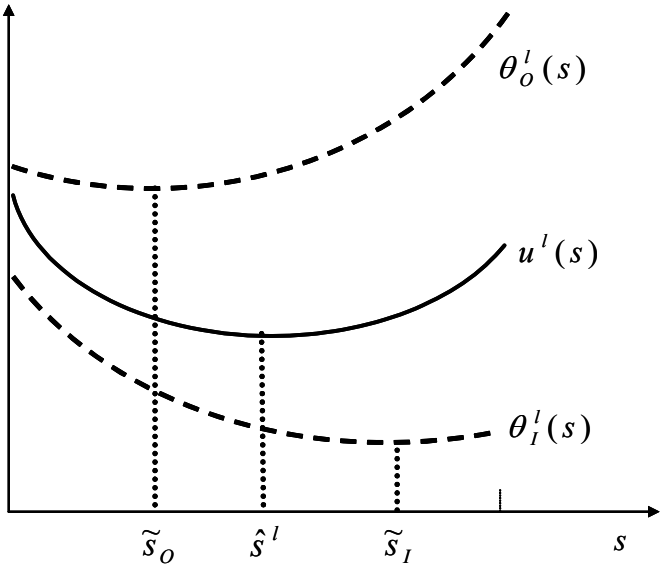

Figure 3.2: EPL: Low-skill Insiders and Outsiders

employment conditions lose their relevance and the indirect utilities of a type-j insider or outsider coincide: $\theta_I^l(s) = \theta_O^l(s) = u^l$.

4. The Political Game

The degree of EPL and the level and generosity of the UB are decided at majority voting. When the election takes place, all agents – employed and unemployed – cast a ballot over $\tau \in [0,1]$, the income tax which finances the unemployment insurance, $\phi \in [0,1]$, the degree of redistribution operated by the UB system and $s \in [0,1]$, the strictness of EPL. Individual preferences over the three issues are represented by the indirect utility functions at equation 3.2, further characterized at equations 3.3 and 3.4 respectively for the outsiders and the insiders. This majoritarian voting game shares an important features with the games analyzed in Conde-Ruiz and Galasso (2003 and 2004). The issue space is three-dimensional, (τ, s, ϕ), and thus a Nash equilibrium

typically fails to exist. To overcome this well-known problem, we follow Shepsle (1979), and more recently Persson and Tabellini (2000), in analyzing voting equilibria induced by institutional restrictions, i.e., structure-induced equilibria. Conde-Ruiz and Galasso (2003 and 2004) discuss the set of institutional restrictions, which are needed to convert a multi-dimensional election into a (dynamic) simultaneous *issue-by-issue* voting game, in which a (structure induced) equilibrium exists. The concept of structure induced equilibrium – or issue-by-issue voting – applied to our political game can be summarized as follows. For every value of s, the degree of EPL, and ϕ, the across-skill redistribution operated by UB, each voter determines her most preferred value of τ, the level of UB; analogously, the most preferred level of s is chosen for given τ and ϕ; and the most preferred value of ϕ for given τ and s. In other words, every agent votes three reaction functions: $\tau(s,\phi)$, $s(\tau,\phi)$ and $\phi(\tau,s)$. A triple (τ^*, s^*, ϕ^*) is an equilibrium of this voting game if τ^* represents the outcome of a majority voting over the jurisdiction τ – the level of unemployment benefit – when the other two dimensions are fixed at their levels s^* and ϕ^*, and so on for s^* and ϕ^*.

We restrict our analysis to steady states and assume that the voting game takes place once and for all. Re-voting, as in Conde-Ruiz and Galasso (2003 and 2004), would allow to capture some dynamic aspects of the game, but at the cost of further complicating the analysis of the political equilibrium. We now turn to the voting game by examining respectively the agents' decisions over the EPL for given τ and ϕ; the decisions over the UB for given s and ϕ, and then the decisions over the level of redistribution within the UB for given s and τ.

4.1. Voting over the degree of Employment Protection Legislation (s)

EPL affects the utility of agents through its effects on the unemployment inflow and outflow rates. As discussed in the previous section, however, EPL does not modify the high skill agents' unemployment inflow and outflow rates. Hence, high skills insiders

and outsiders are indifferent regarding the level of EPL, and abstain from voting over s.

The choice of the low-skill agents is more complex, since the EPL creates a trade-off between their inflow and outflow rates. To see this, consider a low-skill insider. An increase in the degree of EPL has two effects on her indirect utility (see eq. 3.2). First, it has an impact on the (discounted) percentage of time that a current insider will spend unemployed during her lifetime, $\theta_I^l(s)$. Since the utility is larger when employed, this effect is positive for $s < \widetilde{s}_I$ – where $\widetilde{s}_I$ represents the degree of EPL that minimizes $\theta_I^l(s)$ – it becomes zero at $s = \widetilde{s}_I$, and then turns negative, see Figure 3.2. Second, for any positive value of ϕ, an increase in the strictness of EPL has an impact on the unemployment benefit of the low-skilled (see eq. 3.1), through a change in their unemployment rate. This effect is positive for $s < \widehat{s}^l$ – where $\widehat{s}^l$ represents the degree of EPL that minimizes the unemployment rate for the low skill $u^l(s)$ – and weakly negative thereafter. Therefore, a low-skill insider chooses a degree of EPL between $\widehat{s}^l$ and $\widetilde{s}_I$, since she trades off the current positive effect of a decrease in the unemployment inflow rate, with the future negative impact on the average unemployment rate, and thus on the level of UBs, see Figure 3.2. A low skill outsider faces a similar problem. The latter effect coincides with the low-skill insider's decision. However, the former is positive for $s < \widetilde{s}_O < \widetilde{s}_I$ – where $\widetilde{s}_O$ is the degree of EPL which minimizes $\theta_O^l(s)$, the (discounted) fraction of time that a current outsider spends unemployed during her lifetime – it becomes zero at $s = \widetilde{s}_O$, and then turns negative. Hence, a low-skill outsider will choose a level of EPL between $\widetilde{s}_O$ and $\widehat{s}^l$, which best trades off the decrease in the average unemployment rate with the reduction in the current probability of being hired.

Combining these voting decisions, since high skills individuals abstain, if the low-skills unemployed are not a majority, $u^l < 1/2$, the median voter over the jurisdiction s (for given τ and ϕ) is a low skilled insider. The corresponding degree of EPL[7] is thus

[7] A formal discussion is provided in proposition A.1 in the Appendix.

$s^m(\tau,\phi) = s_I^l(\tau,\phi) \in \left(\widehat{s}^l, \widetilde{s}_I\right)$.

How does the degree of EPL chosen by the median voter depend on the configuration of the UB (τ,ϕ)? For this low-skill insider median voter, there is a negative relation between EPL and UB generosity and redistributive content (see proposition A.1 in the Appendix.); and the reaction functions of s with respect to τ (see figure 4.1) and with respect to ϕ are negatively sloped. This result hints at some substitutability between EPL and UB as instruments to protect against labor market risk, provided that the unemployment benefit system significantly redistributes in favour of the low-skill individuals. In fact, a higher level of unemployment insurance for the low-skills – e.g., achieved by increasing τ or ϕ – reduces the cost, in terms of consumption, of being unemployed; thus leading a low-skill insider to require a lower degree of EPL.

4.2. Voting over the level of Unemployment Benefits (τ)

Low and high skill individuals, according to their current employment status, determine their most preferred level of τ, by maximizing their indirect utility function with respect to the tax rate, τ, for given s and ϕ. As in Wright (1986), the most preferred tax rate for a type-j insider is $\tau_I^j(s,\phi) = \theta_I^j(s)$ (see equation 3.4), and for a type-j outsider is $\tau_O^j(s,\phi) = \theta_O^j(s)$ (see equation 3.3), where $j = l, h$. These tax rates are decreasing in the unemployment outflow rate and increasing in the inflow rate, since a lower (higher) probability of being unemployed induces a lower (higher) demand for unemployment insurance. In order to find the median voter over UB, we need to compare these most preferred tax rates. Among the insiders, the low skill types have a higher probability of becoming unemployed and a lower outflow rate. Thus, they prefer a higher tax rate than the high skill workers, $\tau_I^l(s,\phi) \geq \tau_I^h(s,\phi)$. A similar reasoning applies to the outsiders, hence $\tau_O^l(s,\phi) \geq \tau_O^h(s,\phi)$. Additionally, for a given skill type j, the outsiders prefer a higher tax rate than the insiders, due to their current status, and thus $\tau_O^j(s,\phi) > \tau_I^j(s,\phi)$. Although we are not able to provide a complete ordering of

the preferences of the agents over the UB tax rate, the next proposition characterizes the median voter over τ and her most preferred tax rate for given s and ϕ.

Proposition 4.1. *If $u \leq 1/2$, the median voter over the unemployment tax rate is a low skill insider, and the corresponding tax rate is $\tau^m(s,\phi) = \tau_I^l(s,\phi) = \theta_I^l(s)$.*

Except in the extreme case in which the unemployed constitute a majority of the population, the low skill insiders are pivotal in determining the level of unemployment insurance. Taken together with the previous results on the degree of EPL, this suggests that most of the political power rests in the hands of the low skill insiders, who set the UB level and the degree of EPL.

How does their choice over the size of the UB depend on the strictness of EPL and on the redistribution operated by the UB system? As shown in figure 3.2, the tax rate, $\tau^m(s) = \tau_I^l(s) = \theta_I^l(s)$, is first decreasing and then increasing in EPL (see Lemma A.2 in the appendix for a proof). The intuition is straightforward. For low strictness of EPL, an increase in s reduces the average unemployment rate of a low-skill agent as well as her unemployment inflow rate. Thus, a low skill insider is more protected against the risk of being unemployed, requires less UB, and τ decreases. Once the degree of EPL is larger than $\widehat{s}^l$, any additional increase of EPL raises the average unemployment rate, but this effect is compensated by a reduction in the unemployment inflow rate, and thus the demand for UB still declines. However, beyond $\widetilde{s}_I$ – the degree of EPL which minimizes the (discounted) percentage of time spent unemployed by a current insider – the negative effect on the unemployment rate becomes dominant, a low skill insider is more likely to become unemployed and her demand for UB begins to increase.

The degree of redistribution of the UB scheme, ϕ, on the other hand, has no effect on the median voter's most preferred size of the system, since the generosity has no impact on the unemployment inflow and outflow rates, and hence on $\theta_I^l(s)$.

4.3. Voting over the degree of (skill) Redistribution operated by Unemployment Benefits (ϕ)

Individuals' voting over the degree of redistribution of the UB scheme, ϕ, is straightforward. Within skill groups, agents have the same voting behaviour, regardless of their current employment status, since the degree of redistribution only affects the utility when unemployed (see eq. 3.2). High skill agents stand to lose from the introduction of a redistributive element in the system, since their UB is reduced, see eq. 3.1, and hence vote for zero skill redistribution, $\phi^h = 0$. Low skill individuals vote instead for the degree of skill redistribution, which maximizes the transfer from high-skills to low-skills unemployed, by taking in account that ϕ reduces the labor supply of the high skill workers (who vote "exiting" the market when ϕ is too large). Their most preferred tax rate is equal to

$$\phi^l = \frac{\epsilon}{1+\epsilon} w^h = \frac{\epsilon}{1+\epsilon}(1+A)w^l, \tag{4.1}$$

which corresponds to the median voter's decision, since $\rho^h < \rho^l$, and hence the median voter is a low skill worker.

Notice that the most preferred level of redistribution of the UB scheme does not depend on the other two issues at stake, the degree of EPL, s, and the size of the UB, τ. In other words, the reaction functions of ϕ^l with respect to s and to τ are constant. We can thus anticipate that, in the political equilibrium, $\phi^* = \phi^l$, as defined in eq. 4.1, regardless of (τ^*, s^*). Notice that ϕ^l is decreasing in the elasticity of labor supply of the high-skill individuals.

4.4. The Political Equilibria

To find the political equilibria of our voting game over the strictness of EPL, s, and the level and degree of redistribution of UB, τ and ϕ, we need to bring together the voting behavior over s, τ and ϕ in our issue-by-issue voting game. The (structure-induced) equilibrium outcomes of this voting game correspond to the point where the reaction

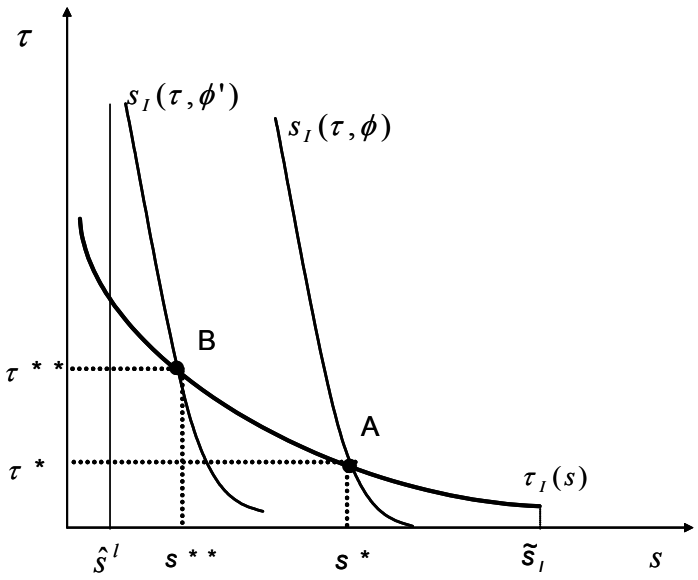

Figure 4.1: The Political Equilibrium and the Trade-off UB-EPL

function of the three median voters – characterized respectively in sections 4.1, 4.2 and 4.3 – cross. This is described in the next proposition and characterized geometrically in Figure 4.1, where two reaction functions, $\tau_I^j\left(s,\phi^l\right)$ and $s_I^l\left(\tau,\phi^l\right)$, are portrayed.

Proposition 4.2. *There exists a SIE of the voting game* (s^*,τ^*,ϕ^*) *in which* $\phi^* = (\epsilon/(1+\epsilon))(1+A)w^l$, $s^m\left(\tau^*,\phi^*\right) = s_I^l\left(\tau^*,\phi^*\right) \in \left(\widehat{s}^l,\widetilde{s}_I\right)$ *and* $\tau^* = \theta_I^l\left(s^*\right)$.

This Proposition suggests that the labor market policy, composed of the degree of EPL and the size and generosity of the UB scheme, is entirely decided upon by the low ability insiders, who represent the pivotal voters in every scheme. Low skill workers set a redistributive UB scheme, however, they prefer to be insured against the risk of becoming unemployed by strict labor market regulations, large EPL, rather than by a sizeable UB scheme. Figure 4.1 displays this equilibrium outcome at A.

The incentives faced by the low-skills insider median voter – and the resulting labor market policies – may however be affected by other labor market features. The next proposition analyzes how a change in the wage differential between high and low-skills workers, A, (recall that $w^h = (1+A)w^l$,) modifies the outcome of our politico-economic equilibrium.

Proposition 4.3. *An increase in the wage differential between high and low-skills workers, A, induces a change in an equilibrium outcome from (s^*, τ^*, ϕ^*) to $(s^{*'}, \tau^{*'}, \phi^{*'})$ with $s^{*'} < s^*$, $\tau^{*'} > \tau^*$ and $\phi^{*'} > \phi^*$*

This proposition contains the crucial theoretical result of the paper and provides a political economics explanation for the observed trade-off between EPL and UB. In countries with large wage differentials, the low skill insiders, which typically constitute a majority of the voters, favor more redistributive UB schemes, in order to appropriate more resources from the richer high skills individuals, when unemployed. However, because of this larger transfer, the difference in utility between the good state – employment – and the bad state – unemployment – is reduced, and hence low skill insiders vote for a lower strictness of employment protection, but for a relatively large UB scheme. This equilibrium is displayed at Figure 4.1 as B. Another key variable in the model is the elasticity of labor supply of the high-skill group: the higher this elasticity, the lower the degree of redistribution which can be activated per any given wage differential across skill groups, hence the less favorable – from the standpoint of low-skill types – the trade-off between EPL and UBs. Similarly, an increase in the discount factor tilts the equilibrium towards more UB and less EPL, since it reduces the relevance to the insiders of their current employment status, thereby inducing them to accept less EPL in exchange for more UB (for a formal treatment of this aspect, see the companion paper, Boeri, Conde-Ruiz and Galasso, 2003).

5. Empirical Relevance

The purpose of this section is to assess the empirical relevance of i) the substantive hypotheses of the model, and ii) its implications.

5.1. EPL, Education and Unemployment Stocks and Flows

Our key political economy results rest on the assumption that i) unemployment inflows are decreasing at a decelerating rate (convex) in the degree of EPL, and ii) the effects of EPL on unemployment inflows are stronger for low-skill types than for high-skill workers. In order to check the empirical relevance of these assumptions we proceed as follows. First, we define a partition of the population distribution by educational attainments such that more than 50% of the population has "low-skills" in all countries and the remaining part belongs to the high-skill group. This amounts to grouping together the first 4 classes of the ISCED classification (attainment of upper secondary education or below) as the "unskilled" and the remaining 3 classes as the high-skill (tertiary education) group. Second, we estimate (proxy) unemployment inflows for these two groups using cross-country comparable (Labor Force Survey) data.

Figure 5.1 displays proxy quarterly job loss rates (defined as persons who are currently unemployed and who have been dismissed by their employer in the previous 3 months, as a proportion of dependent employment) by level of education. Average data for the period 1994-8 are drawn from the retrospective part of the ECHP questionnaire and plotted against the OECD index of employment protection presented in Section 2.

In order to ease the reader, a second-degree polynomial is fitted into the correlogram. In line with the assumptions of our model, we find that unemployment inflows are declining in EPL and, limited to the low-skill workers, are (mildly) convex in employment protection. Furthermore, job loss rates are less sensitive to the changes in the strictness of EPL in the case of the high-skill types who are subject to a lower risk of job loss than the low-skilled types at any given level of s. These facts are in line with the substantive

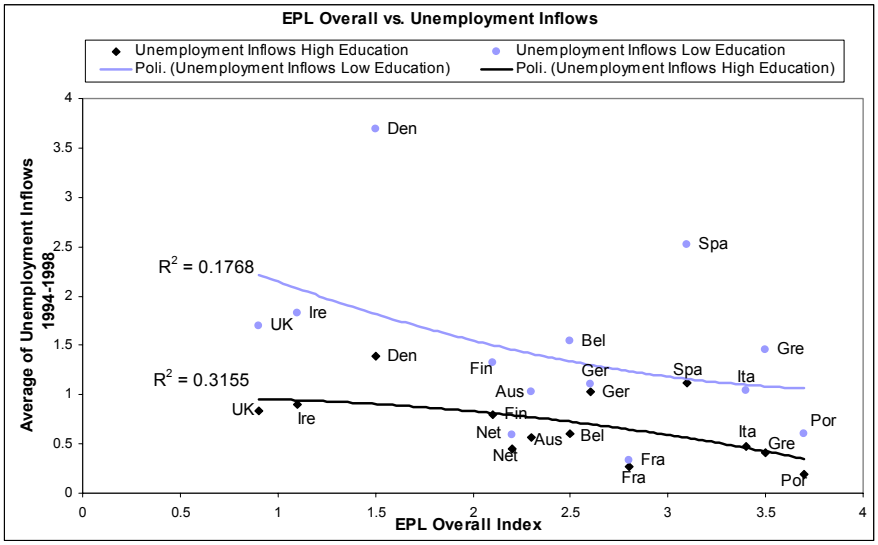

Figure 5.1: Correlation between Unemployment Inflows and Strictness of EPL for High and Low-Skilled Workers

assumptions of our model. The fact that EPL, contrary to UBs, protects only a limited segment of the workforce is also consistent with the observation of more individuals concerned about job security in high-EPL and low-UB countries than in low-EPL and high-UB ones (Clark and Postel-Vinay, 2004).

5.2. Wage Dispersion and Preferences for Employment Protection

A key implication of our model is that countries with more compressed wage structures should originate political equilibria with more stringent EPL than countries where there is a larger wage differential between high and low-skill workers. Figure 5.2 displays, on the vertical axis, returns to one-year of education as can be estimated from ECHP (for the EU-15) and CPS (for the US) data on earnings. In particular, the educational premia reported on the vertical axis are obtained estimating a standard Mincer-type

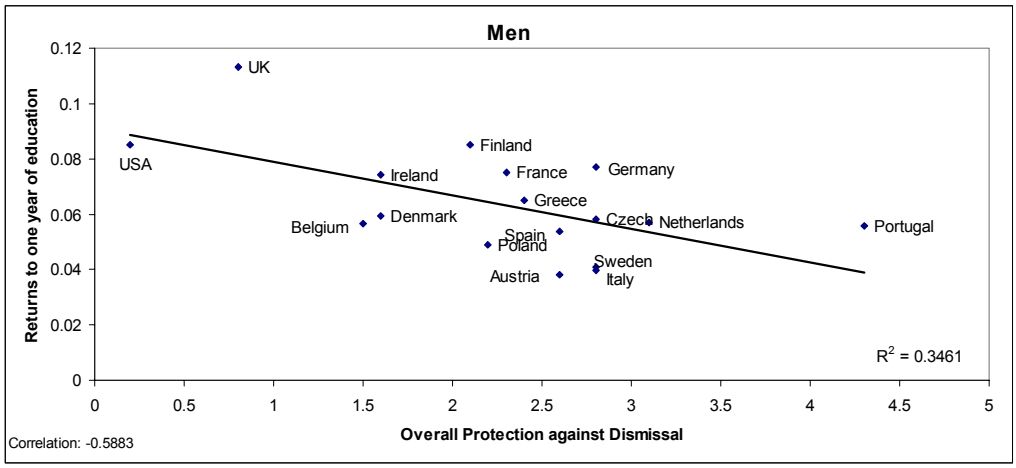

Figure 5.2:

earning equation in which education is defined in terms of years of schooling, that is

$$\log(w_i) = \alpha + \beta EDU_i + \gamma_1 TEN_i + \gamma_2 TEN_i^2 + \lambda_i + \varepsilon_i$$

where EDU are years of education and TEN denotes tenure in the current job, while λ is an Heckman correction term. The strictness of EPL is negatively correlated (-.58, which is significant at 99 confidence levels) with the compression of the earning distribution by education level. While we cannot make any inferences as to the order of causality, the strict association between s^* and the skill wage gap, $(w^h - w^l)$, is consistent with the empirical implications of our model[8].

5.3. Lessons from the Reformers

Simple pairwise correlations (e.g., the pattern displayed in Figure 5.2) cannot capture potential institutional interactions and are not informative as to the order of causality.

[8] A link between wage compression and EPL, yet not UB, was also in Bertola and Rogerson (1997), who viewed them as complementary policies.

Better insights in this respect may come by investigating the experience of the very few countries that reduced EPL for regular workers in the period covered by data and comparing their institutional evolution with that of other OECD countries. A visual inspection of Figure 2.2 suggests that the reformers were Finland, Spain and Portugal, while all the other countries maintained the same strictness of employment protection for regular workers which was prevailing around the mid-1980s. Significantly the most radical reforms of EPL – those occurred in Finland and Spain – were split into a number of milder liberalization measures. In particular, in Finland, there were three waves of reforms: in 1991, 1996 and 2001, while in Spain reductions of EPL were enacted in 1994 and 1997. This is also an indication of the time required to build-up consensus on the reforms.

Table 5.3 contrasts the experience of reformers with that of the other countries, providing information on changes in the OECD EPL indicator for regular contracts, in the gross replacement rates offered by unemployment benefits (also tabulated by OECD) and in the Gini coefficient computed over earnings of middle-aged individuals as collected by OECD (Foerster and Pellizzari, 2000). Two things stand out. First, the countries reducing EPL increased over the period the generosity of UBs while the non-reformers slightly reduced the replacement rate of UBs, and they were mildly increasing EPL. Second, inequality in the earning distributions increased quite dramatically in two out of three reformers. In Portugal the dispersion of earnings increased in line with developments in other OECD countries, but the EPL reform was carried out only at the beginning of the period, without further reductions of EPL later on, as in the case of Finland and Spain.

5.4. Conclusions

OECD countries provide different types of insurance to workers against labor market risks, by combining different degrees of employment protection and unemployment in-

	Δ EPL 1991-2002	Δ UB gross replacement rate 1991-1999	Δ GINI Mid80s-Mid90s
Finland	-0.6	+ 8	+3.0
Portugal	-0.5	+ 11	+1.2
Spain	-1.3	+1	+8.1
Others OECD	0.2	-1	+1.1

Figure 5.3:

surance. A heated debate has been taking place over the need to reform some of the existing labor market institutions, and some form of consensus has emerged even among academics that Southern European countries should adopt institutional configurations assigning a greater weight to UB and less importance to EPL in protecting workers against labor market risk. However, reforming institutions along these lines is proving difficult and politically costly.

Unlike previous literature on EPL, in this paper we have characterized employment protection regulations as a scheme redistributing not only between insiders and outsiders, but also across skill groups, namely providing more protection to low-skill than to high-skill segments of the workforce. We have shown that different institutional configurations can be interpreted as politico-economic equilibria, corresponding to the degree of redistribution between high and low-skill types which is allowed by institutional features other than EPL. Since in our model voters can also choose the amount of cross-skill redistribution in unemployment benefits, these "other" institutional features can be interpreted as unions, legal extension of the coverage of collective bargaining, minimum wages, share of employment in the public administration and minimum wages

for civil servants, etc..

Our empirical results are encouragingly in line with the key assumptions and with the implications of the model. We find that configurations with more EPL and less UB emerge in countries with compressed wage structures. We also document that the countries that succeeded in reducing EPL for regular contracts had an institutional environment characterized by increasing generosity of UBs (in contrast with developments elsewhere in the OECD arena) and widening earning differentials also by international standards. Finally, we find support for the key assumption (and distinguishing feature) of our model, namely that EPL does not significantly affect job security for workers with high skills, while it protects low-skill types.

There is a political feasibility theorem which is inspired by our analysis. It states that reforms of employment protection need to trade labor market flexibility with state-provided unemployment insurance which redistributes in favor of the low-skill segments of the workforce. The trade-off is likely to become less steep when there is a fairly large degree of redistribution across skill groups embedded in the way UBs are financed. This implication differs from the prescription in Blanchard and Tirole (2003) that UBs should mimic employment protection schemes in involving experience-rating, that is, internalizing the costs of dismissals to the employers "responsible" for the redundancies. According to our model, UBs can still be essentially designed in such a way as to pool risk across employers, but wage differentials should grow larger and unemployment benefits should not be strictly earning-related in order to win consensus to reforms. This allows to strengthen redistribution from high to low-wage earners in the provision of unemployment insurance, thereby increasing the substitutability of EPL with UBs in the minds of the median voters.

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A. Appendix

Proposition A.1. *For $u^l < 1/2$, the degree of EPL chosen by the median voter, $s^m(\tau,\phi)$, displays the following features: i) $s^m(\tau,\phi) = s_I^l(\tau,\phi) \in \left(\widehat{s}^l, \widetilde{s}_I\right)$; ii) $s^m(\tau,\phi)$ is decreasing in τ and iii) $s^m(\tau,\phi)$ is decreasing in ϕ, if $\phi \geq \epsilon/(1+\epsilon)w^h$.*

Proof of Proposition A.1: For $u^l < 1/2$, the median voter over s is a low ability insider. Hence, for given τ and ϕ, the most preferred level of EPL, $s_I^l(\tau,\phi)$, is obtained by maximizing eq. 3.2 with respect to s. i) To see that $s_I^l(\tau,\phi) \in \left(\widehat{s}^l, \widetilde{s}_I\right)$, we equates to zero the first order condition resulting from this maximization problem:

$$\underbrace{\beta\left(H_1^l F^l - F_1^l H^l\right)\Delta v^l(\tau,\phi,s)}_{A} - \underbrace{(1-\beta)F_1^l \Delta v^l(\tau,\phi,s)}_{B} + \underbrace{+\frac{F^l}{b^l(\tau,\phi,s)}\left(1-\beta+\beta\left(F^l+H^l\right)\right)\frac{\partial b^l(\tau,\phi,s)}{\partial s}}_{C}. \tag{A.1}$$

where

$$\frac{\partial b^l(\tau,\phi,s)}{\partial s}\frac{1}{b^l(\tau,\phi,s)} = -\frac{u'^l}{u^l}\left(\frac{w^l\rho^l + \phi w^h l^h \rho^h(1-u^h)}{w^l\rho^l(1-u^l) + \phi w^h l^h \rho^h(1-u^h)}\right)$$

If we evaluate this FOC in $\widehat{s}^l$, the first and the third terms, i.e., A and C, are equal to zero, while the second term, and thus the entire FOC, is positive, since $F_1^l < 0$. Therefore, $s_I^l(\tau,\phi) > \widehat{s}^l$. On the other hand, if we evaluate this FOC in $\widetilde{s}_I$, the first two terms, i.e., A and B, are equal to zero, since $\beta\left(H_1^l F^l - F_1^l H^l\right) - (1-\beta)F_1^l = 0$ for $s = \widetilde{s}_I$; while the third term, and thus the entire FOC, is negative, since $\left(\partial b^l/\partial s\right) < 0$ for $s = \widetilde{s}_I$.

ii) To prove that $s_I^l(\tau,\phi)$ is decreasing in τ, we apply the implicit function theorem to the FOC at eq.A.1. Since $SOC\left(s_I^l\right) < 0$, we have that the sign of $ds_I^l(\tau,\phi)/d\tau$ is equal to the sign of $dFOC(s_I^l(\tau,\phi))/d\tau$. Notice that the FOC at eq.A.1 can be written as

$$-\Delta v(s,\tau,\phi)\frac{\partial \theta_I^l(s)}{\partial s} + \theta_i^j(s)\frac{\partial v\left(b^l\right)}{\partial s} = 0 \tag{A.2}$$

and its derivate as

$$\frac{dFOC\left(s_I^l(\tau,\phi)\right)}{d\tau} = -\frac{\partial\theta_I^l(s)}{\partial s}\left(\frac{d\Delta v(s,\tau,\phi)}{d\tau}\right) + \theta_i^j(s)\frac{\partial^2 v\left(b^l\right)}{\partial s\partial\tau} \leq 0$$

since $d\Delta v(s,\tau,\phi)/d\tau \leq 0$ and $\partial^2 v\left(b^l\right)/\partial s\partial\tau = 0$.

iii) To prove that $s_I^l(\tau,\phi)$ is decreasing in ϕ, we apply the implicit function theorem to the FOC at eq.A.1. Since $SOC\left(s_I^l\right) < 0$, again the sign of $ds_I^l(\tau,\phi)/d\phi$ is equal to the sign of $dFOC(s_I^l(\tau,\phi))/d\phi$. By differentiating eq. A.2, we have

$$\frac{dFOC(s_I^l(\tau,\phi))}{d\phi} = -\frac{\partial\theta_I^l(s)}{\partial s}\left(\frac{d\Delta v(s,\tau,\phi)}{d\tau}\right) + \theta_i^j(s)\frac{\partial^2 v\left(b^l\right)}{\partial s\partial\phi} \leq 0$$

Notice that $d\Delta v(s,\tau,\phi)/d\tau \leq 0$ and .

$$\frac{\partial^2 v\left(b^l\right)}{\partial s\partial\phi} = w^h\rho^h(1-u^h)(w^h-\phi)^{\frac{1}{\epsilon}}[1-\frac{\phi}{\epsilon(w^h-\phi)}]$$

is negative if $\phi \geq \epsilon/(1+\epsilon)w^h$. This completes the proof. **q.e.d.**

Proof of Proposition 4.1: Recall that $\tau_O^l \geq \tau_I^l \geq \tau_I^h$. Thus, we may have that either i) $\tau_O^l \geq \tau_O^h \geq \tau_I^l \geq \tau_I^h$, in which case τ_I^l is the median over the distribution of the preferred tax rates only if the outsiders are less than half population, $u < 1/2$; or ii) $\tau_O^l \geq \tau_I^l \geq \tau_O^h \geq \tau_I^h$, in which case τ_I^l is the median over the distribution of the preferred tax rates if the low skill outsiders are not a majority of the population, which is implied by $u < 1/2$, since $\rho^l u^l \leq u$. **q.e.d.**

Lemma A.2. *i) $\tau^m(\tau,\phi)$ is first decreasing and then increasing in s with a minimum in $\widetilde{s}_I$, and ii) $d\tau^m(\tau,\phi)/d\phi = 0$*

Proof of Lemma A.2: i) Recall that $\tau_I^l(s,\phi) = \theta_I^l(s)$, and thus $\widetilde{s}_I = \arg\min \tau_I^l(s,\phi)$. By deriving the numerator of $d\theta_I^l(s)/ds$ w.r.t. s, it is easy to see that – under the assumptions on $F(s)$ and $H(s)$ – the function $\theta_I^l(s) = \tau_I^l(s)$ is first decreasing and then

increasing in s, albeit not necessarily convex for $s < \widetilde{s}_I$. ii) Notice that $\tau_I^l(s,\phi) = \theta_I^l(s)$, and that $\theta_I^l(s)$ – by eq.3.4 – does not depend on ϕ. **q.e.d**

Proof of Proposition 4.2: Recall that the reaction functions are $\tau_I^l\left(s,\phi^l\right)$, $s_I^l\left(\tau,\phi^l\right)$ and $\phi^l(\tau,s) = \phi^l$, as defined in eq. 4.1. We need to show that these three reaction functions cross – at least – once for $s^* \in \left(\widehat{s}^l, \widetilde{s}_I\right)$, $\tau^* > 0$ and $\phi^* = \phi^l$. Recall that, by lemma A.2, $\tau_I^l(s)$ is decreasing in s for $s \in (0, \widetilde{s}_I)$. By lemma A.1, $s_I^l(\tau) \in \left(\widehat{s}^l, \widetilde{s}_I\right)$ is decreasing in τ, however, if the preferences of the low-skill insiders are not single-peaked, $s_I^l(\tau)$ may not be continuous. Let us first consider a continuous function. By using eq. A.1, and the reasoning in Prop. 4.1, it is easy to show that $s_I^l(\tau) = \widehat{s}^l$ – its lower bound, see figure 1 – for $\tau = u^l$. Since $\tau_I^l\left(\widehat{s}^l,\phi^l\right) = \theta_I^l\left(\widehat{s}^l,\phi^l\right) < u^l$, the reaction function $s_I^l\left(\tau,\phi^l\right)$ is above the reaction function $\tau_I^l\left(s,\phi^l\right)$ for $s = \widehat{s}^l$. To show that the two reaction functions cross (for $\phi = \phi^l$), we need to establish that for s close to $\widetilde{s}_I$ the reaction function $s_I^l\left(\tau,\phi^l\right)$ is below the reaction function $\tau_I^l\left(s,\phi^l\right)$. To see this consider the FOC at eq.A.1, which implicitly defines $s_I^l\left(\tau,\phi^l\right)$. Notice that as $\tau \to 0$, $\Delta v^l \to +\infty$, and the first two terms of eq.A.1 tend to $+\infty$, since $s_I^l\left(\tau,\phi^l\right) < \widetilde{s}_I$, while the third term is negative, since $s_I^l\left(\tau,\phi^l\right) > \widehat{s}^l$. Thus, according to the low skill insider optimization, for $\tau \to 0$, $s_I^l\left(\tau,\phi^l\right) \to \widetilde{s}_I$. Finally, notice that for $s = \widetilde{s}_I$, $\tau_I^l\left(\widetilde{s}_I,\phi^l\right) = \theta_I^l\left(\widetilde{s}_I\right) > 0$, and the reaction function $s_I^l\left(\tau,\phi^l\right)$ is below the reaction function $\tau_I^l\left(s,\phi^l\right)$. To summarize, if the function $s_I^l\left(\tau,\phi^l\right)$ is continuous, it crosses $\tau_I^l\left(s,\phi^l\right)$ at least once for $s^* \in \left(\widehat{s}^l, \widetilde{s}_I\right)$, $\tau^* > 0$ and $\phi = \phi^l$. If the function is not continuous, a (Structure Induced) equilibrium may fail to exist, since the crossing may not occur. **q.e.d.**

Proof of Proposition 4.3. It is straightforward. Since $\phi = (\epsilon/(1+\epsilon))\, w^h$, an increase in A increases ϕ. By Lemma A.2, the reaction function $\tau^m(\tau,\phi)$ does not move, while – by Proposition A.1 – the reaction function $s^m(\tau,\phi)$ decreases. It follows that s^* decreases, while τ^* (and ϕ) increase. **q.e.d.**