Uncertainty and the Politics of Employment Protection*

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Abstract

This paper investigates the role that idiosyncratic uncertainty, in the form of firm-specific productivity shocks, plays in shaping social preferences over the degree of labor market "flexibility". How labor markets respond to shocks is shaped by institutional factors such as the strenght of the "bargaining power" of labor. A more volatile environment, and a more modest systematic rate of productivity growth ("bad times") may tend to favor the political support for a (more) rigid labor market only if the rents appropriated by the employed are relatively large to start with (e.g. Continental Europe in the 1970's). However, a similar type of shock can reinforce the socio-political stability of a flexible labor market where workers are relatively weak (e.g. the United States over the same period). The model thus confirms the hypothesis that the exposure to similar shocks may indeed be a source of institutional divergence across economies. A second result demonstrated refers to the possibility of observing "institutional hysteresis". If the institutional structure of the labor market becomes more rigid following a shock, it may fail to revert to the mean once the macroeconomic fundamentals have done so. This is so because of the status quo bias problem associated with labor market rigidities: (some) insiders are reluctant to give up their privileges and do oppose reforms.

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1 Introduction

The issue of the reform of labor market institutions toward more "flexibility" is one of the most important parts of the political agenda of many governments of Continental Europe. It stands at the top of it along with few other topics, most notably the one of the reform of unsustainable pensions systems.

This is perhaps not casual as the endurance of both problems seems to have a common root in the very difficult *political* feasibility of the relative corrective interventions. While the potential gains in terms of efficiency of reforming "sclerotic" labor markets seem to be wide, the implementation of the corresponding interventions has turned out to be almost invariably very problematic across European countries. This fact appears clearly as a quite striking puzzle from a social welfare perspective. But it is a lot easier to rationalize from a political economy one, recognizing the role that the heterogeneity of interests across individuals plays in shaping the outcomes of collective decisions.

Indeed, abundant evidence shows that, during the 1990's, the legislative interventions of labor market reform proposed across Europe have almost everywhere met the fierce political opposition of large segments of the employed workforce. The political weight of these groups in collective decision making has turned out to be almost always determinant.[1] Employed workers, because of their number, can exert a very large political influence, at least within democratic systems, an influence that is potentially higher than the one of nearly any other class of individuals.[2] By the very same token, it is clear that the political weight of the unemployed cannot be but relatively marginal, however high unemployment may reasonably thought to be.

Recognizing the role that the political weight of the employed can play in protecting sclerotic labor market institutions, opens up the door to some deeper questions, which may be articulated as follows.

- What does indeed cause the political support granted by many employed in some (but not in all) countries to job security provisions?

[1] A few examples are the failure of the attempt of the French government to reduce minimum wages in 1994, and the loss of the election by the Swedish government in the same year for having lowered unemployment benefits. Many other cases could be mentioned.

[2] The same thing is true about pensioners, who constitute a relatively large social group, and possibly even more homogenous and compact than the employed. This observation gives extra credit to the basic argument that the correct perspective on the viability of many economic reforms is indeed a political one.

- Secondly and related, are really *all* the employed in favor of the protection, or of the establishment, of rigid labor market institutions? Or else would some of them gain from more elements of employment flexibility?
- Thirdly, how does the aggregate economic framework contribute to shape individual preferences on the stringency of employment protection measures?

This paper attempts to provide an answer to the questions raised above and to do so it develops a dynamic general equilibrium model of the labor market where both wages and job flow rates are endogenous and explicitly derived in closed form. The model also merges together two classes of structures that usually kept separated, namely

- a variant of the "flow" approach to the labor market equilibrium (e.g. Pissarrides (2000)).
- Partial equilibrium models of dynamic of labor demand with idiosyncratic Brownian uncertainty (e.g. Bentolila and Bertola (1990)) as opposed to the more standard Poisson-type uncertainty usually postulated.

The paper has a rather broad historical perspective, in the sense that it is not only concerned with the timely issue of the political economy of labor market reform. Rather, it seeks to shed some light, from a political economy perspective, on the most salient events and turning points that, since the post-war period (and particularly since the 1970's), have brought to the development of the rigid labor market institutions that today still largely characterize the *status quo* in Europe. Let me then continue by briefly reviewing the available evidence on this process.

1.1 Some Longer Run Evidence

Several authors (e.g. Cabellero and Hammour (1998), Blanchard and Wolfers (2000), Blanchard (2000)) have recently stressed that, contrary to a widely held belief, the historical origin of Eurosclerosis has to be traced back to an earlier period, by at least one decade, than the 1970's. Various forms of labor market rigidities and other generous social welfare programs were first introduced through the 1950's and 1960's, and therefore at a proverbially

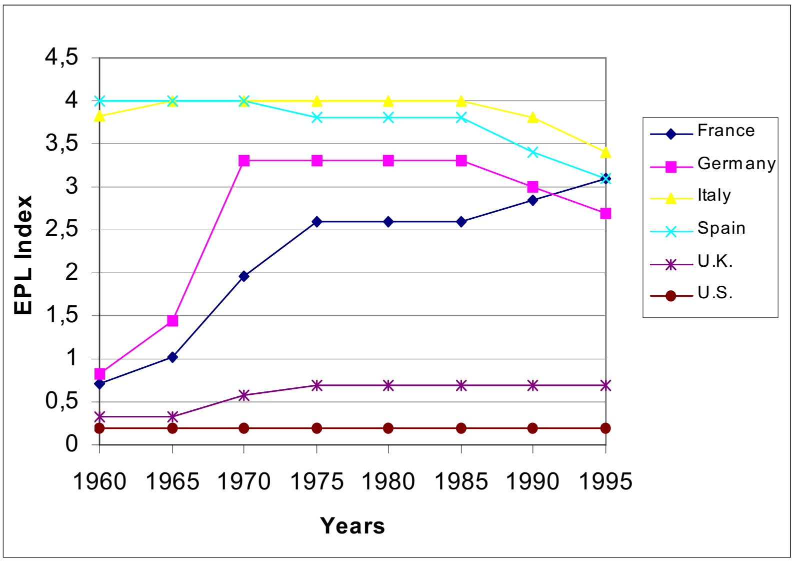

Figure 1: Blanchard and Wolfers EPL Index (1960-1995).

"good" time, that made them appear affordable (Blanchard (2000)). In the 1970's, when things turned bad, all these institutions and, in particular, job security provisions, were further reinforced and expanded.

Some quite clear evidence in this sense is contained in figure 1, which portraits the times series of the index of employment protection (EPL) elaborated by Blanchard and Wolfers (2000)[3] for the five major countries of Europe (France, West Germany, Great Britain, Italy and Spain), and for the U.S., over the period 1965-1995.

Two countries, Italy and Spain, appear to have started out with extremely rigid labor market institutions, which remain very stable for most of the time, and exhibit both a modest trend toward more flexibility only in recent years.[4] The case of the other countries is more interesting. In France,

[3] The time series for this index are essentially a combination of published and unpublished data from the OECD and from the paper of Lazear (1990).

[4] As far as Italy is concerned, Blanchard and Wolfers admit that the index is likely not to capture precisely the extremely high degree of employment protection actually present there through the 1970's, and arguably higher than ever before. Indeed, the year 1970 sees the approval by the Italian parliament of the "Statuto dei Lavoratori", a law imposing some very sharp restrictions on layoffs, and representing a turning point in the history of industrial relations in that country.

the index increases from about 0.7 to 1 between 1960 and 1965, from 1 to 1.97 between 1965 and 1970 and from 1.97 to 2.6 between 1970 and 1975. A very similar trend is also observed in Germany and, though in quite different proportions, even in Great Britain. An inverse trend toward less sclerosis appears through the 1980's and 1990's, but it is rather weak, and not even uniform (it is absent in France).

Finally, the U.S. appear to have always been a virtually fully flexible economy, thus confirming the conventional wisdom belief.

It is worth stressing again that these institutional transformations have taken place within the framework of macroeconomic conditions that are very different over time, but very similar across countries at any point in time. This is transparent as far as two variables as the trend rate of productivity growth, and its volatility around the trend, are concerned, as documented by various recent empirical contributions.

For instance, in a recent paper, Blanchard and Simon (2001) demonstrate that output volatility, defined as the standard deviation of quarterly output growth, has appeared to decline since the 1950's in the U.S. as well as in the other G-7 countries (except Japan). This decline has been substantial (roughly of a factor of 3 up to the 1990's in the U.S. and elsewhere) but discontinuous. A significant interruption of the trend can in fact be observed in the period going from the late 1960's to the early 1980's, when a large increase in output (and in inflation) volatility has characterized virtually all the advanced economies. Also, as figure 2 (data from Blanchard and Simon (2001)) shows, the time pattern of the evolution of output volatility has been strikingly similar across countries, a similarity which clearly suggests the existence of some common force at work at medium and low frequencies. This is confirmed in one other respect by figure 3, which portraits the behavior of the rate of growth of total factor productivity (from 1965 to 1995) in some of the main industrialized economies.

In sum, there is substantial evidence that both the good time of the sixties and the bad time of the seventies have been associated with the progressive build-up of Eurosclerosis, and in particular with a substantial drive toward more rigidity in employment relations.[5] At the same time,

[5] It is interesting to notice that the evidence provided by the time series behavior during the period 1960-2000 of an other important institution like the replacement ratio is instead much more mixed. According to the OECD estimate (reported in Blanchard and Wolfers (2000)), it is for example stationary in Germany during the whole period. In Italy it decreased constantly until the middle of the 1980's. See Saint-Paul (2000) for an

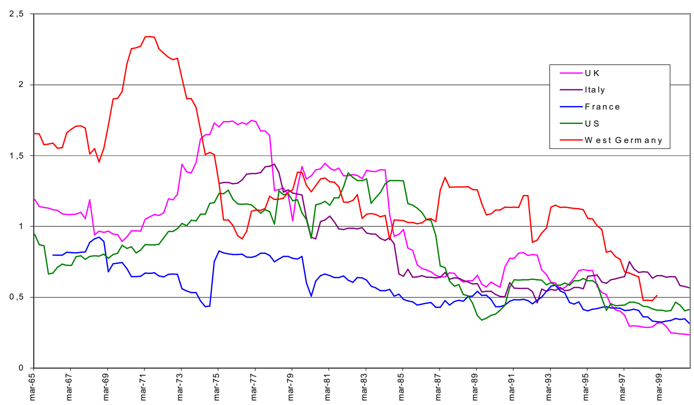

Figure 2: Standard Deviation of Output Growth (1965:3-1993:3).

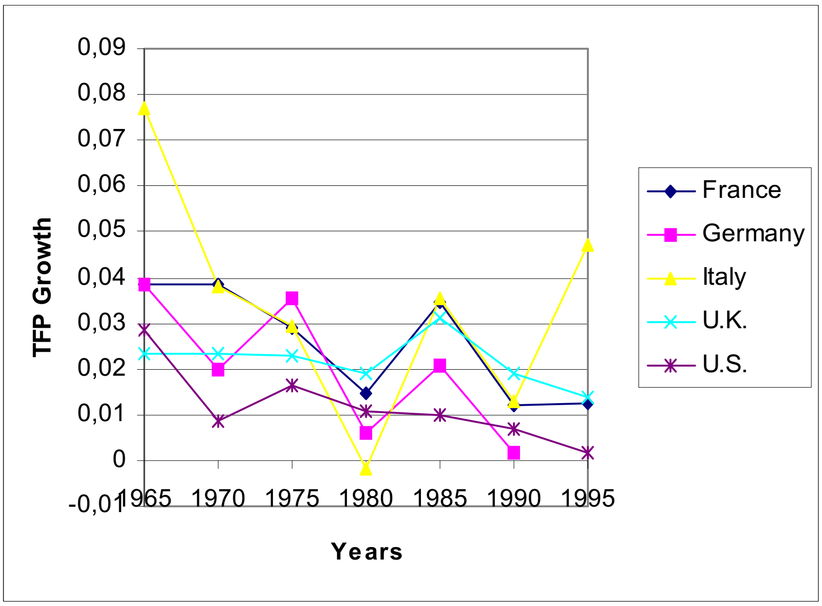

Figure 3: TFP Growth (1965-1995).

there is so far less evidence of something like an institutional reversion to the mean, having the effects of the 1970's shocks presumably largely, if not entirely, died out.

Why has that been so? Why some fundamental macroeconomic transformations, and of opposite sign, have been associated, in Europe, with very similar transformations of employment relations? Why have these transformation instead not been observed in the U.S.? And why, having the macroeconomic framework changed again since last 15 years or so, have they been so much persistent?

1.2 Rents, Uncertainty and Job Protection

In this paper, the *rent* appropriated by the employed as such is identified as the origin of the political support to labor market rigidity. By rent I mean a benefit that accrues to the employed *in excess* to the value of unemployment. Because of some underlying economic mechanism, the unemployed are unable to underbid the employed offering to work for a smaller wage and therefore find themselves *involuntarily* in that state.

Job security provisions are in this context the outcome of a decision of some employed, who attempt to protect their position of insiders and along it their rent. They do so by voting over an institution, a *firing cost* imposed on firms which, acting as a tax on layoffs, tends to extend artificially the duration of jobs and thus of the rents accruing to the employed. This voting decision is not trivial, however, since firing costs, by increasing the total cost of labor borne by firms, reduce job creation. In general equilibrium therefore they depress both the exit rate from unemployment (and along it also the re-employment prospects of the employed) and both wages, which will depend positively on it as in many non Walrasian labor market models.

This paper highlights how the basic trade-off implied by firing restrictions is faced by *ex ante* identical workers, in an economy where firms experience the realization of some idiosyncratic uncertainty related to their output demand-productivity. And where therefore employed workers become *ex post* heterogeneous in terms of their own individual productivity (and wage). So the interaction of two main factors shapes the individual preferences on firing costs of the employed, beyond the magnitude of rents appropriated by them. One is the individual heterogeneity generated by the realization of idiosyncratic shocks. The other one is the form of the uncertainty faced by firms, as parametrized by the stochastic process postulated

argument of why employed workers would prefer employment protection to unemployment insurance.

for their output demand. Changes in the fundamental parameters driving this process may be thought to correspond the realization of the major low frequency shocks that, arguably unexpectedly, have affected similarly industrialized economies during the last forty years.

A basic mechanism operates in the model. Namely a relation of *complementarity* arising in equilibrium between volatility and flexibility. In a more turbulent environment, the positive effect of flexibility on job creation turns out to be higher. This benefits all workers, employed and unemployed. However a similar complementary, but of opposite sign, arises for employed workers only in terms of rents. In a more flexible economy, these are expected to end up sooner, and the more so, the more volatile is the environment. Consequently employed workers tend also to lose relatively more, at the margin, by a relaxation of the firing discipline. Where the "rent extraction power" of the employed is high enough (in Europe, say), more volatility tends to let the negative marginal effect of flexibility on the employed's welfare dominate over the positive one, precisely because rents are a relatively more important component of it. The opposite is true where the employed are able to extract only relatively small rents from firms (say in the U.S.).

This effect, which shapes the preferences of the employed over the stingency of job security provisions, may arguably play an important role in explaining the variations of the latter observed across economies and over time.

1.3 Related Literature

This work is related to a variety of different papers. The list includes previous models of political economy of the labor market, such as the contributions of Lindbeck and Snower (1988) and Saint-Paul (1993). A main difference with both these works is related to the heterogeneity of preferences within the pool of the employed arising here, and to the richer dynamic interactions emerging from the general equilibrium structure of the economy. Both these features imply that the somewhat extreme conflict of employed versus unemployed featured by these earlier models does typically not arise anymore, to allow for more interesting and realistic forms of political equilibrium configurations.

The paper is also related to the dynamic labor demand model of Bentolila and Bertola (1990), which has a stochastic structure in continuous time similar to the one assumed here. However in that paper wages are exogenously determined, and issues related to the political economy of turn-over costs determination are ignored. Also, an important progress relatively to that paper is the explicit (closed form) derivation of the rates of job creation and destruction per unit of time.

The two contributions that are closer to this paper are however the work of Saint-Paul (2002) and a previous paper of mine (Vindigni (1999)). The first paper is concerned with the political economy of employment protection within a vintage capital model of (exogenous) growth. Its emphasis is therefore on the way embodied productivity growth, rather then idiosyncratic fluctuations, shapes the political equilibrium of the model. The second paper considers an economy where workers are *ex ante* heterogenous in terms of their human capital endowment, and studies how this heterogeneity affects the preferences for employment protection.

The paper is organized as follows. Section 2 lays down the foundations of the model, whose economic equilibrium is obtained and characterized in section 3. Political economy issues are mostly treated in sections 4, 5 and 6. Section 7 concludes. All the proofs and derivations are to be found in the appendix, if not reported in the text.

2 The Economy

2.1 Basic Environment

The basic economic environment is similar to the one of Saint-Paul (2002) with the main difference that creative destruction is ignored to focus instead on firm-specific uncertainty due to the realization of productivity and/or demand shocks. The economy is a small and open one, populated by a continuum of measure one of risk neutral workers. Workers may be employed or unemployed, so that their future income stream $\{y_s\}_{s=t}^{\infty}$ is uncertain, and discount future welfare at a rate r equal to the given (real) interest rate faced by the economy. Hence, their preferences may be expressed as[6]

$$u_t = E_t \left\{ \int_t^{\infty} e^{-r(s-t)} y_s ds \right\}. \tag{1}$$

[6] The assumption of risk neutrality implies of course that workers never save any portion of their income, but always consume it entirely. This rules out the possibility of assets accumulation by them, which would occur under a more general preferences specification, available a saving technology.

Jobs are created by risk neutral firms who do incur in a fixed setup cost $C > 0$ in doing so.[7] Since there are no search frictions (e.g. Pissarrides (2000)), firms fill up vacancies instantaneously.[8] The available production technology is Leontief, by which an amount of output is produced per unit of time with one worker only. The productivity x (or, equivalently, the market value of the output) of each establishment is normalized to unity at the moment of its creation, but is exposed thereafter to the realization of random idiosyncratic shocks. More specifically, x is assumed to evolve over time as a geometric Brownian process, whose stochastic differential is represented by

$$dx = \mu x dt + \sigma x dw$$

where w stands for a Wiener process and the parameters $\mu \in \Re_+$ and $\sigma \in \Re_{++}$ indicate the drift and the instantaneous standard deviation of x respectively. μ parametrizes the trend component in the evolution of the rate of growth of the process x, that is the rate of growth of the firm's productivity or output demand,[9] and σ its volatility around that trend.

A unit keeps operating as long as its productivity does not fall below a critical level (see below). When this event occurs, the firm is supposed to pay a firing cost $F \geq 0$ upon laying off its employee, which will be always regarded as purely wasted income.[10] There is an essential difference between the setup and the layoff cost. The setup cost C is given in the sense that it reflects a constraint of technological nature on job creation regarded as a primitive of the economy. The firing cost F vice versa is determined as the outcome of a collective choice process based on majority voting. Therefore F, unlike C, may in principle be zero. A (realistic) upper bound to the degree of admissible rigidity is imposed by assumption.

[7] This setup cost does not really play any substantial role in the model, and in fact I will focus the attention on the case of $C \simeq 0$. I introduce it for a purely technical reason, namely to smooth out an unappealing discontinuity in the firms' value function, which would arise if C was exactly equal to zero.

[8] In equilibrium there will be some unemployment nonetheless, but only *one* side of the market, workers, will be rationed. This is of course different from what happens in an economy with search frictions. In that an environment both sides of the market, firms and workers, do not generally match instantaneously with a trading partner.

[9] For simplicity, unlike Bentolila and Bertola (1990), I will not distinguish between the two of them.

[10] This firing cost corresponds therefore essentially to a deadweight loss rather than to a severance transfer. Indeed, the costs of layoffs for firms in terms of length of the notice period or of related legal procedures are likely to be much more relevant than those implied by pure redundancy payments (Emerson (1988)).

Assumption 1. $F \leq F^{\max}$, *where* $F^{\max} < \frac{1-\beta}{r-\mu} - C$.

Assumption 1 in needed to ensure the existence of an equilibrium with involuntary unemployment.

By standard arguments, the Bellman value $J(\cdot)$ of a job for a firm (the expected present discounted value of the future profits stream *gross* of layoff costs), as a function of the current realization of the productivity shock, x, satisfies then the following functional relation

$$rJ(x) = \max\left\{x - w(x) + \frac{1}{dt}E(dJ), -rF\right\}. \tag{2}$$

The right hand side of (2) corresponds to the maximum between the continuation value of the asset and the flow equivalent, or annuity value, of the firing cost F. The former corresponds to the flow payoff of the asset plus its expected capital gain or loss. The appendix of the paper characterizes the solution of the optimization problem involved in equation (2) in terms of a barrier control policy. A firm closes down, laying off the worker and paying the mandatory firing cost F, if, and as soon as, its productivity reaches a certain reservation level R, corresponding to an optimally set threshold. An immediate implication of the optimal stopping strategy and of the form of the process driving output growth at the microeconomic level is that the support of the cross-sectional distribution of productivity is the unbounded set (R, ∞).

Equation (2) is also subject to the initial value condition following from the standard assumption of free entry, which implies that firms earn no pure profits in equilibrium, and therefore equalizes the *ex ante* value of job creation to the value of the setup cost. Formally, free entry of vacancies implies that

$$J(1) = C. \tag{3}$$

2.2 Wage Setting Mechanism

We can now turn to the wage setting mechanism. It is useful to start by breaking down (1) into a pair of recursive equations satisfied by the Bellman values of employment and of unemployment. The asset value $W(x)$ of working in a firm with idiosyncratic productivity $x \in (R, \infty)$, and the asset value U of unemployment satisfy the following system of functional equations

$$rW(x) = w(x) + \frac{1}{dt}E(dW) \tag{4}$$

$$rU = b + \theta\left(W\left(1\right) - U\right) \tag{5}$$

where $w(x)$ is the wage rate, b is the (exogenously given) unemployment compensation income or value of leisure, and θ stands for the (endogenous) individual exit rate out of unemployment. The value of employment is also subject to the terminal condition, $W(R) = U$.

Notice that the asset value of unemployment is a constant since the uncertainty present in the economy is purely idiosyncratic. Moreover, by assumption, all new jobs start out with a given and constant productivity level, normalized to 1.

I follow again Saint-Paul (2002) by assuming that a worker employed in a unit with productivity x earns a wage rate such that the corresponding Bellman value of employment is equal to the value of unemployment plus a given fraction β of the present discounted value of the output stream that is expected to be generated by the job. The latter corresponds to the rent appropriated by the employed. In other words, I assume that

$$W(x) = U + \beta V(x) \tag{6}$$

where

$$V(x) = E\left\{\int_t^{T(R)} e^{-r(s-t)} x_s ds \mid x_t = x\right\}$$

represents the expected present discounted value of the future output stream generated by a firm having, at a time t, a productivity level $x_t = x$ up to the stopping time $T(R) \equiv \inf\left\{t \in \Re_+ : x_t = R\right\}$ when the process x is absorbed by the barrier R.

The parameter $\beta \in (0, 1)$ measures the power of rent extraction enjoyed by the employed. As such, it indexes the degree of distortion present in wage setting and taken as exogenously given (as opposed to the degree of labor turnover distortion, which is in fact endogenous). It is useful to stress however that β may not be strictly speaking interpreted as an index of bargaining power since (6) is not derived from a bargaining model but from a version of the efficiency wage model à la Shapiro and Stiglitz (1984).[11] As in that model, the rent appropriated by the employed here may be thought

[11] In the model of Shapiro and Stiglitz (1984), the asset value of employment corresponds to a fixed mark-up over the asset value of unemployment. The mark-up depends in particular on the efficiency of the monitoring technology available to the firm, which is assumed to be given, but is independent from the (constant, in that model) flow output

of as originating from a situation of informational asymmetry by which the firm is unable to monitor perfectly the behavior of the worker. To overcome the resulting moral hazard problem, the firm finds it profitable to pay to its employee a non market clearing wage. An immediate corollary of this is that in the economy there is involuntary unemployment. The unemployed would be willing to work for an ε smaller wage than the one granted to the employed, but firms are nonetheless unwilling to hire them.

One other important, and slightly more subtle, implication of a sharing rule like (6) is that under it utility is *not* transferable as it would be for example if the wage was set via Nash bargaining. As long as $\beta > 0$, workers are, *ceteris paribus*, always strictly better-off employed than unemployed: therefore the separation decision is generically made by one side only, that is by the firm.[12]

As demonstrated in the appendix, the wage schedule implied by a sharing rule like (6) reads:

$$w(x) = b + \theta\beta V(1) + \beta x. \tag{7}$$

Closed form expressions turn out to be available both for $V(\cdot)$ and for $J(\cdot)$; they read, respectively,

$$V(x) = \frac{x}{r-\mu} - \frac{R^{1-\xi}x^{\xi}}{r-\mu} \tag{8}$$

of the firm. The sharing rule implied by (6) can therefore be viewed as corresponding to a generalization of the model of Shapiro and Stiglitz, to allow for a positive dependence of the workers' rent on the productivity of labor.

[12] The transferability of utility obtaining under a Nash bargaining mechanism implies that the outside option of one partner is binding if, and only if, the outside option of the second partner is simultaneously so. Hence, it is not really meaningful to speak of the "firing" of the worker given that separation takes place if and only if it is jointly optimal for both partners (and therefore privately, while not necessarily socially, efficient). In other words, a match breaks down only when both partners agree to split. Because of this, it is indeed questionable to assume, as it is typically done, that in models with transferable utility firing costs should appear in the fallback position of firms. More generally, it is questionable that models that do not identify exactly "who fires" and "who is fired" are conceptually that appropriate framework to study the determination and the implications of an institution acting basically as a tax on firings. An alternative approach to the problem, which retains Nash bargaining as the wage setting mechanism, is the one followed by Blanchard and Portugal (2001). They assume that wages are set once and forever at the beginning of an employment relation and cannot be renegotiated thereafter, despite the realization of idiosyncratic shocks. In this way they are able to distinguish clearly between separation and quits but do not allow for the dependence of wages on idiosyncratic productivity which will appear as critical for the political equilibrium of the model.

$$J(x) = \frac{(1-\beta)\,x}{r-\mu} - \frac{b + \theta\beta\left(\frac{1-R^{1-\xi}}{r-\mu}\right)}{r} - \frac{(1-\beta)R^{1-\xi}x^{\xi}}{\xi\,(r-\mu)} \tag{9}$$

where $\xi = \xi(\mu, \sigma) < 0$ corresponds to the negative root of the characteristic polynomial associated with the differential equation (see the appendix) satisfied by $J(\cdot)$.

In both equations the value of the corresponding asset appears decomposed in two components, namely its fundamental and the related option value of waiting for better times. Notice in particular that the option value associated with the asset $J(\cdot)$ is strictly positive so that the value of a job for a firm exceeds the related fundamental.

3 Economic Equilibrium

3.1 Aggregation

Firms in this economy are created at some point in time and experience thereafter different Markov histories reflecting the realization of idiosyncratic uncertainty. While the behavior over time (in terms of productivity and duration) of each unit is random, the one of the cohort to which the unit belongs is not. In fact, since every cohort of new firms/jobs is large, namely made up by a continuum of units, by a law of large numbers its behavior over time can be tracked to the one of its "representative" member. In particular the survival probability of a unit, say from the time u of creation up to time $t+u$, does correspond to the deterministic fraction of the firms of its cohort that are still operative up to that time.

Let T_u indicate the random time in which a u vintage establishment expects to close down *since* the moment of its creation. Let $f(1, u, x, t+u)$ indicate the (time homogenous) transition density function of its productivity as of time $t+u$ given that $x_u = 1$ for every u, conditional on not having the unit yet closed. The probability at which the unit is still in operation at time $t+u$, equivalent to the probability that T_u exceeds t, is represented by

$$\begin{aligned}\Pr(T_u > t) &= \int_R^{\infty} f(1, u, \zeta, t+u)\, d\zeta = \\ &= \int_R^{\infty} f(1, \zeta, t)\, d\zeta\end{aligned}$$

and is independent from the calendar time u of creation of the unit by the homogeneity of its transition kernel. At time u the flow of workers from unemployment into employment, equivalent to the mass of newly created production units, has measure $\theta_u (1 - L_u)$. Total employment, say at time t, may be decomposed as the (integral) sum of total job creation from an infinitely remote past, weighting each cohort of firms/jobs by its survival probability, so that

$$L_t = \int_{-\infty}^{t} \theta_u (1 - L_u) \Pr(T_u > t - u)\, du = \int_{0}^{\infty} \theta_{t-v} (1 - L_{t-v}) \Pr(T > v)\, dv. \tag{10}$$

In an ergodic steady state, aggregate labor market outcomes are stationary, and therefore $L_t = L$, $\theta_t = \theta$, $\forall\ t$. Equation (10), together with labor market flows balance condition by which $\delta L = \theta (1 - L)$, where δ indicates the aggregate job destruction rate, implies then that

$$\delta = \frac{1}{\int_0^\infty \Pr(T > t)\, dt}.$$

The expression of δ is explicitly derived in the appendix and it is reported below along with the ergodic probability density function of productivity across employment.

Result 1. *Suppose that* $\mu < \frac{\sigma^2}{2}$ *. The steady state aggregate job destruction rate then reads*[13]

$$\delta = \frac{1}{|\ln R|} \left(\frac{\sigma^2}{2} - \mu \right). \tag{11}$$

Result 2. *The ergodic cross-sectional distribution of productivity across production units,* $\Psi(\cdot)$*, has probability density function represented by*

$$\psi(x) = 2\frac{|\eta|}{\sigma^2} R^{\frac{-1}{\sigma^2}\eta} x^{2\frac{\eta}{\sigma^2}-1} \cdot I_{\{R \le x < \infty\}}(x) \tag{12}$$

where $\eta \equiv \left(\mu - \frac{\sigma^2}{2}\right)$.

[13] Assumption 1 and equation (16) (see below) imply that $R > 0$, so that δ is strictly bounded away from 0 and an equilibrium (with involuntary unemployment) exists.

3.2 Characterization

Taking as given the degree employment protection, the equilibrium of the model is defined by a pair of equations in the two endogenous variables, the reservation productivity R and the exit rate from unemployment θ. The first of these equation is the free entry condition, which from (3) and (9) is found to read

$$\frac{(1-\beta)}{r-\mu} - \frac{b+\theta\beta\left(\frac{1-R^{1-\xi}}{r-\mu}\right)}{r} - \frac{(1-\beta)R^{1-\xi}}{\xi\,(r-\mu)} = C. \tag{13}$$

The second equation corresponds to the "value matching" condition, which arises from the solution of the optimal stopping problem of the firm (see the appendix), and establishes the continuity of the firm's value function upon closing down. This equation reads

$$\frac{(1-\beta)\,R}{r-\mu} - \frac{b+\theta\beta\left(\frac{1-R^{1-\xi}}{r-\mu}\right)}{r} - \frac{(1-\beta)R}{\xi\,(r-\mu)} = -F. \tag{14}$$

Equation (13) may be used to obtain an expression for the equilibrium market tightness, as a function of the reservation productivity, or

$$\theta = \frac{r\,(1-\beta)\left(R^{1-\xi}-\xi\right)}{\xi\beta\,(R^{1-\xi}-1)} + \frac{(r-\mu)\,(b+rC)}{\beta\,(R^{1-\xi}-1)}. \tag{15}$$

This expression and equation (14) may be combined to obtain a relation defining implicitly the equilibrium value of R, which equates the expected present discounted value of gross profits to the total non wage labor cost, namely

$$\frac{1-\beta}{r-\mu}\left(\frac{R-R^{1-\xi}}{\xi}+1-R\right) = F + C. \tag{16}$$

The model turns out to have a recursive structure. Equation (16) determines the (unique) equilibrium value of the reservation productivity as a function of various exogenous parameters. Equation (14) defines a (strictly) upward sloping locus in the (R,θ) plane. Given the equilibrium value of R, equation (14) delivers therefore the unique value of the equilibrium exit rate out of unemployment.

3.2.1 The Limit Case of the Fully Flexible Economy

A particular case of special interest is the one obtaining in absence of any restriction to layoffs, namely when $F = 0$. Being $C > 0$, the employed still earn rents over the unemployed, and therefore unemployment remains involuntary. However the origin of these rents is purely technological, just as in Lindbeck and Snower (1988), where technologically given labor turnover costs do not allow, over some range, the underbidding of the insiders by the outsiders. This economy is of interest essentially because it approximates, as $C \to 0$, the limit case of an economy where technological as well as institutional turnover costs are both absent.

How does this limit economy look like? Consider the schedule $R = R(F, C)$ defined implicitly by equation (16) and let $R_{Flex} \equiv R(0, C)$. It is straightforward to verify that $\lim_{C \to 0} R_{Flex}(C; \beta) = 1$, $\forall\ \beta \in (0, 1)$. So in the limit case of absence of technological as well as institutional frictions, the reservation productivity is equal to the standardized initial productivity level. Also, in this limit economy both the rate of job creation and of job destruction tend to infinity, and the duration of any employment and unemployment spell tends to zero. In this sense, the state of employment is understood as being perfectly shared across workers.

3.3 Comparative Statics

The (only) equilibrium of the model has some expected comparative statics properties and few less obvious one. They are discussed next, under the qualification that F is always held constant as the other parameters are let vary.

1. Higher firing costs reduce without ambiguity the reservation productivity and the exit rate from unemployment. Both these effects are well known and are found to be standard across many non competitive models of the labor market such as "search and matching" as well as in partial equilibrium models with exogenous wage determination. An implication of this pair of results is the also well known fact that firing restrictions have effects of ambiguous sign on steady state level of employment.

2. Higher setup costs have qualitatively the same effects of higher firing costs: they reduce both R and θ. Notice however that, while the marginal impact of setup costs on R is identical to the one of firing costs, their marginal impact on θ is different. In fact, setup costs

reduce directly, namely holding R constant, the rate of job creation. Therefore, the overall impact of higher setup costs on equilibrium employment, while in principle ambiguous, is more likely to be negative than the one of higher firing costs is.

3. A higher value of β reduces both the reservation productivity and the market tightness. The reservation productivity falls since firms wish to hold on for a longer time as they need to compensate the resulting loss of flow profits. The market tightness falls along with the reservation productivity, but also holding the latter constant, due to the direct negative effect that a higher β has on profitability.

4. Greater volatility decreases the equilibrium reservation productivity. This is so since in a more turbulent environment, the option value associated to the asset "job" is higher (given θ and R), and therefore firms find it desirable to hold on more. Hence R falls. An implication of this result is that the impact of σ on the steady state aggregate rate of job destruction δ is twofold and of opposite sign. δ raises directly with σ, but it falls with it as R falls. In principle the balance of this two effects is ambiguous, but it may be safely assumed as often done in the literature (e.g. Pissarrides (2000)), that the direct positive effect dominates.

5. In equilibrium, a greater value of σ is also found to *stimulate* job creation, namely to raise θ. This is in essence a consequence of the convexity effect of volatility, which tends to increase the expected value of a job for a firm, and along it drives up job creation.[14] Notice that this is an equilibrium effect, which dominates over the negative impact that σ has on R directly, and therefore on θ indirectly. It is also worth stressing again that this effect obtains holding F constant: in the next section it shall be argued that, as the variance of shocks increases, an economy may well become more rigid as a result of a political equilibrium change. Notice finally that, as both θ and δ increase with σ holding F constant, the impact of the latter on equilibrium employment is not clear *a priori* and may in principle go in either direction.

6. A higher value of the drift coefficient μ increases the equilibrium reservation productivity but has *a priori* ambiguous effects on the exit

[14] Pissarrides (2000) finds instead that in a "search and matching" model with endogenous separation and Poisson uncertainty, a higher arrival rate of shocks reduces job creation in equilibrium.

rate from unemployment. The reservation productivity increases since higher growth tends to raise profitability, and therefore R must increase as well to restore the equilibrium. The impact of μ on θ is not conversely clear since both the value of output and the cost of labor tend to increase with it.

4 Politics

4.1 The Voting Mechanism

We assume that a *given status quo* level of firing cost $F = F^{SQ} > 0$ is implemented since time "$-\infty$". Equivalently, given the existence of a one-to-one relation between them, corresponding to equation (16), and for analytical convenience only, we shall refer from now onwards to R rather than to F.

At a certain point in time $t = T^{*}$, R is determined by majority rule. Because of the stationarity of the environment, the calendar time of the voting process is actually irrelevant.[15]

The political equilibrium of many political economy models is usually characterized through the application of the median voter theorem. This will not be possible here as the preferences of some agents over the policy variable do fail to be single-peaked.[16] Still, a (global) result of existence of a unique Condorect winner shall be demonstrated under one extra parametric restriction, placing an upper bound on the rent extraction power of workers. When such restriction does not hold vice versa, we will demonstrate that the voting process has two equilibria, depending on the given *status quo* level of firing costs. This multiplicity of equilibria reflects the well known problem

[15] In particular, because aggregate shocks are thought of as unpredictable low frequency events, every future voting process is expected, at any point in time, to generate the same outcome. So there are no problems related to strategic voting incentives, even if elections take place repeatedly.

[16] The general assumption of focusing on one social class only may appear as restrictive. At least two relevant groups of agents have been left away, namely capitalists and pensioners. It seems fairly obvious that capitalists would oppose any degree of labor market rigidity in whichever form. But, less obviously, pensioners may have very similar preferences over the status of labor market institutions. Indeed, to the extent that more efficient labor market institutions allow to reinforce the stability of a pension system or even allow it to pay more generous contributions, pensioners may well join the coalition for flexibility. Interestingly, the evolution in the social attitude toward the regulation of labor market institutions often observed in recent years across countries has proceeded in parallel to the growth of the share of pensioners over the population at large. Still, focusing primarily on the preferences on employment protection of employed workers, viewed as the determinant social group, does not appear unjustified.

of the *status quo* bias associated to rent-generating institutions. When such institutions exists, they do create their own constituency and self-stabilize themselves.

4.2 Workers' Value Functions

Let's begin by characterizing the life-time utility of the different workers. By combining equations (4), (5), (6) and (7), the asset value of unemployment may be written down as

$$U = \frac{b}{r} + \beta \frac{\theta}{r} \frac{1 - R^{1-\xi}}{r - \mu}. \tag{17}$$

This expression can be further simplified by eliminating θ with (15) to yield the following

$$U = \frac{1 - \beta}{r - \mu} - \frac{(1 - \beta) R^{1-\xi}}{(r - \mu) \xi} - C. \tag{18}$$

Straightforward differentiation of equation (18) shows that the asset value of unemployment is strictly increasing in R: unemployed workers would be strictly better-off in a fully flexible labor market where layoffs are not constrained in any way and where therefore the exit rate from unemployment is as high as it can be.

What about the employed? The asset value of employment in a firm with productivity x, which is of course defined provided that $x \geq R$, is computed combining equations (18) and (8), and reads

$$\begin{aligned} W(x) &= U + \beta V(x) \\ &= \frac{1 - \beta}{r - \mu} - \frac{(1 - \beta) R^{1-\xi}}{(r - \mu) \xi} - C + \beta \frac{x - R^{1-\xi} x^{\xi}}{r - \mu}. \end{aligned} \tag{19}$$

4.3 Preferences over R

Equation (19) allows us to assess how the employed's welfare depends on a marginal change in R. This is a crucial point to keep in mind since, again, (19) is only defined provided that $x \geq R$.

Result 5. *Let $R = R^{SQ}$. All workers employed in firms enjoying a level of productivity $x \in (x^*, \infty)$, where*

$$x^{*}=\max\left\langle\left(\frac{1-\beta}{\beta\left|\xi\right|}\right)^{\frac{1}{\xi}},R^{SQ}\right\rangle$$

benefit strictly from a marginal increment in flexibility of the labor market. Vice versa, all workers involved in jobs with productivity $x\in\left[R^{SQ},x^{*}\right)$ *are made strictly worse-off by the same.*

Result 5 tells us that in this economy workers employed in relatively productive firms tend to prefer a more flexible labor market, at the margin, over the *status quo*, while a political support to maintain the existing level of employment protection builds up around the employees of relatively unproductive units. What is this so? Employment protection is to some degree costly for anyone. We know already that for the unemployed the marginal cost is always lower than the marginal gain of relaxing the firing discipline. For the employed instead this is not necessarily the case. By differentiating equation (19), the effect of an infinitesimal increment of R on the employed's welfare may be decomposed into two parts, corresponding to the marginal gain and loss respectively:

$$\frac{\partial W\left(x;R\right)}{\partial R}=\underset{(+)}{\frac{\partial U}{\partial R}}+\beta\underset{(-)}{\frac{\partial V\left(x;R\right)}{\partial R}}\;. \tag{20}$$

At the margin, the gain of reducing F, and thus of increasing R, is *the same* for all employed workers, independently from their individual productivity. In fact, it is due entirely to the corresponding variation of the asset value of unemployment. Conversely, the marginal loss of a reduction of R, which goes through the variation of the rent component of the asset value of employment can be shown to be *decreasing* in x.[17] Therefore, relatively more productive workers lose relatively less by a relaxation of the firing discipline: hence their support to more flexibility (and the opposition to it from their unproductive counterpart).[18]

[17] The sign of the relevant expression is the same as the sign of

$$\frac{\partial^{2}V\left(x;R\right)}{\partial R\partial x}=-\frac{\xi\left(1-\xi\right)}{r-\mu}R^{-\xi}x^{\xi-1}$$

which is positive.

[18] This result depends in crucial way on the nature of the stochastic process postulated for productivity, and in particular on the persistence proper of geometric Brownian uncertainty. If the realizations of x were governed, say, by a homogeneous Poisson process,

Notice that it can never be the case that *all* the employed may be hurt at the margin by flexibility since under any parametrization consistent with the equilibrium since $x^* < \infty$.[19]

The (unique) threshold value x^* at which $\frac{\partial W(x;R)}{\partial R} = 0$ depends on three exogenous parameters, namely on the workers' rent extraction power β and, through $\xi = \xi(\mu, \sigma)$, also on the instantaneous mean μ, and on the instantaneous standard deviation σ.

The value of x^*, if different from R^{SQ}, appears to be strictly increasing in β. Indeed, for employment protection to be attractive for the employed, the rent they enjoy, directly related to β, must be rich enough to compensate for the distortions caused by firing costs. In the limit case of $\beta = 0$ there is obviously no scope whatsoever for job security provisions and in fact, $\lim_{\beta \to 0} x^*(\beta) = 0$.

Perhaps more surprisingly, the rent extraction power of the employed turns out to determine also the effects of changes of σ and of μ on the threshold x^*. These are remarked in the following.

Result 6. *An increment in the degree of volatility present in the economy and a reduction of the trend rate of demand growth both tend to increase* x^* *, if* $\beta \in (\beta_*, 1)$ *where* $\beta_* = \frac{e}{e+|\xi|}$*. The same have both the opposite effect if* $\beta \in (0, \beta_*)$ *and are irrelevant if* $\beta = \beta_*$*.*

In other words, the response of employed workers to a greater variability and to a depressed demand growth is not unambiguous but depends crucially on the rent extraction power enjoyed by them. Where such power is relatively high, more variability is likely to render the marginal worker identified by x^* more productive, and vice versa. Why is this the case? Formally, it can be verified that more volatility has a twofold and opposite effect on the marginal impact of flexibility on the employed's welfare. By the envelope theorem, a marginal change in σ has only direct (namely going through holding R constant) first order effects on $\frac{\partial W(x^*;R)}{\partial R}$. These can be decomposed in two groups: those affecting the asset value of unemployment and those affecting the rent.[20] The two effects are clearly of opposite sign,

then an infinitesimal increment of R would have the same effect on the lifetime utility of *all* of the employed (which would be independent of x).

[19] It is the case that $\lim_{\beta \to 1} x^*(\beta) = \infty$. However $\beta = 1$ is not consistent with the existence of an equilibrium given that firms would make negative profits if they hired a worker.

[20] Formally, it is the case that:

the former being positive, and the latter negative. In other words, a form of complementarity does exist between volatility and flexibility, in the sense that more of the former tends to raise the marginal gain from the latter experienced by the employed (and by the unemployed as well). But it also pulls up the marginal loss in terms of rent destruction. If $\beta > \beta_*$, the rent is a relatively important component of the welfare of the employed, and therefore the second effect dominates. The marginal worker identified by x^* has to become more productive since, to be indifferent toward a marginally higher flexibility, in a more turbulent environment, he must suffer relatively less from it. The opposite is true if rents are a relatively unimportant for workers, in which case to restore indifference the trigger productivity has to fall.

As far as growth is concerned, it is possible to verify that, around x^*, $\frac{\partial U}{\partial R}$ decreases with μ and $\frac{\partial V(x;R)}{\partial R}$ increases with it. That is, higher productivity growth decreases the marginal gain of flexibility and decreases as well the marginal loss in terms of rent destruction. Equivalently, if demand growth falls, the marginal gain from flexibility increases and so does the related marginal loss. When β is relatively high, the second effect dominates: the trigger productivity level x^* must increase as the marginal workers need to be more insulated from the risks impled by higher flexibility. The converse is of course true if β is relatively low.

4.3.1 The Non Single-Peakness Issue

From what has been said so far, it may seem that all workers with productivity below x^* will be harmed by a reduction of R. However, this is not correct. In essence, the marginal evaluation embodied in (20) is not necessarily informative about the preferences of all the employed over a *discrete*, rather than infinitesimal, change in R. If R jumps from $R^{SQ} < R_{Flex}$ to a higher value R^{New}, a set of jobs of not trivial measure is instantaneously destroyed, a peculiar implication of higher flexibility. The employed with productivity $x \in (R^{New}, x^*)$ are indeed worse-off in the more flexible economy. But what about the remaining employed? They will now typically

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$$\frac{\partial^2 W(x^*)}{\partial R \partial \sigma} = \frac{\partial^2 U}{\partial R \partial \sigma} + \beta \frac{\partial^2 V(x^*)}{\partial R \partial \sigma}$$

$$\propto \frac{(1-\beta) R^{-\xi}}{(r-\mu)\xi^2} \underbrace{(1+\xi(1-\xi)\ln R)}_{(+)} + \beta \frac{R^{-\xi}(x^*)^{\xi}}{(r-\mu)} \underbrace{\left(\frac{1}{\xi} + (1-\xi)\ln R\right)}_{(-)}.$$

split in two groups, with opposite preferences over the institutional change, the following reason. It is clear that the function $W = W(x)$ is continuous over the range (R, ∞); indeed, the stopping rule followed by firms implies also its continuity at $x = R$. This means that the welfare of those employed workers with productivity in a (left) neighborhood of R, is approximately equal to U. Now, the voting process we are considering involves a discrete choice, which, for those employed workers with productivity $x \simeq R^{SQ}$ is nearly a choice between being unemployed in a rigid and in a flexible economy. Given that the latter value is strictly greater than the former, it is clear that the workers in the lower tail of the distribution of productivity will vote for more flexibility.

This argument may be developed more formally by looking for the expression of the productivity level that leaves workers indifferent between the two alternatives. Letting $W(\cdot; R^{SQ})$ indicate the value of employment in the *status quo* labor market as a function of productivity, and letting $U(R^{New})$ indicate the value of unemployment in the reformed one, this critical threshold, $x^{**} = x^{**}(R^{SQ}, R^{New})$, is defined implicitly by the indifference condition equating them, that is $W(x^{**}; R^{SQ}) = U(R^{New})$, which implies that

$$x^{**} - (R^{SQ})^{1-\xi}(x^{**})^{\xi} = \frac{1-\beta}{\beta\,|\xi|}\left\{(R^{New})^{1-\xi} - (R^{SQ})^{1-\xi}\right\}. \tag{21}$$

Since the left hand side of this equation is increasing strictly in x^{**}, and equal to zero if $x^{**} = R^{SQ}$, while its left hand side is strictly positive, it is clear that (21) always has a unique solution over the range (R^{SQ}, ∞). Hence a semi-closed set of non zero measure $\left[R^{SQ}, x^{**}\right)$ of *status quo* productivity levels always exists, such that the corresponding workers find themselves strictly better-off as unemployed in the more flexible labor market. These workers are of critical importance as their preferences appear not to be single-peaked in the policy variable. The presence of these workers implies the violation of one of the assumptions of the median voter theorem, which therefore cannot be readily applied to solve for the political equilibrium in this model.[21]

Summarizing, we can state the following.

Result 7. *In voting between the two alternatives R^{SQ} and R^{New}, the status quo is preferred only by those employed workers with a level of idiosyn-*

[21] A similar result is also found in Vindigni (1999), where it arises in an economy populated by workers who are *ex ante* heterogeneous, rather than *ex post* as here, due to exogenous differences in their human capital endowments; it is also found in the paper of Saint-Paul (2002).

cratic productivity $x \in (x^{**}, x^*)$. *All the unemployed, and the employed with productivity* $x \in \left[R^{SQ}, x^{**}\right] \cup [x^*, \infty)$, *vote the alternative.*

How does the second trigger productivity value x^{**} vary with the parameters of interest?

Result 8. *The trigger productivity* x^{**} *increases strictly with* σ *and decreases strictly with* β *and* μ.

Again, the negative impact of an increment of β on x^{**} is quite intuitive: when the employed are able to extract higher rents from firms their position of insiders cannot but become more appealing. As a result, the lower trigger productivity level falls also.

A higher value of μ is found to reduce x^{**}, namely to cut down the political support for flexibility within the *less* productive workers without any ambiguity. Why is this so? The point is that a higher trend component in demand/productivity growth means that employed workers, whatever their current productivity level, expect to become relatively more productive in future. This is in particular true about the employed in low productivity units. As a result, a higher value of μ induces them to become relatively more optimistic about their future productivity, hence about the future rents to be appropriated by them as employed, and hence makes them more reluctant to give up their position of insiders.[22] By the same token, in a more volatile environment, the risk of a critical fall in productivity is higher. So the insiders at the lower margin, being in a more unstable position, are more willing to leave and this explains why a higher value of σ has the opposite effect of μ on x^{**}.

5 Political Equilibria

We can now turn to the characterization of the political equilibria of the model. We will demonstrate essentially two results. If the rent extraction

[22] This particular result may seem to be in sharp contrast with the corresponding result obtained in Saint-Paul (2002), where it is found that faster productivity growth *unambiguously* increases the support for flexibility. And in particular it does so within the less productive employed. The crucial difference is that in that model the growth of productivity is due to embodied technological progress, which benefits only newly created units of production. In other words, in that economy units become inevitably more and more obsolete over time relatively to the moving technological frontier. As a result, their employees have no hope of benefitting from growth in terms of their own productivity, remaining in the same firm. This is of course not what happens here, where the productivity of a firm can always vary stochastically in each direction.

power of workers is low enough (that is, below some threshold value), the model has a unique political equilibrium, unconditionally on the *status quo*. If not, however, the model will have two equilibria, full rigidity or full flexibility, depending on the *status quo*. That is, a *status quo* bias issue exists, as it is often the case in presence of some rent-generating institution.

To proceed, we introduce the following two definitions of political equilibrium.

Definition 1. *$R = R^*$ is defined as a global political equilibrium, conditional on the status quo, if it defeats any other alternative in pairwise comparisons conditionally on $R = R^{SQ}$.*

Definition 2. *$R = R^*$ is defined as an unconditional global political equilibrium, if it defeats any other alternative in pairwise comparisons unconditionally on the status quo value of R.*

Propositions 1 and 2 state that the economy has always a global political equilibrium, the nature of which depends basically on the values of β and of R^{SQ}. More precisely, let β_{**} be defined as the unique[23] value of β solving equation (24)

$$\left(\frac{1-\beta}{\beta\,|\xi|}\right)^{\frac{1}{\xi}} = R_{Flex}\,(C;\beta) \tag{22}$$

That is, at $\beta = \beta_{**}$, $x^*(\beta)$ is equal to the reservation productivity obtaining in absence of firing costs, given β.

Let also $R_{Rigid} = R\,(F^{\max})$, where $F^{\max}$ indicates the maximum level of firing costs allowed for (by assumption 1).

5.1 The $\beta \leq \beta_{**}$ Case

Proposition 1. *Suppose that $\beta \in (0, \beta_{**}]$, then $F = 0$ ($R = R_{Flex}$) is the (unique) unconditional global political equilibrium of the model.*

Proposition 1 tells us that, as long as the rent extraction power of the employed is relatively low, a (fully) flexible institutional structure will be stable, in the sense that it will be preferred *whatever* the alternative is.

[23] The left hand side of (24) is strictly increasing in β and onto $(0,\infty)$ while its right hand side is strictly decreasing and onto $(0,1)$. Hence the two schedules do cross each other once and only once.

And that, also, flexibility will emerge inevitably at the moment of voting, *whatever* the *status quo* is. An intuition for this result may be grasped by recalling that if β is, at the limit, equal to 0, there is no point whatsoever for anyone in voting for some firing restriction as rents are null anyway. So it is not surprising that in this limit case full flexibility will emerge as the unique political equilibrium of the game. Proposition 1 tells us that this very intuitive result is somewhat more general, as it holds not only in that singular case, but whenever β belongs to some right neighborhood of zero.

It is natural then to ask to the model how the trigger value β_{**} depends on the parameters of interests. A clear answer this question may provided if setup costs are approximately equal to zero.

Result 9. *As $C \to 0$, β_{**} increases strictly with σ and it decreases strictly with μ.*

So it appears more easy, in the sense that β_{**} shifts to the right, in a relatively volatile environment, to obtain a *unanimous* political support for flexibility. In other words, in the light of the result just derived greater variability should reinforce the stability of the socio-political consensus toward existing flexible labor market institutions, which in turn can be expected to survive if the rents extracted by the employed are relatively low.

A higher value of trend term μ plays again the opposite role. In fact β_{**} shifts to the left as μ increases.

What is the intuition behind this pair of results? It has been already pointed out that as the variance of shocks increases, flexibility becomes at the margin more appealing provided that the rents extracted by the employed are relatively low, namely if $\beta \in (0, \beta_*)$ where β_* is defined as in result 6. Since $\lim_{C \to 0} \beta_{**}(C) = \frac{1}{1+|\xi|} < \beta_* = \frac{e}{e+|\xi|}$, this is indeed the case over the range now of interest. A "compensating variation", in the form of an increment of the rent extraction power β, must then occur in order to restore the indifference between rigidity and flexibility of the marginal workers at the productivity level $x^* \simeq \lim_{C \to 0} R_{Flex}(C) = 1$. In other words, the set $(0, \beta_{**}]$ must become larger and in this sense uncertainty is found to act as reinforcing the stability of a flexible economy.

When μ increases, both the marginal gain and the marginal loss from flexibility fall. Given that β is by assumption relatively low, the fall of the marginal gain appears to be relatively more important. As a result, flexibility tends to become relatively less appealing for the marginal workers. To restore their indifference around $x^* \simeq 1$, β_{**} must fall.

In sum, the parametric range $(0, \beta_{**}]$ consistent with a unanimous support for full flexibility shrinks in presence of faster demand/productivity growth and lower volatility. And, in this sense, good business conditions, are found to be harmful for the preservation of a flexible labor market.

Interestingly, the institutional transformations that brought to the build-up of Eurosclerosis started already to take place during the 1950' and 1960's, and therefore within the very favorable macroeconomic framework of sustained growth and relatively low volatility typical of those years. According to the results just demonstrated, precisely the macroeconomic well being enjoyed by the industrialized economies of Europe during that time may have played an important role in favoring that "fundamental transformation".

What if, else, $\beta > \beta_{**}$?

5.2 The $\beta > \beta_{**}$ Case

Let $x^{++} = x^{++}(R_{Rigid}, R_{Flex})$ be defined as the productivity level (if one exists) that leaves a worker just indifferent between being employed in the most rigid of the possible worlds (corresponding to $F^{\max}$) and unemployed in the fully flexible economy. Let also $x^{**} = x^{**}\left(R^{SQ}, R_{Flex}\right)$ by defined as in (21)465* and λ_{Ψ} indicate Lebesgue-Stieltjes measure induced by $\Psi(\cdot)$.

Proposition 2. Suppose that $\beta > \beta_{**}$. (i) If $x^{++} \geq R^{SQ}$, then $R = R_{Rigid}$ $(R = R_{Flex})$ is the conditional global political equilibrium if, and only if, $L \cdot \lambda_{\Psi}\{(x^{++}, x^{*})\} \geq \frac{1}{2}$ $(< \frac{1}{2})$. (ii) If $x^{++} < R^{SQ}$, then $R = R_{Rigid}$ $(R = R_{Flex})$ is the conditional global political equilibrium if, and only if, $L \cdot \lambda_{\Psi}\{(x^{**}, x^{*})\} \geq \frac{1}{2}$ $(< \frac{1}{2})$.

Proposition 2 tells us several things. First of all, it confirms and makes more precise one result in part already emerged, namely that rigidity tends to be supported by those employed workers with "intermediate" productivity. To the contrary, flexibility is supported by an extreme coalition made up by the more and less productive employed and by the employed. It tells us also that this economy should be expected to be either fully flexible or as much rigid as possible, even if this sharp result depends very much on the structure of the model.[24] Finally it clarifies the role played in this model by history, that is by the *status quo* institutional structure of the labor market. If $x^{++} < R^{SQ}$, the measure of the set (x^{**}, x^{*}) is strictly decreasing in R^{SQ} (since $\frac{\partial x^{**}}{\partial R^{SQ}} > 0$). Hence, holding constant β (and therefore x^{*}),

[24] For instance, Saint-Paul (2002) demonstrates the existence of local interior political equilibria in a slightly more general framework.

an economy starting out more rigid (flexible), seems more likely to become more and more rigid (flexible) over time. In other words, it is not strictly necessary according to our model to assume the existence of a difference in the bargaining power of labor in order to observe persistent inequality across societies in terms of institutions and economic outcomes. The role played by history may be sufficient to account for this. This role emerges here in relation to the rent-generating nature of employment protection legislation. Rent-generating institutions tend to be quite stable politically, as they do create their own constituency once implemented.[25]

6 Comparative Dynamics of Labor Market Institutions

Having characterized the politico-economic equilibrium of the model, we can then apply it to interpret the comparative evolution of the institutional structure of the labor markets of Continental Europe and the U.S. (U.K.). We shall focus primarily on two issues, namely the "fundamental trasformation" toward rigidity that took place since the late 1960's and the process of evolution in the opposite direction currently observed to some extent in some economies.

In assessing how the political support for different values of R is affected by variations in the parameters of interest, we shall maintain the qualification of holding constant the reservation productivities, as if voting was actually taking place between alternative and given values of R rather than of F.[26]

6.1 The Big Push Toward Labor

The years going from the date of 1968 to the middle of the 1980's corresponds according to Caballero and Hammour (1998) to a substantial institutional

[25] It is tempting in this respect to relate our model also to some recent contributions in the political economics of public finance (e.g. Bénabou (2000)), emphasizing the existence of politico-economic complementarities behind the existence, and the persistence, of "unequal societies", with very different degrees of redistribution and inequality. Though a *status quo* bias problem does not typically arise in that literature, cross-sectional equality generates the political support for policies reproducing it. Similarly, here high firing costs tend to generate the political support for their preservation.

[26] While a one-to-one relation between F and R exists in equilibrium, this depends on the exogenous parameters of the model. Hence, variations of the latter affect R for a given the value of F. We ignore these effects and focus the attention on R as the employment protection index actually relevant.

build-up in favor of labor in France. The start of the period is symbolized well by the events of the May of 1968. But again the French experience is very well representative of the one of Continental Europe at large.[27]

The period is characterized by a marked wage progression which goes through until the early 1980's, highlighting a sharp increase of the rent appropriation power of labor. Yet, while its first part sees the continuation, albeit in somewhat weaker terms, of the trend of economic expansion proper of the earlier decade, this is then followed by a break (which for France may be located in 1974) which inaugurates a second phase of depressed business conditions and highly volatile demand.[28]

How did organized labor reacted to the sudden and unexpected deterioration of the macroeconomic conditions? To quote again these authors, "Faced with deteriorating aggregate conditions, insider labor attempted to build fences around itself thorough a combination of job-protection regulations and political resistance to large-scale industrial labor shedding..." (see Caballero and Hammour (1998) p. 2).[29]

Within our model, this process can be represented as a transition from a *status quo* level of employment protection expressed by R^{SQ} to an alternative level $R^{New} < R^{SQ}$. By proposition 2, we can identify R^{New} with R_{Rigid}. R^{SQ} is vice versa identified (approximately) with R_{Flex}, capturing the transition from a relatively flexible to rigid labor market.[30] Crucially, we assume that in this economy ("Continental Europe, first half of the 1970's"), the rents appropriated by the employed are relatively high. That is, we assume that $\beta > \beta_*$. This is a reasonable assumption in the light of the shift

[27] For example, the French May 68 was shortly followed by the Italian "Hot Autumn" of 1969.

[28] Several are the events that have contributed to shape the macroeconomic framework typical of the 1970's. One could mention the end of the Bretton Woods era with the transition toward a flexible exchange rates regime, the increasing openness to trade of all the industrialized economies, the productivity slowdown and the uncoordinated monetary and fiscal policies often implemented during those years, to name only some of the most important. Arguably, all of these events can have played some role in destabilizing European labor markets and in favoring the transformation of their institutions.

[29] A short list of important events in this sense includes the law of July 13, 1973, requiring "real and serious" motives for layoffs, and the law of January 3, 1975, imposing an administrative authorization for economically motivated firings.

[30] This is not exactly true since we know already that several European economies were already not anymore "fully flexible" at the end of the 1960's. However, all the results we will demonstrate carry over (by continuity) to the case of $R^{SQ} \simeq R_{Flex}$. What is essential is that the variation in the threshold corresponding to x^{**} induced by a shock is negligible, which is the case in the *status quo* is not too far from the full flexibility benchmark (from (21), $\frac{\partial x^{**}}{\partial \xi}$ tends to zero as R^{SQ} approaches $R^{New} = R_{Flex}$).

of the balance of power in industrial relations occurred through the 1960's and 1970's and captured more or less precisely by movements in the share of labor documented, for example, in Bentolila and Saint-Paul (1999) and by Blanchard and Wolfers (2000).

We know (result 5) that a transition toward a more rigid labor market is favored by all those employed workers with productivity below the trigger value x^* and above the *status quo* reservation productivity R_{Flex}.

What can we say about the comparative statics of the political equilibrium? As already said, we shall answer to this question with the qualification of holding constant the two alternative reservation productivities, as if voting was actually taking place between alternative values of R rather than of F.[31] We already know how the trigger value x^* responds to variation of β, μ and σ, in particular if $\beta > \beta_*$, the case now of interest. A stronger rent extraction power, higher volatility and a smaller rate of systematic growth all tend to shift x^* to the right, and would therefore seem to increase the number of employed who would gain from a more rigid labor market.

However the problem is more subtle since composition effects have also to be taken into account. In fact changes in μ and in σ alter the form of the ergodic cross-sectional distribution of productivity across employment. Moreover, along with changes in β, they do also affect stock variables, since they impact on equilibrium employment and unemployment. It turns out, however, that *controlling for unemployment*, all composition effects tend to reinforce the effects on the trigger productivity x^*.[32] So more volatility and a depressed rate of demand growth tend both to shift probability mass to the left of the support of the distribution, and therefore both act so as to increase directly the dimensions of the coalition for more rigidity. The effect of μ is rather intuitive: when the productivity of units grows at a higher systematic rate, more firms tend to enjoy relatively high productivity levels. The effect of σ is somewhat less obvious. It goes through since higher volatility tends to make more likely the event of a critical fall of idiosyncratic productivity. And therefore it tends also to make it more unlikely for a firm to reach relatively good business conditions.

[31] While a one-to-one relation between F and R exists in equilibrium, this depends on the exogenous parameters of the model. Hence, variations of the latter affect R for a given the value of F. We ignore these effects and focus the attention on R as the employment protection index actually relevant.

[32] It can be verified that, for any value of x, the following hold: $\frac{\partial \Psi(x;\mu)}{\partial \mu} \in (-\infty, 0)$ and $\frac{\partial \Psi(x;\sigma)}{\partial \sigma} \in (0, \infty)$.

We can then summarize the results on the comparative statics of the political equilibrium in the following proposition.

Proposition 3. *Suppose that* $\beta \in (\beta_*, 1)$*. Then a higher volatility, a slower rate of growth, and a higher rent extraction power of employed workers, controlling for the rate of unemployment, increase the political support for a transition toward a rigid labor market when the status quo corresponds to a relatively flexible one.*

This result is again somewhat weakened by the assumption of holding constant unemployment. However, it has already been argued the variations of μ and σ have both ambiguous effects on the rate of equilibrium unemployment. Moreover, what remains unconditionally true of proposition 3 is that higher rents, more volatility and less sustained growth unambiguously increase the support for a more rigid labor market *within the employed* if these are already able to extract sufficiently high rents to start with.

Finally, observe that the assumption that workers extract relatively high rents is an essential one. If $\beta < \beta_*$, a negative shock would push the trigger productivity level x^* to the left, so the balance with the composition effect would be *a priori* unclear. In principle, it may well be the case that the coalition against more rigidity may become stronger.[33]

It is tempting to interpret in this light the very different political and institutional response of Continental Europe, a high rents economy, from the one of the U.S., a low rents one, to the shocks of the 1970's. In other words, proposition 3 suggests that a shock resulting in a sharp increment in turbulence and in depressed business conditions, such as the ones experienced by industrialized countries three decades or so, may be expected to be a source of institutional *divergence* rather convergence across economies whose labor market structure is significantly different and in particular does/does not depart markedly from the perfect competition limit.

6.2 Voting on a Reform

A the present moment, the political debate over labor market institutions in Europe is centered around the elimination of part of their rigidity. According

[33] It is interesting to refer in this regard to the experience of the U.K., where the bargaining power of labor was substantially cut-down since the late 1970's by the conservative government. Basically, as figure 1 shows, employment protection does seem to have increased very little in that country over the period of interest, being it already low to start with.

to some authors (e.g. Bean (1998)) "good times", such as one presently experience by the economies of virtually all industrialized countries, should be a favorable period for implementing reforms. Yet, a political consensus toward incisive transformations in this sense seems to build up very slowly, if it does so at all.

Our model can shed some light on this apparent puzzle, arguing that there is not a simple and clear relation between macroeconomic well being and the build up of political support for a transition toward more flexibility from a rigid *status quo*. This is an important result in itself, given its interpretative power for the current realm of Europe. But also because it reveals a possible striking asymmetry between the "political response" of an economy to a worsening and to an improvement of aggregate business conditions, which is basically an expression of the *status quo* bias problem typically associated with any rent-generating institution.

We can now turn to the characterization of the political equilibrium. Again by proposition 2, we will think to the *status quo* as being R_{Rigid} and to the alternative as R_{Flex}. Let x^{**} be defined as in equation (21); result 7 tells us that a transition toward more flexibility is favored by an extreme coalition of very lucky and of very unlucky workers. These workers do not have need much for rigidity (they are so productive to have little fear of a layoff) or do not want it all (they are unemployed and want to find a job quickly or they are employed but gain relatively small rents and expect them to terminate quickly). How are do the sizes of the two coalitions depend from the parameters of interest?

First of all, let's have a look to the rent extraction power of the employed. It may seem that a higher value of β reduces without ambiguity the size of the coalition for reform: x^* is strictly increasing in it while x^{**} is strictly decreasing. This impression is however again not necessarily true since in equilibrium unemployment also increases with β without ambiguity. Under the qualification of holding unemployment constant however, the dimensions of the coalition standing for the preservation of the *status quo* increase along with the rents appropriated by employed and the intuition for this result is by now very clear.

What about the impact of σ and μ on the two levels of trigger productivity? We have to distinguish two different cases, corresponding to a value of β smaller of greater than $\beta_* = \frac{e}{e+|\xi|}$.

- If $\beta \in (0, \beta_*)$ the answer is unambiguous. In fact $\frac{\partial x^*}{\partial \sigma} < 0$ and $\frac{\partial x^*}{\partial \mu} > 0$ in that case, and, whichever the value of β is, $\frac{\partial x^{**}}{\partial \sigma} > 0$ and $\frac{\partial x^{**}}{\partial \mu} < 0$.

- If $\beta \in (\beta_*, 1)$ things are not so clear since, while the effects of σ and μ on x^{**} are qualitatively the same as before, on x^* they are the opposite given that $\frac{\partial x^*}{\partial \sigma} > 0$ and $\frac{\partial x^*}{\partial \mu} < 0$.

The second case may be thought to be more relevant, in the sense that it corresponds to the reality of the high rents economies of Continental Europe.

What can the model then tell us about the current and future prospects of reforming European labor markets? Unfortunately, not a clear cut message.

If one is optimist and expects a bright future of fast growth and not affected by substantial shocks, as for example Blanchard and Wolfers (2000) and Blanchard and Simon (2001) do, he or she should expect from this model ambiguous predictions about the future political viability of substantial labor market reforms. Not only x^* and x^{**} tend to move in opposite directions if μ increases and σ decreases, but composition effects also complicate the picture. Faster growth and lower volatility both shift probability mass to the right. Therefore they both tend to increase the mass of most productive employed who stand for flexibility. Or, more formally, the Lebesgue-Stieltjes measure of the set (x^*, ∞) induced by $\Psi(\cdot)$, namely (dropping the constant L) $\lambda_\Psi \{(x^*, \infty)\} \equiv 1 - \Psi(x^*)$. But they also tend increase the dimension of the coalition for rigidity, namely the Lebesgue-Stieltjes measure of the set (x^{**}, x^*), or $\lambda_\Psi \{(x^{**}, x^*)\} \equiv \Psi(x^*) - \Psi(x^{**})$, moving in it workers at the lower productivity margin, and causing therefore a contraction of the support for flexibility at the bottom. Or, formally, a reduction of $\lambda_\Psi \{(R_{Rigid}, x^{**})\} \equiv \Psi(R_{Rigid}) - \Psi(x^{**})$.

In sum, our model questions, at least in some sense, the validity of the argument that good times are necessarily good also for reforms. Cutting down the rents appropriated by the employed seems to be an important pre-requisite of a successful labor market reform. However, variations in the parameters governing the driving process for productivity, do not seem to have clear-cut implications for the political feasibility of a reform toward more flexibility in employment relations. This is in essence an expression of the *status quo* bias problem associated to firing costs as rent-generating institution. Once implemented, it may be difficult to eliminate them as some people do not wish to give up the rents they generate. In other words, transformations in labor market institutions may turn out to be hardly reversible, even once the shocks that have induced them have vanished or have been followed by other shocks of opposite nature.

7 Conclusions

This paper has laid down a framework for interpreting the comparative dynamics of one labor market institution, employment protection legislation, in Europe and in the U.S. since the post-war period and up to the present day.

A key result demonstrated concerns the broad importance of wage setting distortions, that is to say of the ability of employed workers to extract rents. Wage setting distortions (parametrized by β) and labor turnover distortions (expressed by F and indirectly by R) have appeared to be closely linked as part of rigid political equilibria of some institutional choice process. This is quite intuitive: if rents are low there is little scope for their protection also.

But on top of that, the institutional response of an economy to some macroeconomic shock has also been found to depend on the ability of labor to extract rents. Specifically, we have argued in the paper that the differential pattern of institutional evolution experienced by Continental Europe and by the U.S. in response to similar aggregate shocks over the last few decades, can be rationalized in the light of the different bargaining strength of labor across the two sides of the Atlantic.

8 Appendix

8.1 Solution of the Firms' H-J-B Equation

Firms face a standard problem of optimal stopping in continuous time, which is formalized by the Hamilton-Jacobi-Bellman (H-J-B) equation (2). The solution of this class of problems (e.g. Dixit (1993) or Dixit and Pindyck (1994)) is known to be characterized in terms of a productivity threshold R such that the continuation value of the asset "job" exceeds its value upon stopping as long as $x > R$ and is exceeded by it if $x < R$, the two of them "matching" at $x = R$. The optimal stopping rule is then of letting the job continue producing as long as x remains above R and of closing it down, firing the workers and paying the associated layoff cost F, as soon as the absorbing barrier R is first reached.

On the continuation region $\{x \in \Re_+ : x > R\}$ therefore, equation (2) boils down into

$$rJ(x) = x - w(x) + \frac{1}{dt}E(dJ) \tag{23}$$

while at R, the "value matching" condition

$$J(R) = -F \tag{24}$$

holds, establishing the continuity of the value function $J(\cdot)$ upon stopping. A second functional relation, the "smooth pasting" condition, must hold as well for the stopping rule to be optimal. In general, this condition implies the differentiability with continuity of the value function along the curve separating the continuation from the stopping region and in our particular case it assumes the form

$$J'(R) = 0. \tag{25}$$

Equation (23) may be transformed into a second order ordinary differential equation in the unknown function $J(\cdot)$ by applying Ito's lemma to evaluate $E(dJ)$; this equation reads:

$$\frac{1}{2}\sigma^2 x^2 J''(x) + \mu x J'(x) - rJ(x) + x - w(x) = 0. \tag{26}$$

Since $w(x) = b + \theta\beta V(1) + \beta x$ (see below), the general integral of this equation is of the type

$$J(x) = \frac{(1-\beta)x}{r-\mu} - \frac{b + \theta\beta V(1)}{r} + C_1 x^\delta + C_2 x^\xi$$

with C_1 and C_2 standing for constants to be determined and with δ and ξ standing for the positive and for the negative root of the characteristic polynomial $\psi(\epsilon) = \left(r - \mu\epsilon + \frac{\sigma^2}{2}\epsilon(1-\epsilon)\right)$ associated with (26). By a standard argument (e.g. Dixit (1993) p. 25), the root $\delta > 1$ must be eliminated by setting the constant C_1 equal to zero. Otherwise the fundamental of the asset would become negligible relatively to its option value as $x \to +\infty$. The value of C_2 is instead determined through the smooth pasting condition, which implies that

$$C_2(R) = -\frac{1-\beta}{(r-\mu)\xi} R^{1-\xi}.$$

Taking into account the expression (below derived) for the wage rate, equation (9) obtains then readily, with the (optimal) barrier R defined then implicitly by (25).

Notice that, being $\xi = \frac{1}{\sigma^2}\left(\frac{\sigma^2}{2} - \mu - \frac{1}{2}\sqrt{(\sigma^2 - 2\mu)^2 + 8\sigma^2 r}\right)$, the following inequality is identically true

$$\frac{\partial \xi}{\partial \sigma} = 2\frac{\mu\left(\sqrt{(\sigma^2 - 2\mu)^2 + 8\sigma^2 r} - (\sigma^2 - 2\mu)\right) + 2\sigma^2 r}{\sigma^3\sqrt{(\sigma^2 - 2\mu)^2 + 8\sigma^2 r}} > 0.$$

Similarly, it can be verified that $\frac{\partial \xi}{\partial \mu} < 0$.

8.2 Derivation of the Expected PDV of Output

The integral in (6) may be broken down recursively to yield the following (trivial) Bellman equation, satisfied by the functional $V(\cdot)$ over the continuation region (R, ∞)

$$rV(x) = x + \frac{1}{dt}E(dV). \tag{27}$$

The general integral of the second order differential equation associated with (27) is represented by:

$$V(x) = \frac{x}{r-\mu} + C_1 x^\delta + C_2 x^\xi \tag{28}$$

where δ and ξ are respectively the positive and negative root of the relevant characteristic second order polynomial $\psi(\epsilon)$ (identical to the one associated with (27)). Excluding again the positive root δ by setting $C_1 = 0$, and taking into account the boundary condition $V(R) = 0$ in (28), equation (8) is obtained.

8.3 Derivation of the Wage Schedule

"Differentiating" (the derivative of a functional of a Brownian process exists almost nowhere) both sides of equation (6) and taking expected values, one obtains that

$$\frac{1}{dt}E(dW) = \beta\frac{1}{dt}E(dV).$$

Hence, equation (4) may be written down as

$$rU + r\beta V(x) = w(x) + \beta\frac{1}{dt}E(dV). \tag{29}$$

From equations (4), (5) and (6), the value of unemployment may be expressed as

$$U = \frac{b}{r} + \frac{\theta\beta V(1)}{r}. \tag{30}$$

By combining equations (29) and (30) one thus gets that

$$w(x) = b + \theta\beta V(1) + r\beta V(x) - \beta\frac{1}{dt}E(dV). \tag{31}$$

However, an application of Ito's Lemma to (8) delivers the following expression for the expected value of the "derivative" of $V(\cdot)$

$$\begin{aligned} \frac{1}{dt}E(dV) &= \frac{1}{dt}E(V_x(x)\,dx) + \frac{1}{dt}E\left(\frac{1}{2}V_{xx}(x)(dx)^2\right) = \\ &= V_x(x)\,\mu x + \frac{1}{2}V_{xx}(x)\,\sigma^2 x^2 \\ &= \frac{\mu}{r-\mu}x - \xi\mu\frac{R^{1-\xi}}{r-\mu}x^{\xi} + \frac{\sigma^2}{2}\xi(1-\xi)\frac{R^{1-\xi}}{r-\mu}x^{\xi}. \end{aligned} \tag{32}$$

Finally, by combining equations (31) and (32) the wage rate turns out to read

$$w(x) = b + \theta\beta V(1) + \beta x$$

given that ξ is a root of the characteristic polynomial of the differential equation associated with (27), namely $\psi(\epsilon) = \left(r - \mu\epsilon + \frac{\sigma^2}{2}\epsilon(1-\epsilon)\right)$.

8.4 Derivation of the Aggregate Job Destruction Rate and of the Expected Duration of a Job

It will be convenient to consider, rather than the original process x, its linear equivalent, namely the process $z \equiv \ln x$. It is known that (e.g. Dixit (1993)), being x a geometric Brownian process with drift μ and instantaneous standard deviation σ^2, z is a linear (or absolute) Brownian process with mean $\eta = \left(\mu - \frac{\sigma^2}{2}\right) < 0$ by assumption, and instantaneous standard deviation σ. Let $g(z_0, z; t)$ indicate the probability density function that $z(t) = z$ and that the process does not reach the barrier $\ln R$ within the time interval $(0, t)$ so that

$$\begin{aligned} \Pr\{z(\tau) > \ln R \;\forall\; \tau \in (0,t)\,,\; z(t) > \ln R\} &= \int_{\ln R}^{\infty} g(z_0, \zeta; t)\,d\zeta \\ &\equiv G(z_0, \ln R; t) \end{aligned} \tag{33}$$

where the initial position z_0 is let to vary and the arrival position is held constant at $\ln R$.

Notice that the random time $T(\ln R; z_0)$ at which the process z first reaches the barrier $\ln R$ starting at z_0, directly relevant in the computation of the aggregate job destruction rate, has a distribution function such that

$$\Pr\{T(\ln R; z_0) > t\} = \int_{\ln R}^{\infty} g(z_0, \zeta; t)\, d\zeta = G(z_0, \ln R; t).$$

Since our objective is to the evaluate the expected value of a random time, it is natural to look at the Kolmogorov backward partial differential equation satisfied by the transition kernel $g(\cdot, \ln R; \cdot)$, namely

$$\frac{1}{2}\sigma^2 \frac{\partial^2 g(z_0, \ln R; t)}{\partial z_0^2} + \eta \frac{\partial g(z_0, \ln R; t)}{\partial z_0} = \frac{\partial g(z_0, \ln R; t)}{\partial t} \tag{34}$$

with the boundary conditions $g(\ln R, \ln R; t) = 0$ and $\lim_{z_0 \to \infty} g(z_0, \ln R; t) = 0$.

The function $G(z_0, \ln R; t)$ is known to satisfy the same partial differential equation (see Cox and Miller (1965)) and we shall look for the solution of the latter. For our purpose, it will be convenient to solve this boundary value problem with the Laplace transform method. Let $\gamma(\cdot; z_0, \ln R)$ indicate the Laplace transform of $G(z_0, \ln R; t)$, reading

$$\gamma(\rho; z_0, z) = \int_0^{\infty} e^{-\rho t} \left(\int_{\ln R}^{\infty} g(z_0, \zeta; t)\, d\zeta \right) dt. \tag{35}$$

By transforming both sides of equation (34) using the theorem of differentiation of the original (e.g. Krasnov et al. (1987)), $\gamma(\rho; \cdot, \ln R)$ is shown to satisfy the following second order ordinary differential equation, given that $\int_{\ln R}^{\infty} g(z_0, \zeta; 0)\, d\zeta = 1$ as $z_0 > \ln R$:

$$\frac{1}{2}\sigma^2 \frac{d^2 \gamma(\rho; z_0, \ln R)}{dz_0^2} + \eta \frac{d\gamma(\rho; z_0, \ln R)}{dz_0} = \rho \gamma(\rho; z_0, \ln R) - 1 \tag{36}$$

with the two transformed boundary conditions $\gamma(\rho; \ln R, \ln R) = 0$ and $\lim_{z_0 \to \infty} \gamma(\rho; z_0, \ln R) = 0$. Letting $\theta(\rho) = \frac{1}{\sigma^2}\left(-\eta - \sqrt{\eta^2 + 2\sigma^2 \rho}\right)$ indicate the negative root of the characteristic polynomial $\psi(\epsilon) = \left(\frac{\sigma^2}{2}\epsilon^2 + \eta\epsilon - \rho\right)$ associated with (35), the solution of this problem is found to be

$$\gamma(\rho; z_0, \ln R) = \frac{1}{\rho}\left(1 - e^{\theta(\rho)(z_0 - \ln R)}\right). \tag{37}$$

Notice that, under the assumption that $\eta < 0$,

$$\gamma(0;0,\ln R) = \lim_{\rho\to 0}\frac{1}{\rho}\left(1-e^{-\theta(\rho)\ln R}\right) = \frac{\ln R}{\eta}$$

where the second equality follows from de l'Hospital theorem. So the rate of aggregate job destruction can be directly obtained from (11) and from this last expression as

$$\delta = \frac{1}{\int_0^\infty \Pr\{T(R;1)>t\}\,dt} = \frac{1}{\gamma(0;0,\ln R)} = \frac{1}{|\ln R|}\left(\frac{\sigma^2}{2}-\mu\right).$$

8.5 Derivation of the Ergodic Cross Sectional Distribution of Productivity

Let X indicate a random variable corresponding to the aggregate productivity in the steady state cross section of firms. We look for obtaining its probability distribution.

Let $g(z_0, z; t)$ be defined as in (32), but holding constant at 0 the initial productivity z_0 and letting the arrival productivity now vary. This is appropriate since we are now essentially looking for the distribution of z at time t given its initial state, and therefore we shall be interested in solving the Kolmogorov forward differential equation satisfied by that kernel. Then,

$$\Pr\{z(\tau)>\ln R\ \forall\ \tau\in(0,t),\ z(t)<z\} = \int_{\ln R}^{z} g(0,\zeta;t)\,d\zeta.$$

The distribution of X, which again stands for steady state productivity across employment, thus reads

$$\begin{aligned}\Pr\{X<x\} &= \frac{\theta(1-L)}{L}\int_{-\infty}^{t}\left(\int_{\ln R}^{\ln x} g(0,\zeta;t-u)\,du\right)d\zeta = \\ &= \delta\int_{\ln R}^{\ln x}\left(\int_0^\infty g(0,\zeta;v)dv\right)d\zeta\end{aligned}$$

where the second line follows from Fubini's theorem and from the definition of the stationary aggregate job destruction rate. Consider now the Laplace transform of the function $g(0,z;t)$, $\omega(\rho;0,z) = \int_0^\infty e^{-\rho t} g(0,z;t)\,dt$. By a transformation of the Kolmogorov forward differential equation satisfied by $g(0,\cdot;\cdot)$, $\omega(\cdot;0,z)$ is found to satisfy the following second order ordinary differential equation

$$\frac{1}{2}\sigma^2\frac{d^2\omega}{dz^2} - \eta\frac{d\omega}{dz} = \rho\omega \tag{38}$$

along with he transformed limit boundary condition: $\lim_{z\to\infty}\omega(\rho;0,z)=0$.

The solution of this problem, up to the constant C_2, is found to be

$$\omega(\rho;\ln R,z)=C_2 e^{\theta(\rho)z}$$

where $\theta(\rho)=\frac{1}{\sigma^2}\left(\eta-\sqrt{\eta^2+2\sigma^2\rho}\right)$ indicates the negative root of the characteristic polynomial $\psi(\epsilon)=\left(\frac{\sigma^2}{2}\epsilon^2+\eta\epsilon-\rho\right)$ associated with (38). Given that $\int_0^\infty g(0,z;t)dt=\omega(0;0,z)$ and that $\omega(0;0,z)=C_2\exp\left\{\frac{2\eta}{\sigma^2}z\right\}$ since $\eta<0$, the aggregate steady state cross sectional distribution of productivity can now be written down and reads

$$\begin{aligned}\Psi(x) &= \Pr\{X<x\}=\delta\int_{\ln R}^{\ln x}\omega(0;0,\zeta)\,d\zeta=\delta C_2\int_{\ln R}^{\ln x}\exp\left\{\frac{2\eta}{\sigma^2}(\zeta)\right\}d\zeta\\ &= 1-\exp\left\{\frac{2\eta}{\sigma^2}(\ln x-\ln R)\right\}=1-\left(\frac{x}{R}\right)^{\frac{2\eta}{\sigma^2}}\end{aligned}$$

with the constant C_2 pinned down by the "summing up" condition by which $\int_{\ln R}^{\infty}d\Psi(x)=1$.

It is straightforward to verify that, $\forall\ x\in[R,\infty)$, $\Psi(\cdot)$ satisfied the following properties: $\frac{\partial\Psi(x;\beta)}{\partial\beta}>0$, $\frac{\partial\Psi(x;\sigma)}{\partial\sigma}>0$ and $\frac{\partial\Psi(x;\mu)}{\partial\mu}<0$.

8.6 Comparative Statics Properties

(1, 2, 3) Straightforward implicit differentiation in equations (16) and (13).

(4) Differentiating implicitly R with respect to ξ in equation (16), the following expression is obtained

$$\frac{\partial R}{\partial\xi}=-R\frac{R-R^{1-\xi}-\xi R^{1-\xi}\ln R}{\xi(1-\xi)(R^{1-\xi}-R)}=R\frac{-R^{1-\xi}\left(R^{\xi}-\ln R^{\xi}-1\right)}{\xi(1-\xi)(R^{1-\xi}-R)}<0$$

since the denominator of this expression is positive, while the numerator is negative since $a-\ln a>1$ for every $a\neq 1$. An important property of this schedule, which shall be useful later on, is its limit behavior as R approaches one, which is readily found to be such that

$$\lim_{R\to 1}\frac{\partial R}{\partial\xi}=\lim_{C\to 0}\frac{\partial R_{Flex}}{\partial\xi}=0.$$

(5) The following preliminary results (obtained with some intermediate algebra) shall be useful:

$$\frac{\partial V(x;\xi)}{\partial \xi} = \left(\frac{-R\left(R^{-\xi} - \ln R^{-\xi} - 1\right)}{\xi\left(R^{1-\xi} - R\right)} - \ln x \right) \frac{R^{1-\xi}}{r-\mu}.$$

The first term within the large squared brackets is negative while the second is positive if $x \in (R, 1)$ and negative if $x > 1$. It can be verified that $\frac{\partial V(R;\xi)}{\partial \xi} > 0$. Hence $\exists\ x = x' \in [R, 1)$ such that $\frac{\partial V(x;\xi)}{\partial \xi} > 0$ if $x \in [R, x')$ and $\frac{\partial V(x;\xi)}{\partial \xi} > 0$ if $x \in (x', \infty)$. In particular

$$\frac{\partial V(1;\xi)}{\partial \xi} < 0 \Longrightarrow \left(\frac{\partial R(\xi)^{1-\xi} x^{\xi}}{\partial \xi} \right)_{x=1} > 0.$$

The derivative of the schedule $\theta = \theta(R(\xi), \xi)$ is the found to be

$$\frac{\partial \theta}{\partial \xi} = r(1-\beta) \frac{\frac{\partial R(\xi)^{1-\xi}}{\partial \xi}\left(\xi^2\left(1 - \frac{(r-\mu)(b+rC)}{r(1-\beta)}\right) - \xi\right) + R^{1-\xi}\left(1 - R^{1-\xi}\right)}{\xi^2\left(R^{1-\xi} - 1\right)^2}$$

and this expression is surely positive if $\frac{1-\beta}{r-\mu} \geq C + \frac{b}{r}$. By assumption 1, this so if $b \leq rF^{\max}$, which is assumed to be the case.

(6) An implicit differentiation in equation (16) shows that

$$\frac{\partial R}{\partial \mu} = R \frac{\frac{\partial \xi}{\partial \mu}(1-\beta) R\left(1 - R^{-\xi} + R^{-\xi} \ln R^{-\xi}\right) - F\xi^2}{\xi(1-\xi)(1-\beta)\left(R - R^{1-\xi}\right)} > 0$$

given that both the numerator and the denominator of this expression are positive.

8.7 Proof of Proposition 1

We want to establish if, and when, $\forall\ x \in [R^{SQ}, x^*(\beta)]$ and $\forall\ R^{SQ}$,the following weak inequality is true

$$W(x;\beta;R^{SQ}) \leq U(R_{Flex}). \tag{39}$$

If (39) is true for some value of β, full flexibility is the unique political equilibrium of the model for that value of β. In fact, by (39), *all* workers do prefer a transition toward full flexibility *whatever* the *status quo* is. Also, because the asset value of unemployment is strictly increasing in R (and hence $U(R) < U(R_{Flex})$ for every $R \neq R_{Flex}$), it is clear that, if (39) holds, full flexibility defeats in pairwise comparison any alternative and hence it is the unique Condorcet winner of a majority voting process, whatever the *status quo* is.

Some simple algebra shows that (39) is equivalent to

$$x - (R^{SQ})^{1-\xi} x^{\xi} \leq (x^*(\beta))^{\xi} ((R_{Flex})^{1-\xi} - (R^{SQ})^{1-\xi}).$$

The left hand side of this equation is increasing in x and hence it reaches its maximum over the range of interest at $x = x^*(\beta)$, where (39) assumes the form

$$x^*(\beta) - (R^{SQ})^{1-\xi} (x^*(\beta))^{\xi} \leq (x^*(\beta))^{\xi} ((R_{Flex})^{1-\xi} - (R^{SQ})^{1-\xi})$$

or, more simply, $x^*(\beta) \leq R_{Flex}$.

Since x^* is strictly increasing in β and since, by definition, $x^*(\beta_{**}) = R_{Flex}$, (38) is identically true for any value of $\beta \in (0, \beta_{**}]$.

8.8 Proof of Result 8

Differentiate implicitly x^{**} in equation (21) with respect to ξ to obtain

$$\begin{aligned} & \left[1 - \xi \left(R^{SQ}\right)^{1-\xi} (x^{**})^{\xi-1}\right] \frac{\partial x^{**}}{\partial \xi} \\ = \; & \frac{(1-\beta)}{\beta \xi^2} \left[\left(R^{New}\right)^{1-\xi} \left(1 + \xi \ln R^{New}\right) - \left(R^{SQ}\right)^{1-\xi} \left(1 + \xi \ln R^{SQ}\right)\right] \\ & + \left(R^{SQ}\right)^{1-\xi} x^{**\xi} \ln \frac{x^{**}}{R^{SQ}}. \end{aligned}$$

The term in the squared brackets on the left hand side of this expression is strictly positive. The right hand side is also so, given that $a^{1-\xi}(1 + \xi \ln a)$ is strictly increasing in $a \in (0,1)$ if $\xi < 0$ and given that $x^{**} > R^{SQ}$. This implies that, $\forall\ \beta \in (0,1)$, $\partial x^{**}/\partial \xi > 0$. All the statements contained in result 8 follows then simply from the dependence of ξ on the parameter of the model, which has already been discussed.

8.9 Proof of Proposition 2

Recall that, by assumption, $\beta > \beta_{**}$, and therefore that $R_{Flex} < x^*(\beta)$.

We following two preliminary lemmas will be useful.

Lemma 1. *If $R' \succ R^{SQ}$ for some $R' < R^{SQ}$, then R_{Rigid} defeats any $R \leq R'$ in pairwise comparisons.*

Proof. Immediate consequence of result 5.

Lemma 2. *If $R'' \succ R^{SQ}$ for some $R'' > R^{SQ}$, then R_{Flex} defeats any $R \geq R''$ in pairwise comparisons.*

Proof. Immediate consequence of the fact that U is strictly increasing in R and of results 5 and 8.

Let $R' < R^{SQ} < R''$, where $R' \geq R_{Flex}$ and $R'' \leq R_{Rigid}$. Let x^{++} defined as the (unique) productivity level such that $W(x^{++}; R') = U(R'')$. It is immediate to deduce that $x^{++} < x^{**}$ (since $\frac{\partial^2 W}{\partial R \partial x} > 0$ for any x and for any R) where x^{**} is such that $W\left(x^{**}; R^{SQ}\right) = U(R'')$. x^{++} may be greater or lower than R^{SQ}.

Case (i): $x^{++} > R^{SQ}$. We know (result 5) that R' is preferred strictly to R^{SQ} by the employed with productivity $x \in \left(R^{SQ}, x^*\right)$. This set has Lebesgue-Stieltjes measure $L \cdot \lambda_\Psi \left\{(R^{SQ}, x^*)\right\} \equiv \gamma$ (remind that $\Psi(\cdot)$ is defined as a distribution function across employment, thus we need to multiply λ_Ψ by L). R^{SQ} is preferred to R'' by the workers with productivity $x \in (x^{**}, x^*) \subset \left(R^{SQ}, x^*\right)$ (result 8), which has Lebesgue-Stieltjes measure $L \cdot \lambda_\Psi \{(x^{**}, x^*)\} \equiv \alpha < \gamma$. Finally, R' is preferred to R'' by the workers with productivity $x \in (x^{++}, x^*)$, which has Lebesgue-Stieltjes measure $L \cdot \lambda_\Psi \{(x^{++}, x^*)\} \equiv \phi$. Since $(x^{**}, x^*) \subset (x^{++}, x^*)$, it is the case that

$$\alpha < \phi < \gamma$$

We can then distinguish two sub-cases.

- $\gamma \leq \frac{1}{2}$. In this instance, α and ϕ and also both lower than $\frac{1}{2}$. This means that $R^{SQ} \succeq R'$, $R'' \succ R^{SQ}$ and $R'' \succ R'$ (R'' wins).

- $\gamma > \frac{1}{2}$. We have to consider three possibilities. (i) α and ϕ are both greater than $\frac{1}{2}$. In this case, $R' \succ R^{SQ}$, $R^{SQ} \succ R''$ and $R' \succ R''$ (R' wins). (ii) $\phi \geq \frac{1}{2}$ and $\alpha < \frac{1}{2}$. In this case $R' \succ R^{SQ}$, $R^{SQ} \succ R''$, $R' \succ R''$ (R' wins). (ii) α and ϕ are both lower than $\frac{1}{2}$. In this case, $R' \succ R^{SQ}$, $R'' \succ R^{SQ}$, $R'' \succ R'$ (R'' wins).

We conclude that R' (R'') defeats any of the two alternatives in pairwise comparisons (and that $\succ$ is transitive) if, and only if, $\phi \geq \frac{1}{2}$ ($< \frac{1}{2}$).

Consider now the function $\phi = \phi(R', R'')$, which does *not* (by definition of ϕ) depend on R^{SQ}. Notice first of all that $\frac{\partial x^{++}}{\partial R'} > 0$ and that $\frac{\partial x^{++}}{\partial R''} > 0$. Therefore, $\frac{\partial \phi}{\partial R'} < 0$ and $\frac{\partial \phi}{\partial R''} < 0$.

Then, in sum, if $\phi(R_{Rigid}, R_{Flex}) \geq \frac{1}{2}$, it follows that $\phi(R_{Rigid}, R'') \geq \frac{1}{2}$ $\forall\ R'' < R_{Flex}$; by lemma 1, R_{Rigid} is also strictly preferred to any $R < R^{SQ}$. This demonstrates the if in (i) part 1; the only if is obvious. If, instead $\phi(R_{Rigid}, R_{Flex}) < \frac{1}{2}$, then $\phi(R', R_{Flex}) < \frac{1}{2}\ \forall\ R' > R_{Rigid}$. By lemma 2, R_{Flex} is also strictly preferred to any $R > R^{SQ}$. The only if is also obvious.

Case (ii): $x^{++} < R^{SQ}$. In this case R' is always preferred to R'' and $\phi = \gamma$. The proof is then almost identical to the one relative to case (i) and is therefore omitted.

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