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Labor-market flexibility and aggregate employment volatility*

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Abstract

Recent empirical work for the Spanish Economy indicates that after 1984, when the rules for temporary employment were significantly relaxed, aggregate employment increased but has become highly volatile. The counterpart of this in the labor microevidence is a significant increase in the hazard rates for match destruction. This paper develops a model of job creation and destruction with dismissal costs and analyses the effect of introducing a rule by which all jobs terminated within a given period of time are exempt from these costs. The model is calibrated using microevidence on registered social-security job matches for the Spanish economy.

1 Introduction

In recent years, the view that labor-market restrictions in European economies was partly responsible for high unemployment rates has been quite commonly held (see, e.g., Dolado and Jimeno 1995, Lazear 1990, Millard and Mortensen 1994, Millard 1994). Several theoretical models have been applied to provide a quantitative verdict. The results are far from clear. Bentolila and Bertola

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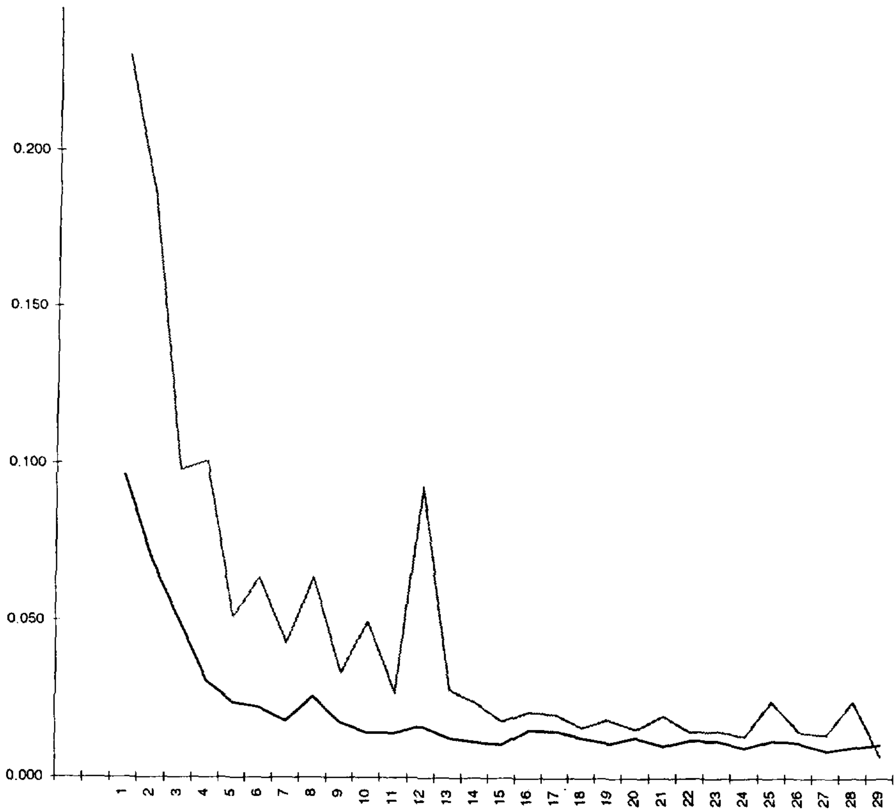
(1990) consider the effect of layoff costs on the hiring and firing decisions of firms which face idiosyncratic uncertainty to the returns to labor. They argue that if the shocks faced by firms are highly persistent and worker attrition high, the effect of this type of policy should be negligible. Hopenhayn and Rogerson (1993) incorporate this structure in a general equilibrium model, calibrating the stochastic process for firms' productivity to match US evidence on job creation and destruction. Their results suggest that layoff costs can reduce considerably the rate of turnover and the overall efficiency of the economy, but the effects on unemployment are undetermined. Finally, in a recent paper based on a labor-matching model, Millard and Mortensen (1995) calibrate a specialized version of the Mortensen-Pissarides (1994) model and show that layoff costs have a fairly small effect on turnover but can increase substantially the rate of unemployment.

The Spanish labor market is a good example of what has been called *eurosclerosis.* Unemployment rates have been close to 20% for more than 10 years and the market is considered to be heavily regulated. More interestingly, the Spanish case provides an extremely interesting natural experiment to study the impact of labor mobility restrictions. In 1984, a wide labor-market reform was instituted which extended considerably the scope and duration of temporary labor contracts. As a consequence, workers can be hired with temporary contracts for up to 36 months and fired at much lower cost to the firm. After this reform, unemployment decreased from 21% to approximately 16% in five years. This trend, however, was quickly upset by the 1992 recession, where in a few months unemployment rates climbed to the pre-reform levels.

A detailed examination of job creation and destruction suggests that the behavior of the labor market changed dramatically after the reform. Figure 1 provide estimates of hazard rates for match destruction for the two periods based on a random sample of social-security records. The gray line corresponds to the situation after 1984 and the dark line before that time period. The flow is substantially higher after the reform. A rough calculation indicates that in order to maintain the same steady-state employment rate, the average hazard rates of job creation must be twice as high after the reform.

An examination of the cyclical properties of match creation and destruction shows also an interesting qualitative change after the reform. Figure 2 provides a plot of the cyclical component for the rates of entry and exit from unemployment, computed from household surveys. It can be observed that the volatility of job creation increases substantially after the reform; in contrast, the cyclical properties of job destruction remain unchanged. As a consequence, the volatility of aggregate employment seems to have increased.

The behavior of the labor market before and after the reform provides an interesting challenge for the theory of job creation and destruction. There are


0.200
0.150
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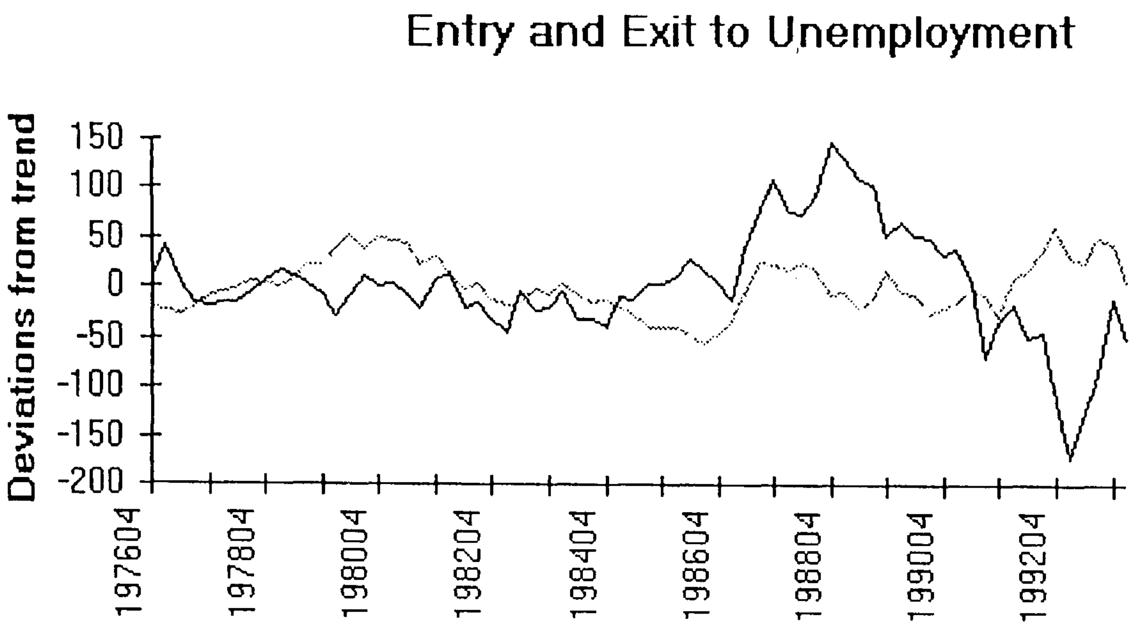
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

FIGURE 1


Entry and Exit to Unemployment
Deviations from trend
150
100
50
0
-50
-100
-150
-200
197604
197804
198004
198204
198404
198604
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199004
199204

FIGURE 2

two classes of models that have been used to study labor reallocation: firm-based models and matching models. In the first class of models, firms are subject to idiosyncratic productivity or demand shocks that give rise to adjustments in its employment [see Bentolila and Bertola (1990), Bentolila and Saint-Paul (1992), and Hopenhayn and Rogerson (1993)]. The second class of models (see Mortensen and Pissarides, 1994) take the individual match as the unit of analysis and consider in more detail the frictions associated to match formation.

The model we consider belongs to the first class and is a variant of the one in Bentolila and Saint-Paul (1992). Firms has subject to idiosyncratic productivity shocks, which follow a Markovian structure. In addition there are aggregate shocks, which also follow a Markov process. Two variants of the model are considered. In the first one, all jobs are considered to be permanent, which we take as a stylized approximation of the situation prevailing prior to the reform. In the second model, temporary workers can be hired, approximating the situation after the reform. Labor supply is taken exogenously.

We calibrate the model using micro evidence on match duration before and after the reform, information on the share of temporary contracts, and recent estimates of Solow residuals (Nicolini and Zilliboti, 1996.) Our model does not show an important increase in average labor demand when temporary jobs are included, but a substantial increase in reallocation and employment volatility. Most of this reallocation occurs at the intensive margin and does not generate large surplus. In consequence, the average performance of the economy measured by its productivity or total employment is not affected dramatically by dismissal costs.

The paper is organized as follows. Section 2 provides some background information on the Spanish labor market. Section 3 describes the model at a general level and provides some theoretical results. Section 4 specializes the model and provides details on how parameter values were chosen. Section 5 gives the results of the model. Finally, Section 6 gives some concluding remarks. The paper contains an appendix with more detailed information on labor-market contracts in Spain.

2 The facts

Spanish unemployment is the highest of all OECD countries. Even during 1995, a relatively good year in the business cycle with a growth rate of GDP close to 3%, the unemployment rate was above 20%. The high unemployment rate is a relatively recent phenomenum. Starting from a low 5% in the late 70s, it increased steadily to reach the 20% level in the mid 80s. The story usually told is that this period starts with a series of important shocks (the oil crisis and the change in the political regime after Franco's death), which led to large job destruction throughout the early 80s. This was followed by a period of very low creation and extended unemployment spells. This period is also characterized by a very generous unemployment insurance policy and high dismissal costs.

The severity of the unemployment problem in Spain and the belief that the high degree of employment protection in Spain (the second largest in Europe according to the OECD) was responsible for at least part of this problem led the authorities to introduce changes in the legislation that allowed the possibility of noncausal fixed-term contracts in 1984. The main innovation of these contracts is that employers did not need to show that the activity performed was temporary in any essential way, and the severance pay at termination was much lower than for indefinite length contracts and was not subject to costly court challenges.

The impact of this reform on the labor market seems clear: the unemployment rate decreased continuously after the reform until 1991, to reach a level five-percent lower than before the reform. However, the story does not end there. After the 1992 recession the rate of unemployment went back to its prior levels in just a few months. A very high level of match destruction coupled with a large reduction in match creation explain this reversal.

2.1 *The extent of reallocation*

Recent empirical evidence for the US and other European economies shows that substantial amounts of labor reallocation take place at all points in the business cycle, and therefore policies that interfere with that process may have important consequences for the behavior of unemployment. We will first review some of the microevidence that is available for the Spanish economy.

Salvador and Dolado (1995) with data from the Central de Balances of the Bank of Spain (CBBE), a panel database with data from approximately one thousand relatively large firms, show that small firms tend to create more employment than they destroy (4.9% versus 3.9%, for firms under 100 employees), while for large firms the opposite is true (2% versus 4.6%, for firms over 1000 employees - see Table 6.) They also report a tendency for creation and destruction to be done in small amounts; around 50% of adjustments affects under 5% of the employees of a firm (see Table 7).

As for the cyclical behavior of worker flows, Salvador and Dolado (1995) show that there is a very strong positive correlation between creation and net flows, and since they interpret net flows as a proxy for the cycle, this implies procyclical creation. They also find strong negative correlation between destruction and net flows, and thus countercyclicality of employment destruction (see Table 5). This result is corroborated by Antolí (1995), who, using the Spanish labor-force survey (EPA), finds that the flows from employment to nonemployment in Spain are countercyclical and the flows from nonemployment to employment are procyclical. Looking at match creation and destruction (that is, taking into account job-to-job flows) produces a different picture, since Antolín also shows that match creation is procyclical but match destruction is acyclical. This can be explained by the procyclicality of quits.

García-Fontes and Hopenhayn (1996) also study match creation and destruction, estimating hazard rates for match destruction, as well as hazard rates for obtaining a new job (see Table 9). Their estimates show that the hazard function for match destruction is rapidly decreasing in the first few periods and then slows down. As a consequence the distribution of match durations is very skewed towards short matches. They also find that match destruction by quits is procyclical and layoffs are moderately countercyclical.

The 1984 labor-market reform led to dramatic changes in the Spanish labor market. As Bentolila and Saint Paul (1992) report, 98% of new contracts from 1984 on were temporary. As for the stocks of contracts, in 1987 15% of the total and by 1990 almost 30% of the total number of contracts were temporary. The percentage is larger for women, the young, illiterates, and agricultural and construction workers, and lower for men, the middle-aged, college graduates, and industry and service workers (see Table 12). The ratio of the inflow of job demands to employment - a measure of turnover - increased from 3.4% in 1980-84 to 6.5% in 1991-92, as Bentolila and Dolado (1994) report. According to the estimates of García-Fontes and Hopenhayn (1996) the average turnover goes from 2% to 5% (see Table 9). Segura, Durán, Toharia, and Bentolila (1991) report an average duration of 18 to 20 months. A similar finding is reported by García-Fontes and Hopenhayn (1996). The increase in job destruction was more than compensated by the rise in job creation. As a consequence, persistence of unemployment, measured as a percentage of the long-term unemployed, decreased by 6 points from 1985 to 1991.

Bentolila and Saint-Paul (1991) use data from the CBBE to estimate the change in the effects of cyclical shocks on employment induced by temporary contracts. They find that the elasticity of employment to a change in sales went from 0.06 to 0.09. The change was more dramatic for firing (where the coefficient went from 0.04 to 0.09) than in firing (from 0.4 to 0.5 – see Table 10). García-Fontes and Hopenhayn (1996) also find a very significant increase in hazard rates of match destruction after 1984 (Table 9).

2.2 *The regulation of dismissals and temporary contracts*

The Spanish labor market is one of the most regulated in Europe, according to the OECD. This rigidity is specially apparent in the treatment of job redundancies. In the UK, for example, the law provides a redundancy pay that goes from 0.5 to 1.5 weeks per year worked (Hepple and Fredman, 1992); in France the regulation is between 0.5 to 2 weeks per year worked (Despax and Rojot, 1987). In Spain, the law that regulates labor relations, the Worker's Statute (ET), which was instituted in 1980, provides for 20 days per year worked if the termination is considered "fair" and 45 days if it is considered "unfair."

There are basically two types of "fair" dismissal (art. 50 and 51 ET); those that occur because the worker is found incompetent to undertake the tasks for which he was hired, and those that occur for economic or technological reasons. Showing that the firm finds itself in one of those situations involves a lengthy and costly process that involves regulatory authorities and the courts. The average time necessary for a dismissal to be accepted is 14 days and the standard deviation is 15 days (see Malo, 1996). "Unfair" dismissals also involve a court procedure (art. 56, ET), and the workers are paid their salaries until a decision is taken. There are mediation and arbitration processes which probably lead to more efficient outcomes. But at least 15% of the terminations are settled in court, (Bentolila 1996) and 73% are favorable to the workers. The figures for total average layoff costs are not very good, but Bentolila (1996) estimates total costs between \$10,000 and \$20,000. Unfortunately we do not have separate figures for legal costs and other costs that are separate from the transfers whose effects may be more easily bargained away.

To mitigate the negative consequences of the costs of adjusting the labor force, the ET (art. 15) provided the possibility of fixed-term contracts, which could be canceled at termination with a much smaller severance pay and no court or regulatory intervention. These fixed-term contracts were divided into causal and noncausal. The causal contracts could be used for jobs that are temporary in nature, to replace workers that have left the firm for maternity leave, or for the initial period of activity of a firm. The noncausal contracts were included in the law explicitly as a policy instrument to promote employment (*fomento de empleo*), and their regulation, which included the possibility of subsidizing hiring or reducing the social-security tax for certain groups of workers, was left to the government.

Some limited use of this discretionary power was made in 1981 and 1982, and noncausal fixed-term contracts for the youth, the long-term unemployed and the inhabitants of certain depressed areas were allowed. By 1984 it became clear that these measures were not sufficient and the government decided to broaden the scope of fixed-term contracts. The need of a valid cause for a temporary contract was eliminated and contracts were not restricted to certain classes of workers any more. There were still two main types of noncausal fixed-term contracts, one that still subsidized hiring for the youth (*contratos en prácticas y de formación*), and the rest with no subsidy (though there still was some implicit subsidy through unemployment insurance). The other main characteristic of these contracts was that the duration was limited to a minimum of six months, and may be extended by periods of at least six months until a total maximum of three years. If the contract was terminated before its agreed-upon time, the normal dismissal procedures applied; otherwise the firm was liable to a severance pay of 12 days per year worked (or the proportional amount for shorter periods) and there were no court or regulatory procedures involved. There were still some limits to the use of these contracts. A firm could not replace a temporary worker whose maximum duration of three years had expired by another temporary worker doing exactly the same job, for at least a year. But the rotation between jobs of some core workers (Valdés 1985) and not very strict enforcement of that rule made it rather ineffective.

Another important change in the legislation appeared in 1992. By that time it was obvious that temporary contracts had induced vast amounts of turnover, and government finances were being hurt by the fact that many individuals were working for very short periods of time (as short as 6 months) and then getting unemployment benefits (one could get three-months' unemployment benefits for 6-months' work), to resume work thereafter. This implied an unintended subsidy for activities with low turnover costs. The law in 1992 changed the minimum fixed-term noncausal contract length to one year. The minimum time of employment required to be eligible for unemployment benefits was also extended to one year. The subsidies for youth contracts were abolished. Finally, subsidies were given to firms that transformed fixed-term contracts into permanent contracts.

In 1994 there was another change in the law. This time the noncausal contracts were abolished, except for the youth, the handicapped, the long-term unemployed, or the older than 45. The contracts that had been signed prior to 1994 were allowed to continue and be renewed under the old law, but new contracts of that type were not possible any more.

As of the writing of this paper the future of labor-market regulations in Spain is unclear. Currently, labor unions and business organizations are discussing a reform of the labor market which could entail some lowering of job protection provisions, but an agreement seems difficult. The government has announced that if there is no agreement among business and labor they will take unilaterally some reform measures, but they have not been specific about these reforms.

3 The model

We consider only the demand side of the labor market, so wages are exogenously given. The model described below is a variant of the ones considered by Bentolila and Saint-Paul (1992) and Hopenhayn and Rogerson (1993).

At any point in time a firm receives a flow of net revenues as given by a function $R(\theta(t), s(t), n(t))$, where $n(t)$ is the labor input of the firm, $s(t)$ an idiosyncratic shock and $\theta(t)$ an aggregate shock common to all firms. We assume that $s(t)$ follows a Poisson process with arrival rate λ and that at each arrival the distribution for the new shock is given by a conditional distribution $F(ds; s(t))$, *i.e.,* $s(t)$ follows a Markov process at exponentially distributed time intervals. We assume similar Markovian structure for $\theta(t)$, with arrival rate γ and conditional distribution $\Psi(d\theta; \theta(t))$.

Firms discount future expected profits at the interest rate r. Without loss of generality we assume that a firm can adjust its labor force at times where either the idiosyncratic or aggregate shocks change. If at that time the firm reduces its total employment, it pays a cost f per unit of employment reduced. We assume that all (permanent) workers are homogeneous, so a firm would only fire a worker if it plans to reduce its employment. Consequently, all worker reallocations in the model correspond to job reallocations. Let $V(\theta, s, n)$ denote the value function of a firm at a time of adjustment of its labor force, where n denotes its initial employment and θ, s the current values of the aggregate and idiosyncratic shocks, respectively. Then $V(\theta, s, n)$ satisfies the following functional equation

$$\begin{aligned} V(\theta, s, n) &= \max_{n'} \frac{R(\theta, s, n')}{r+\lambda+\gamma} - f \cdot max(0, n-n') \qquad (1) \\ &+ \frac{\lambda}{r+\lambda+\gamma} \int V(\theta, s', n') F(ds'; s) \\ &+ \frac{\gamma}{r+\lambda+\gamma} \int V(\theta', s, n') \Psi(d\theta'; \theta). \end{aligned}$$

The first term corresponds to the expected discounted value of revenues from the current time period to the next arrival; the second term corresponds to layoff costs; the third term corresponds to the expected value of the firm after a new arrival of the idiosyncratic shock; and the last term to the expected value after the arrival of a new aggregate shock. It is easy to check that the mapping defined by the above functional equation is a contraction, so assuming that R is bounded, it admits a unique solution V.

A simple characterization of the optimal employment policy can be given under some regularity assumptions, which are now given.

Assumption 1. *(Stochastic dominance) (i) F(s', s) is decreasing in s for* *all s': (ii)* $\Psi(\theta', \theta)$ *is decreasing in* θ *for all* θ'.

Assumption 2. *R is bounded above, continuous, increasing in* (θ, s, n) *strictly concave in n and has increasing differences in* (θ, n) *and* (s, n).

The stochastic dominance assumption implies that a firm with higher shocks today is more likely to face higher shocks after the next arrival. The assumption is quite natural and is satisfied for example if the shocks follow AR1 processes with positive persistence. Strict concavity in n guarantees a unique solution. The assumption of increasing differences implies that marginal returns to labor are increasing in both shocks.

Let $n' = g(\theta, s, n)$ give the unique solution to (1). The following proposition provides a characterization of this optimal policy function.

Proposition 1 *There exist two increasing functions* $N(\theta, s) \geq n(\theta, s)$ *such that*

$$g(\theta, s, n) = \begin{cases} n(\theta, s) & \text{if } n < n(\theta, s) \\ n & \text{if } n(\theta, s) \leq n \leq N(\theta, s) \\ N(\theta, s) & \text{if } n > N(\theta, s) \end{cases}$$

Proof. See Appendix.

For fixed values of the aggregate shock, the optimal policy involves two target employment levels, one for increments and one for employment reductions, and a band of innaction when the original employment is inbetween. As $f \to 0$, these two levels converge and the band of innaction disappears.

3.1 *Layoff costs and no temporary workers*

In this section we specialize the model to the case where all workers are permanent, which – in a stylized way – corresponds to the situation prior to the labor-market reform. We assume that the wage of a worker w is exogenously given and firm revenues are given by

$$R(\theta, s, n) = f(\theta, s, n) - wn \tag{2}$$

where f is a production function which is strictly concave in n and increasing in both θ and s. We assume that f has the same properties given in Assumption 2, so that firms with higher idiosyncratic shocks employ more workers and aggregate labor demand is procyclical.

The above formulation abstracts from bargaining considerations, which have been an important component in recent work on job matching (see

Mortensen and Pissarides, 1994). However, an alternative interpretation can be given to the model which could accommodate bargaining considerations.

In our model firms can hire workers instantaneously (there is a perfectly elastic supply of workers at wage w) and by assumption all workers are identical. This would justify our assumption of a constant wage in the absence of layoff costs or severance pay. In contrast, positive layoff or severance costs give an employed worker (insider) some bargaining power, since a cost must be borne by the firm to replace this inside worker with an outsider. Workers with permanent contracts should thus command a higher wage, dependent on the size of layoff costs or severance pay.

However, if there is an initial trial period with no dismissal costs – as is usually the case – efficient sequential bargaining (e.g., sequential Nash bargaining) will give rise to a wage profile that has the same present value as the constant flow w and will induce separations. Such separations will not be affected by the size of severance payments (which represent only a transfer between the firm and the worker), but will obviously be affected by the net separation costs. For this reason, in what follows we will interpret f as comprising these layoff costs and not the severance pay. Such costs include, for example, litigation fees.[1]

3.2 *Temporary workers*

In this section we include the option of hiring temporary workers. The model is very close to the one given in Bentolila and Saint-Paul (1992).

There are two types of workers. These workers differ in their productivity, wages, and firing costs. Type 1 workers, the "permanent" workers, have a salary w_1 and there is a cost f for the firm if they are laid-off. Type 2 workers have a salary w_2 and there is no cost attached to laying them off. The relative productivity of type 1 and type 2 workers is η. Since we are not modeling the supply side and wages are exogenous, there is no loss of generality in assuming that $w_1 = w_2 = w$, given that the relative productivity parameter η can be used to adjust for different wages. In this case $\eta < 1$, for otherwise permanent workers would never be employed. Notice that when $\eta = 0$, this model specializes to the one with no temporary workers discussed in the previous section.

Revenues are now given by $f(\theta, s, n_1 + \eta n_2) - w(n_1 + n_2)$, where n_1 is the total number of permanent workers employed by the firm and n_2 is the number of temporary workers employed. The demand for temporary workers is the solution to a static problem, which gives rise to the following reduced

[1]According to Bentolila (1996), at least 15% of the terminations are settled in court. The average time for a dismissal to be accepted is 14 days and the standard deviation 15 days (Malo, 1996).

revenue function

$$R(\theta, s, n_1) = \max_{n_2} f(\theta, s, n_1 + \eta n_2) - w(n_1 + n_2).$$

Temporary workers will obviously be hired to the point where their marginal product equates the wage. It is easy to show that if f satisfies the assumptions given in the previous section, this reduced revenue function will satisfy Assumption 2. The adjustment of the permanent labor force will thus follow the policy described in Proposition 1.

As in Bentolila and Saint-Paul (1992), we assume here that there is no time limit to temporary employment. This is only an approximation to the situation after the labor-market reform, since a time limit of 3 years was then imposed. Short of modelling explicitly this time limit, there are two ways to examine how good an approximation this may be. Consider first the evidence on hazard rates for dismissals estimated over the years after the reform given by the gray line in Figure 1. The peak in quarter 12 corresponds to dismissals occurring at the time limit for temporary employment. Though this peak reflects the fact that for some matches the time limit was indeed binding, only 10% of those matches were destroyed when this time limit was reached. Since only 40% of the matches created were not destroyed before that 3-year time limit, the constraint seems binding for at most 4% of the temporary jobs created.

A second comparison can be obtained by considering the match duration for temporary jobs obtained in our model under the identifying assumptions described in the following section. The results from our calibration indicate that of all temporary matches created, less than 15% survive the 3-year time limit.

At the other extreme, we identify the model with no temporary jobs given in Section 3.1 with the situation prevailing prior to the reform. This assumption is less satisfactory since some form of temporary employment, with shorter time limits and additional constraints, existed prior to the reform, accounting for approximately one-third of the flow of new contracts.[2] As explained below, we attempt to take this into account in our calibration. Nevertheless, our model will underestimate the rates of match creation and destruction of these short-term jobs.

3.3 *Jobs and matches*

The model used in this paper takes firms as decision units. An alternative class of models extensively used in labor economics consider instead a match

[2] Depending on their size, firms were also restricted to a maximum share of temporary jobs over their total employment, with a maximum of 30% for small firms and 10% for large ones.

as the basic unit. It is hard to argue that since most matches correspond to firm hirings, the former class of models have added some fundamental value. However, the information we use to calibrate the model corresponds to match durations. In this section we describe a method that can be used to account for histories of matches that arise from job reallocation.

We illustrate the method for the case with no temporary workers. The extension to the general case is straightforward. New matches are created when the firm expands its employment. Using Proposition 1, this occurs when $n < n(\theta, s, n)$. In order to keep an accounting of match durations, we make the following identifying assumption: the last matches created are the first ones to be destroyed. This seems the most reasonable assumption and is consistent with data for other economies (Layard, Nickell, Jackman, 1991). At any point in time, we can describe the matches of a firm by a vector m_t of dimension equal to n_t, its employment at t, where each element of the vector corresponds to a specific worker's seniority. Suppose this vector is ordered from highest to lowest. Every time a new arrival occurs, three things may happen. If total labor force is reduced by an integer Δn, the corresponding rows of the vector m_t are deleted and those matches terminated. If total labor force is increased by Δn, additional Δn rows are appended to the vector of matches m_t with seniority values equal to zero. If there is no adjustment in the labor force, the m_t vector remains unchanged. Each element of the vector of matches is increased correspondingly over time with the added seniority until a new arrival occurs. The procedure is then repeated.

For the purpose of quantifying labor turnover, our model does not take into account labor reallocation that may result without a job reallocation. This has two consequences. Firstly, there is no role for attrition to be used as a means of reducing firm employment. As argued by Bentolila and Bertola (1990), this omission can be important since high rates of attrition make layoff costs less binding. Secondly, our model will predict less turnover than what is observed in the match duration data. This will be discussed later in Section 4.

An indication of the importance of attrition can be obtained by examining data on match destructions due to quits. Estimates obtained from the social-security data show that initially the monthly hazard rate for quits is in the order of 4%, declining rapidly to reach less than one percent after one year and less than half of a percent after 3 years. This evidence conforms with the casual empirical evidence that permanent jobs are highly valued positions for the average Spanish worker.

3.4 *Aggregation*

We will denote the firm's decision rules by two functions $N_1(\theta, s, n_1)$, the amount of permanent workers to employ, and $N_2(\theta, s, n_1)$, the amount of temporary workers to employ. The aggregate labor demand will be determined by a measure $\mu_t(\theta, s, n_1)$ describing the amount of firms in the different states at every instant t, according to

$$N^d(\mu_t) = \int (N_1(\theta, s, n_1) + N_2(|theta, s, n_1))d\mu_t(\theta, s, n_1).$$

This aggregate measure of firms evolves over time according to the idiosyncratic shocks received by firms and the aggregate shocks.

In order to construct the aggregate statistics implied by the model, a procedure frequently used is to generate a very large sample path for a single firm and compute averages from this path. The procedure is justified if the process followed by the state of the firm (θ_t, s_t, n_t) is ergodic. The following proposition gives a condition that must be met by the optimal decision rule for the process to be ergodic.

Proposition 2 *Suppose that* $\inf_{\theta,s} N(\theta, s) < \sup_{\theta,s} n(\theta, s)$ *and the processes* θ_t *and* s_t *are bounded and satisfy the monotone mixing condition in Hopenhayn and Prescott (1992). Then the process* $\{\theta_t, s_t, n_t\}$ *has a unique invariant distribution and is ergodic.*

Proof. Assumption 1 and Proposition 1 imply that the process for $\{\theta_t, s_t, n_t\}$ satisfies the monotone mixing condition. By theorem 2 in Hopenhayn and Prescott (1992), there is a unique invariant distribution, which in turn implies that the process is ergodic. □

Loosely speaking, the monotone mixing condition is satisfied by any mean reverting process, and is thus satisfied for the AR1 process considered in Section 4.

4 Calibration

To calibrate the model we set the time-unit to a quarter. The interest rate $r = 0.01$. The production function $f(x, s, n) = xe^{s(1-\alpha)}n^{\alpha}$. Labor shares of aggregate output in Spain have been very variable during the time period considered. We will use the standard value $\alpha = 2/3$, which is within the observed range of variation for these shares.

The evidence of hazard rates for dismissals shows a substantial decrease as a function of time. In order to accommodate this observation, the support of the distribution of shocks must contain many values. For example, if we were restricted to two possible shocks, as in Bentolila and Saint-Paul (1992), all jobs created after a good shock would be destroyed when the luck is reversed. Such a stochastic process would imply constant hazard rates.

The process followed by the firm-specific shocks to productivity (once they arrive) is assumed to be AR(1), and given by

$$s' = \rho s + \epsilon, \epsilon \sim N(a, \sigma_\epsilon^2), a \geq 0, 0 \leq \rho < 1.$$

Two values were taken for the aggregate shock, $x_0 = 0.975$, and $x_1 = 1.025$, so that from peak to trough there is a 5% difference in productivity. The arrival rate of aggregate shocks $\gamma = 1/8$, so that the expected duration of cycles is 4 years. Nicolini and Zilibotti (1996) compute Solow residuals for the Spanish economy which suggest that these numbers are roughly correct.

To assign values to the parameters of the firm specific stochastic process $(\lambda, \rho, a, \sigma_\epsilon^2)$, the following procedure was used. The arrival rate, persistence, and variance were chosen to match the average rate of turnover and overall structure of the hazard rates after 1984, as given in Figure 3. The values used were $\lambda = 1.25, \rho = 0.975$, and $\sigma = 0.1$.

For an economy with no layoff costs, the stochastic process for the idiosyncratic shocks implies an AR1 process for employment given by

$$lnn_t = \frac{(1-\rho)(ln\alpha - lnw)}{1-\alpha} + \rho lnn_{t-1} + \frac{\epsilon_t}{1-\alpha}$$

which suggests an alternative method to estimate these parameters if firm-level data were available.[3] Based on a sample of large firms, Bentolila and Saint-Paul (1992) estimate an AR1 process for employment growth, but include as explanatory variable the rate of change in the total sales of the firm. They find a coefficient for the lagged value of employment of 0.87. Since they work with annual data, and we work with quarterly data and $\lambda = 1.25$ – which implies an average of 5 shocks a year – their coefficient should be approximately ρ^5. Notice that $0.975^5 = 0.88$.[4]

The value of a is chosen so that $\partial f(\bar{x}, \bar{s}, n)/\partial n = w$, for $n = 20$ where $\bar{s} = a/(1-\rho)$, is the unconditional expectation of s. In this way the average firm size would be around 20, if there were no lay off costs. We experimented with other values, without observing substantial differences.

The layoff cost was calibrated according to two alternative procedures. First, a value was chosen to match the average rate of turnover for the spanish economy prior to 1984, giving a value for the layoff cost equal to 0.2 (equivalent to 1/5 of a quarterly wage.) There are two reasons why one may expect the model to underestimate this turnover rate. Firstly, we only consider job turnover, which is probably a large part but to all of labor turnover. Secondly, the model applied to this time period considers all contracts permanent. As mentioned above, more limited temporary contracts

[3]This method was used in Hopenhayn and Rogerson (1993).

[4]The persistence reported for this sample of Spanish firms is substantially smaller than estimates obtained for US manufacturing firms (see Hopenhayn and Rogerson, 1993).


30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
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FIGURE 3

existed prior to 1984 and accounted for approximately 30% of the total flow of new contracts. To address some of these issues, we provide alternative estimates where the layoff cost is chosen to match the hazard rates for layoffs for workers with more than 3 years of seniority. The resulting layoff cost is equal to half of one year of wages.

Figure 4 plots the estimates for hazard rates of match destruction due to layoffs prior to 1984 and the hazard rates obtained from our two alternative calibrations, constructed according to the method described in Section 3.3. Note that both of these underestimate the observed hazard rates for the first few quarters. The hazard rate obtained for a layoff cost of 0.2 also overstates the rate of turnover for the latter years.

Temporary contracts comprised between 93% and 98% of new contracts after the reform, and the stock of temporary workers in manufacturing reached 30% in 1990. The value for the efficiency parameter was chosen to obtain a share of temporary contracts consistent with these observations. Since this share depends also on layoff costs, two values were used: 0.995 for the economy with layoff costs equal to 0.2 and 0.985 for the economy with higher layoff cost. Though the difference in productivity may seem small, it does not seem counter to the empirical evidence: Jimeno and Toharia (1993) find a small negative (-0.09) elasticity of productivity to the proportion of temporary employees, while Hernando and Vallés (1993) find no effect.

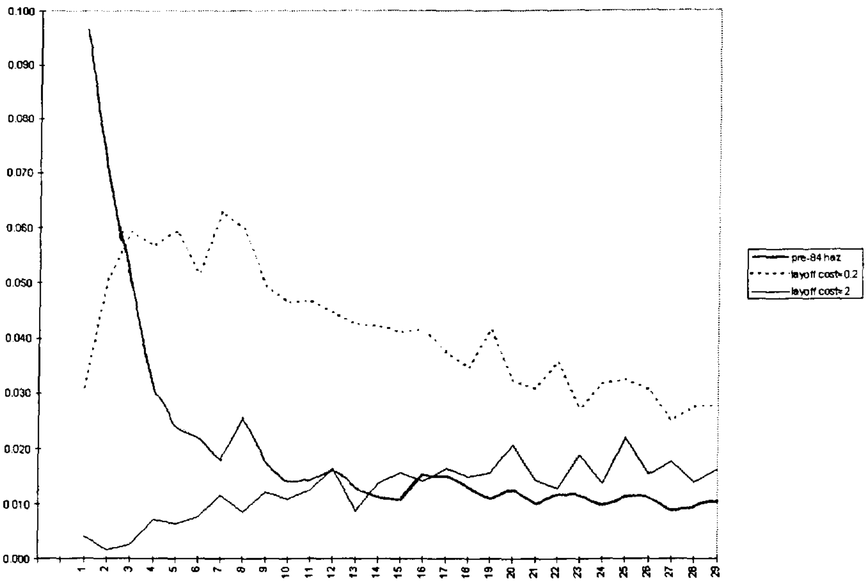
The algorithm used to compute the model proceeds by solving the dynamic programming problem given in (1). To do this the conditional expectation of the option value resulting from a firm specific shock is approximated by legendre quadrature, using a grid of 40 values for the shock. The maximum value $s^M = ln(60) + ln(w/\alpha)^{1/(1-\alpha)}$, and the minimum value for the grid is $s^m = ln(2) + ln(w/\alpha)^{1/(1-\alpha)}$, so that the minimum firm size when there are no layoff costs is 2 and the maximum firm size is 60.

Once the firm's policy is obtained we generate a history of 100,000 shocks and compute the probabilities for transitions between different states. In this way we generate the statistics reported in the following section.

5 Results

This section presents the results of our calibration. Table 1 gives the values for total labor demand and turnover for the model economies. It can be readily seen that total labor demand is not affected considerably by introducing a layoff cost. At a general level, it is hard to predict the direction in which total labor demand should change, given that both hiring and firing are reduced as a result of introducing layoff costs.

In contrast, labor turnover is considerably reduced with layoff costs. Qualitatively, this result is to be expected. What is perhaps more surprising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0.090
0.080
0.070
0.060
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pre-84 haz
layoff cost=0.2
layoff cost=2

FIGURE 4

Table 1:
Employment and Turnover

	Permanent		Temporary
	f=0	f=2	f=0.2
Labor Demand	100	98.1	99.1
Turnover	5.5%	0.5%	4.7%

is the quantitative impact of layoff costs. Not, for instance, that a layoff cost equivalent to slightly me than two weeks of wages reduces turnover to one-third of its value when temporary jobs are allowed (which is even lower than the turnover obtained with zero layoff costs).

This suggests that perhaps a large fraction of job turnover is associated to very small differences in productivity and does not generate much surplus. To examine this hypothesis, we compute the average and standard deviations of the surplus (difference between marginal product and wage) associated to hirings in the model with no layoff costs and idiosyncratic shocks only. The average is about 3% of the normalized wage and the standard deviation below 1%. Thus, the high frequency component of job reallocation is associated with movements at the intensive margin, where marginal product is very close to wages. In consequence, small firing costs can have a large effect on reallocation. Notice that this may also contribute to understanding why rates of job reallocation vary so much across different economies.

We now turn to the analysis of the cyclical behavior of labor demand. Table 2 gives values for job creation, job destruction, and employment obtained from our model economies. It is immediately apparent how the inclusion of temporary work increases the variability of demand from less than 5% to almost 14%. This change is also reflected in the rate of creation, which becomes strongly procyclical, and destruction, strongly countercyclical. It is worth noting that because of our assumption of a perfectly elastic labor demand, the variability of aggregate employment and job flows should be interpreted as upper bounds.

Comparing these results with the data for Spain discussed in Section 2, the following observations can be made. The model captures quite well the increase in volatility. For instance, the change in employment from the peak in 1991 to the low point in 1994 which followed the last recession was approximately 9%. As for the increase that occurred after the reform, it has been argued that because it coincided with an expansion, it is hard to separate how much was due to the added labor flexibility. According to our

Table 2:
Cyclical Behavior

		Permanent		Temporary		
		f=0.2	f=2	f=0	f=0.2	f=2
Job Creation	contraction	3.5%	3.5%	4.6%	1.0%	0.4%
	expansion	5.8%	5.8%	6.3%	2.3%	0.6%
Job Destruction	contraction	5.8%	5.6%	6.5%	1.9%	0.6%
	expansion	3.7%	4.0%	4.6%	1.4%	0.4%
Employment	contraction	100	100	100	100	100
	expansion	114.0	112.5	111.4	105.2	101.4

results, the labor-market reform has not increased significantly average labor demand, but has increased substantially its volatility.

Job creation appears to be more cyclical than destruction in absence of temporary jobs. This reflects the fact that hirings are less affected by layoff costs than firings, due to discounting. The persistence in the aggregate shock implies that during an expansion the discounting of future layoff costs is more important, so hirings tend to respond somewhat more. When temporary contracts are allowed for, this difference in the cyclicality of job creation and destruction disappears, in contrast to the empirical observations for the Spanish economy cited before.

Table 3:
Temporary and Permanent Contracts
(Share of Temporary Contracts in Model Economy)

		f=0.2	f=2
Job Creation	contraction	91.6%	98.5%
	expansion	94.2%	98.9%
Job Destruction	contraction	92.3%	98.8%
	expansion	94.8%	99.1%
Employment	contraction	24.2%	28.8%
	expansion	32.9%	36.8%

Finally, we examine the role played by temporary employment in the model. Table 3 gives the share of temporary workers in job creation, destruction, and employment during contractions and expansions. It is interesting to note that all shares increase during expansions, reflecting the fact that those jobs created in response to favorable aggregate shocks are perceived by the firms as transitory.

6 Final remarks

In this paper we provide a theoretical model and calibrate it to study the impact of dismissal costs for the Spanish economy. Some tentative conclusions emerge from this analysis. In the first place, high layoff costs are not a complete answer as to why unemployment is so high in Spain. On the other hand, they do seem responsible for lower turnover rates and significantly reduced rates of job (and worker) reallocation.

In our model layoff costs reduce dramatically the high frequency component of job expansion and contraction at the firm level. This is explained by the fact that such high frequency movements correspond to small adjustments at the intensive margin which are associated with little surplus creation. As a result, layoff costs have a relatively small effect on average labor productivity and a moderate effect on labor demand. In a model calibrated for the US economy, Hopenhayn and Rogerson (1993) find larger productivity effects. A possible explanation for this difference is that while we take here the number of firms as given, the Hopenhayn and Rogerson paper considers explicitly the margin of entry and exit. Notice that in our model total output falls as labor demand decreases. This implies that total factor productivity – including firms as capital – decreases even if labor productivity does not change.

These considerations also suggest that in evaluating the effects of such restrictive labor-market policies, it is important to understand better what is behind job reallocation. If most of this reallocation consists of small changes at the intensive margin, then the quantitative effect of these policies on reallocation can be quite substantial, but the welfare effects may not be as large. In our model this translated into small calibrated values for the layoff costs. If our model is wrong, and the surplus associated with these high frequency reallocations is large, then the restrictions to mobility could have had a larger impact on welfare.

In particular, one drawback of our model is that we have not considered labor reallocation that is not associated with job changes, e.g., mismatches between workers and jobs. Though it is very hard to know how much surplus may be generated by this type of reallocation, it could be considerable. However, it is not clear how much of this type of reallocation has been affected by layoff costs. There are two considerations that suggest the effect may not be very large. Firstly, if the quality of the match can be learned rather quickly, then the costs of firing are bound to be smaller. Secondly, the hazard rates for match destruction during the first few months of employment were quite substantial even in the period prior to the 1984 reform. In any case, incorporating mismatches in the type of model considered here would certainly contribute to a better assessment.

By assuming a perfectly elastic labor supply at an exogenously given wage, our model abstracts from labor-supply considerations. This has two important implications. On the one hand, our results on variability of aggregate employment and job reallocation should be taken as upper bounds, since wages could pick part of the adjustment to aggregate demand fluctuations. On the other hand, labor-supply considerations may be crucial to understand the reasons why unemployment is so high. In particular, it has been suggested that generous unemployment insurance may be an important cause for this high unemployment (see Blanchard and Jimeno, 1995).

Finally, we abstract in this paper from bargaining considerations and the possible effect of restrictive trade union practices. As for the first, our experience with the analysis of job reallocation models with efficient bargaining (Cabrales and Hopenhayn, 1995) has reduced to some extent our confidence in using the existing matching models for this type of policy analyses. A large scope of results, ranging from super-neutrality of policies to the opposite extreme, can be obtained depending on details of the policies considered. Restrictive trade union practices have been often regarded as a potentially important explanation of the segmentation of the Spanish labor market. However, as Blanchard and Jimeno (1995) point out, such practices seem to prevail in many European countries, such as Portugal, where unemployment rates are significantly lower than in Spain.

Appendix 1
Proof of Proposition 1

Since function $R(\theta, s, n)$ is strictly concave in n, and $-f \cdot max\{0, n - n'\}$ is also concave in n and in $n', V(\theta, x, n)$ is concave in n by Theorem 9.8, Stokey and Lucas (1989). This implies that

$$G(\theta, s, n) = R(\theta, s, n) + \frac{\lambda}{\lambda + r + \gamma} \int V(\theta, s', n) F(ds'; s) + \frac{\gamma}{\lambda + r + \gamma} \int V(\theta', s, n) \Psi(d\theta'; \theta\theta)$$

is a strictly concave function.

We will first show that for a given (θ, s), the policy function has the form given in the proposition. Fix then $(\theta, s).g(\theta, s, n)$ is the unique maximizer in n' of $F(\theta, s, n', n) = G(\theta, s, n') - f \cdot max\{0, n - n'\}$. Since $G(\theta, s, n')$ is strictly concave and bounded in n', it has a unique maximand in n', call it n^M.

Claim 1: Let $n > n^M$. If $g(\theta, s, n) = n^A < n$, then $g(\theta, s, \bar{n}) = n^A$ for all $\bar{n} > n$.

Concavity implies that $G(\theta, s, \bar{n}) > G(\theta, s, n')$ for all $n' > \bar{n}$, so $g(\theta, s, \bar{n}) < \bar{n}$. Optimality of n^A implies that

$$G(\theta, s, n^A) - f \cdot max\{0, n - n^A\} > G(\theta, s, n') - f \cdot max\{0, n - n'\}, \text{ for all } n' < n$$

therefore

$G(\theta, s, n^A) - f \cdot max\{0, \bar{n} - n^A\} > G(\theta, s, n') - f \cdot max\{0, \bar{n} - n'\}$, for all $n' < n$ thus $g(\theta, s, \bar{n}) \notin [0, n^A) \cup (n^A, n)$. It remains to be shown that $g(\theta, s, \bar{n}) \notin [n, \bar{n}]$. Fix $n' \in [n, \bar{n}]$. By 6 we have that

$$-f \geq \frac{G(\theta, s, n) - G(\theta, s, n^A)}{n - n^A}$$

but concavity implies then

$$-f \geq \frac{G(\theta, s, n') - G(\theta, s, n^A)}{n' - n^A}$$

so

$$G(\theta, s, n^A) - f \cdot max\{0, \bar{n} - n^A\} > G(\theta, s, n') - f \cdot max\{0, \bar{n} - n'\} \square$$

Claim 1 implies that there can only be one level of n such that $g(\theta, s, n) < n$, for $n > n^M$, so we can call it $N(\theta, s)$. Also, it implies that $g(\theta, s, n) = n$, for $n^M > n > N(\theta, s)$

Claim 2. Let $n \leq n^M$. Then $g(\theta, s, n) = n^M$.

Proof: By optimality of $n^M G(\theta, s, n') < G(\theta, s, n^M)$ for $n' \leq n$, thus $G(\theta, s, n' - f \cdot max\{0, n - n'\} < G(\theta, s, n^M) - f \cdot max\{0, n - n^M\} = G(\theta, s, n^M)$.

Similarly for $n' > n$

$$G(\theta, s, n') = G(\theta, s, n') - f \cdot max\{0, n - n'\} < G(\theta, s, n^M) - f \cdot max\{0, n - n^M\}$$

$$= G(\theta, s, n^M)$$

Thus, $n(\theta, s) = n^M$.□

To complete the proof we need to show that $n(\theta, s)$ and $N(\theta, s)$ are increasing functions of θ and s.

Since $R(\theta, s, n') - f \cdot max\{0, n - n'\}$ is supermodular in (n, n') for all (θ, s) and has increasing differences, the policy function $g(\theta, s, n)$ is monotone increasing. We will show now that the monotonicity of the policy function implies the monotonicity of the functions $N(\theta, s)$ and $N(\theta, s)$.

Suppose that $n(\theta, s)$ were not increasing in s. Then, for some θ, there would be two states $s > s'$ such that $n(\theta, s) < n(\theta, s'$. But then let some n' such that $n(\theta, s) < n' < n(\theta, s')$, and $n' < N(\theta, s')$. Then, we must have that $g(\theta, s, n') = n'$ and $g(\theta, s', n') = n(\theta, s')$, so $n' = g(\theta, s, n') < g(\theta, s', n') = n(\theta, s')$, which contradicts the monotonicity of $g(\theta, s, n)$.

Suppose that $N(\theta, s)$ were not increasing in s. Then, for some θ, there would be two states $s > s'$ such that $N(\theta, s) < N(\theta, s')$. But then let some n' such that $N(\theta, s) < n' < N(\theta, s')$, and $n' > n(\theta, s')$. Then, we must have that $g(\theta, s', n' = n'$ and $g(\theta, s, n') = N(\theta, s)$, so $n' = g(\theta, s', n') > g(\theta, s, n') = N(\theta, s)$, which contradicts the monotonicity of $g(\theta, s, n)$.□

Appendix 2
Types of Contracts in Spain

Ordinary

Duration: In principle, indefinite. The parts can agree to a test period of at most 3 months (6 months for college graduate) when contract can be terminated at the discretion of the firm and implies no severance pay.

Termination:

a) Worker quit. If worker quits because of substantial changes in work conditions, delays in pay, or lack of payment of wages or serious firm's fault, treated like unfair dismissal. Otherwise no severance pay.

b) For technological or economic reasons. Requires one-month consultation with workers and authorization of labor regulators. Severance pay: 20 days per year worked.

c) For objective reasons. Worker's inability to adjust to new technology or to work conditions. One to three months' notice and severance pay of 20 days per year worked.

d) Disciplinary dismissal. Gross negligence, repeated absences, or violence at work. No severance pay.

e) Unfair dismissal. All firm-initiated dismissals can be challenged in court. If found unfair the firm chooses between readmission or a severance pay of 45 days per year worked. In both cases salaries since the day of notification of dismissal have to be paid.

Fixed-term ordinary

a) For a predetermined task or service

Duration: Indeterminate, but limited. Notice period of at least 15 days if duration longer than a year. There may be a test period.

Termination: No severance pay if notice period respected. If activity continues after the end of task contracted for, the contract becomes automatically like an ordinary indefinite-length contract.

b) For special circumstances of production

Duration: At most 6 months in any given year. There may be a test period.

Termination: If activity continues after 6 months, becomes an indefinite-length contract. No severance pay.

c) To substitute a worker with a legal right-of-leave

Conditions of leave: Maternity, vacations, sickness or accident, temporarily handicapped, military service, exercise of public office, preventive prison, *other legal or contractual rights of leave.*

Duration: While right-of-leave lasts. There may be a test period.

Termination: At date of end of right-of-leave. No severance pay.

d) To start up a firm

This contract was created in 1984.

Duration: Minimum 6 months. Maximum 3 years from time firm starts up. May be renewed until maximum length. There may be a test period.

Termination: If work continues after 3 years, becomes an indefinite-length contract. No severance pay.

Discontinuous ordinary

Duration: Indefinite, but work is performed only in certain periods of the year, with flexible starting and finishing times. There may be a test period.

Termination: Like indefinite-length ordinary.

Part-time

Duration: Indefinite. Work time is shorter than 2/3 of normal.

Firm and worker characteristics: From 1980 to 1984, only for under 25, registered unemployed or farm workers.

Subsidies and incentives: Social-security tax in proportion to time worked.

Termination: Like indefinite-length ordinary.

Replacement for pre-retired or partially retired

Duration: Until the partially-retired reaches retirement age, or until the legal age of retirement arrives for the pre-retired.

Firm and worker characteristics: Registered employed workers for the replacement contract or having the right to a retirement pension for partially retired. Firm must use other unemployed worker if the replacement quits.

Subsidies and incentives: If replacement worker is given an indefinite-length contract at the time of retirement of pre-retired, social-security tax of the firm is reduced to 50%.

Termination: No severance pay at termination.

Fixed-term employment promotion contracts

a) General fixed-term employment promotion contracts

Duration: Maximum 3 years (2 years from '81 to '84). Minimum, 6 months (1 years from 1992), or 3 months in the lodging, food services, and construction sectors. Contracts can be renewed until the maximum.

Firm and worker characteristics: Worker, registered unemployed who has not worked for the same firm as temporary worker the previous year if the maximum 3 years were reached. No new contracts of this type can be initiated after 1994 in general although the government can make exceptions. At present the exceptions are the handicapped, the older-than-45-years-old, or the registered unemployed for longer than 1 year.

Firm, not having reduced work force the previous year or the same job was done by a temporary worker whose contract reached the maximum 3 years.

Before 1984 there was a percentage limit in the number of temporary workers, (between 5% and 25% depending on the number of workers).

Termination: Notice period 15 days. Severance pay: 12 days per year worked.

b) Contracts, work practice, and formation

Duration: Maximum 3 years (1 year from '82 to '84 for work practice, 2 for formation; 2 years after 1994). Minimum, 3 months (1 year from 1992, 6 months after 1994). They can be renewed until the maximum. There may be a test period.

Firm and worker characteristics: Worker, registered, unemployed. For work practice having a college degree not older than 4 years. For formation, between 16 and 20 years old. Firm, not having delayed social-security payments, and dedicating between 15% and 50% of time to education for the formation contracts.

Subsidies and incentives. Reduction of firm's social-security contributions. 5% for work practice and between 90% and 100% for formation. These subsidies were suppressed in 1992. After 1994 the formation contract could pay a salary below the minimum wage and above 60% of the minimum wage. There is a subsidy (since 1992) of 500,000 pesetas ($4,000) if contract is transformed into indefinite length.

Termination: No severance pay.

c) Social collaboration contracts

Duration: The time remaining covered by unemployment benefits.

Firm and worker characteristics: worker, must be receiving unemployment benefits, and must accept the job if the job is socially useful, adapted to its qualifications, does not involve a change in residency, under penalty of stoppage of unemployment benefits. Firm, an agency of the government at any level, central, autonomic or local, which must pay the difference between the unemployment benefits and the salary on which the benefits are based.

Subsidies and incentives: The firm does not pay social-security contributions (except for work-related illnesses or accidents).

Termination: No severance pay.

Indefinite length employment promotion contracts

a) Indefinite length contracts for the older-than-45

Duration: Indefinite.

Firm and worker characteristics: Worker, registered unemployed older than 45, registered unemployed for over 1 year. Firm, not having delayed payments of taxes or social-security contributions and not having reduced work force the previous year.

Subsidies and incentives: Subsidy of 5000,000 pesetas ($4,000) for each contract and reduction of 50% of firm's social-security contribution for the life of contract.

Termination: As any indefinite length contract.

b) Indefinite-length contracts for women in underrepresented occupations

This contract created in 1992.

Duration: Indefinite.

Firm and worker characteristics: Worker, registered unemployed for over 1 year, hired in a sector where women are underrepresented as defined by the government, or women returning to work after 5 years absent from the work force, if the return is not legally mandatory for the firm. Firm, not having delayed payments of taxes or social-security contributions and not having reduced work force the previous year.

Subsidies and incentives: Subsidy of 500,000 pesetas ($4,000) for each contract.

Termination: As any indefinite-length contract.

c) Indefinite-length contracts for younger than 25 or between 25 and 29

This contract created in 1992.

Duration: Indefinite.

Firm and worker characteristics: Worker, registered unemployed for over 1 year, under 25 or between 25 and 29 and not having worked for more than 3 months before the contract. Firm, not having delayed payments of taxes or social-security contributions and not having reduced work force the previous year.

Subsidies and incentives: Subsidy of 400,000 pesetas ($3,000) for each contract.

Termination: As any indefinite-length contract.

d) Indefinite-length contracts for the handicapped

Duration: Indefinite.

Firm and worker characteristics: Worker, officially declared handicapped. Firm, maintaining the worker for at least 3 years, and not hiring more than 51% handicapped (unless it is 100%).

Subsidies and incentives: Subsidy of 500,000 pesetas ($4,000) for each contract. Reduction of social-security payments for firm of 70% if worker younger than 45 or 90% if older than 45.

Termination: As any indefinite-length contract.

Changes in employment promotion contracts in 1984

1. Changes in general employment promotion:

	Before 1984	After 1984
Duration	Minimum 6 months	Minimum 6 months
	Maximum 2 years	Maximum 3 years
Percentage limits		
given firm size:		None
> 1000	5	
501 to 1000	10	
251 to 500	15	
101 to 250	20	
51 to 100	25	
26 to 50	40	
1 to 25	50	

2. Changes in practice contracts.

	Before 1984	After 1984
Duration	Minimum 3 months	Minimum 3 months
	Maximum 1 year	Maximum 3 years
Year from degree	2 years	4 years
Subsidies	100% Firm's social-security tax	75% Firm's social-security tax

3. Changes in formation contracts.

	Before 1984	After 1984
Duration	Minimum 3 months	Minimum 3 months
	Maximum 2 years	Maximum 3 years
Age limit	16-18	16-20
Time for education	33% to 66%	25% to 50%

4. New type of contract, for starting up a firm.

Appendix 3:
Facts and Estimates

Table 4:
Worker Flows

	POS	NEG	NET	PERM	TEMP
1985	0.0200	0.0539	-0.0338	-0.0389	0.0050
1988	0.0454	0.0268	0.0186	-0.0037	0.0204
1992	0.0174	0.0571	-0.0396	-0.0337	-0.0059
Avge	0.0306	0.0401	-0.0096	-0.0158	0.0076
StDv	0.0196	0.0103	0.0198	0.0130	0.0094

Table 5:
Correlation Matrix

	POS	NEG	SUM	NET
POS	1			
NEG	-0.78	1		
SUM	0.36	0.29	1	
NET	0.95	-0.94	0.04	1

Table 6:
Worker Flows by Size of Firm

	POS	NEG	NET	PERM	TEMP	% Emp	% Temp
1-99	0.0488	0.0387	0.0101	0.0050	0.0051	0.10	0.103
100-249	0.0426	0.0326	0.0100	-0.0012	0.0112	0.14	0.098
250-499	0.0352	0.0309	-0.0080	-0.0080	0.0122	0.18	0.090
500-999	0.0317	0.0438	-0.0120	-0.0222	0.0102	0.15	0.073
> 999	0.0201	0.0460	-0.0259	-0.0334	0.0075	0.43	0.048
Avge	0.0357	0.0384	-0.0027	-0.0119	0.0092		
StDv	0.0098	0.0059	0.0141	0.0140	0.0026		

Table 7:
Percentage of Firms in Creation/Destruction Intervals

Growth Rate	Frequency
< -0.75	0.004
-0.75, -0.50	0.009
-0.50, -0.25	0.052
-0.25, -0.10	0.182
-0.10, -0.06	0.224
-0.05, 0.00	0.529
0.00, 0.05	0.446
0.05, 0.10	0.236
0.10, 0.25	0.236
0.25, 0.50	0.067
0.50, 0.75	0.011
> 0.75	0.005

Table 8:
Variance Decomposition

	POS	NEG	SUM
$var(y_i)/var(y)$	1.50	0.94	2.47
$var(y-y_i)/var(y)$	4.32	3.25	0.87
$2cov(y,y-y_i)/var(y)$	-4.82	-3.18	-2.34
	1	1	1

Table 9:
Hazard Rates for Transition from
Employment into Nonemployment

Quarter	Before 1984	After 1984
1	0.0902	0.2306
2	0.0691	0.1851
3	0.0498	0.0980
4	0.0306	0.1006
5	0.0240	0.0590
6	0.0223	0.0636
7	0.0180	0.0428
8	0.0257	0.0636
9	0.0174	0.0333
10	0.0142	0.0496
11	0.0143	0.0271
12	0.0164	0.0925
13	0.0126	0.0280
14	0.0114	0.0292
15	0.0107	0.0181
16	0.0151	0.0210
17	0.0150	0.0203
18	0.0128	0.0160
19	0.0101	0.0186
20	0.0119	0.0153
Turnover	0.0218	0.0517

Table 10:
Estimated Elasticities

Variables	1985-1988	1985	1986-1988
Recession			
Growth rate of sales	0.08	0.04	0.09
Expansion			
Growth rate of sales	0.05	0.04	0.05

Table 11:
Labor-Demand Estimation

Variables	Basic form	Structural Change
Employment $t-1$	0.86	0.83
	(13.2)	(12.8)
Labor cost	-0.50	0.1851
	(3.3)	(3.1)
Labor cost $t-1$	0.24	0.22
	(4.1)	(3.8)
Price of Materials	-0.20	-0.20
	(3.8)	(4.0)
Price of Materials $t-1$	0.17	0.17
	(3.8)	(3.8)
Capital Stock	0.05	0.05
	(3.7)	(3.9)
Growth rate of Sales	0.31	0.23
	(7.1)	(5.2)
Growth rate of Sales $\times$ D1986-88		0.11
		(3.6)

Table 12:
Selected Percentages of Fixed-Term Contracts

	1987	1990
20-24	31.6	61.7
35-39	10.0	18.8
50-54	8.0	14.3
Men	14.4	27.8
Women	18.4	34.2
Primary education	20.4	41.0
College degree	9.4	17.3
Agriculture	39.4	50.6
Construction	29.5	54.1
Manufacturing	15.3	29.7
Financial sector	11.7	22.0
TOTAL	15.6	29.8

Table 13:
Numbers of Contracts (in thousands)

	1989	1987	1985
Employment Promotion contracts:			
General fixed-term	1110	667	432
Part-time	355	221	122
Replacement	1.5	0.9	1.9
Practice	332	218	113
Younger than 26		119	45
Older than 45	10.8	10.6	6.4
Handicapped	3.7	3.5	2.2
Pre-retirement	0.9	0.8	1.0
INEM Agreements	265	293	271
TOTAL	2290	1661	1046
Ordinary:			
Indefinite length	136	73	57
Predetermined task or service	1276	1048	799
Special circumstances of production	1210	854	502
Substitution of worker on leave	223	174	143
New activity	52	33	26
Ordinary discontinuous	106	135	123
Other ordinary	67	61	38
TOTAL	3071	2378	1688

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