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HOW IMPORTANT IS FIRM BEHAVIOR TO UNDERSTAND EMPLOYMENT? EVIDENCE FROM SPAIN

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Traditional macroeconomic analyses of the Spanish labor market have not been successful in accounting for Spain's high unemployment rates. In this paper, we take a microeconomic perspective, studying the entry and exit behavior of Spanish firms and, hence, their behavior concerning job creation and job destruction. We calibrate a model economy with entry and exit to Spanish data and we find that the reduction of the dismissal tax from the equivalent of one year of wages to zero increases employment by 8.13 per cent, and productivity by 2.28 per cent. (*JEL* L11, L16, D21)

1. Introduction

Recent Spanish labor market reforms have renewed the discussion regarding the importance of labor market flexibility to improve the behavior of the unemployment rate. The apparently strict regulations of the Spanish labor market, particularly the dismissal legislation, might have played a role in explaining the dismal employment performance in the Spanish economy. Spain still suffers the highest unemployment rate among all developed countries, but traditional macroeconomic analyses of the Spanish labor market have not been successful in accounting for this fact.

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The main objective of this paper is to analyze how changes in the Spanish labor market legislation could affect decisions at the firm level, and how these translate into changes in total employment, job turnover, productivity and the structure of the industry. Our concern is to what extent regulations on dismissals are behind the high unemployment rate of the Spanish economy, something that has been lately at the core of the social and economic debate.

Even though there has been a number of studies worrying about the effects of changes in the Spanish legislation over employment (see Bentolila and Dolado, 1994; Bentolila and Saint-Paul, 1992; Blanchard, Jimeno *et alia*, 1995; and Dolado and Jimeno, 1997), none of them has tried to quantify the aggregate impact of decisions made at the microeconomic level, something that, as Davis and Haltiwanger (1990, 1992, and 1995) and Davis, Haltiwanger and Schuh (1996) have shown for the U.S. economy, turns out to be important for the understanding of the labor market behavior[1].

We apply the Hopenhayn and Rogerson (1993) model for the Spanish economy since it allows us to study firms' dynamics. At the same time, being a general equilibrium model, it also allows us to consider the impact of changes in the policies at the aggregate level, something that the studies mentioned above could not achieve. We solve and calibrate this model for the Spanish economy under two different legislation environments. The solution to a model of these characteristics, with heterogeneous firms, implies the computation of the distribution of employment among firms We can not obtain analytical decision rules for the firms as in Hopenhayn and Rogerson (1993) and therefore there is not a direct way to calibrate the parameters of the firm's problem. As a consequence, we have to use a simulation procedure to simultaneously calibrate them.

The main results are that the reduction of a dismissal tax from the equivalent of one year of wage to zero cost increases employment and productivity 8.13 percent and 2.28 percent respectively, although it increases the job turnover rate by 27.37 percent. We also performed simulations to show that subsidizing firms, even by the same amount

[1] Studies showing similar results have been done for other economies such as Germany (see Boeri and Cramer, 1992), Italy (see Contini and Revelli, 1990), Norway (see Salvanes, 1995), France (see Abowd, Corbel and Kramarz, 1995), Canada (see Baldwin, Dunne and Haltiwanger, 1994) and Spain (see Díaz-Moreno and Galdón-Sánchez, 1998a)

that the total tax revenue, has very little impact on the results, proving that this is not just a distributional issue. These results address the cost, in terms of efficiency, imposed by labor regulations in the economic system, in addition to the cost in terms of employment.

Unfortunately, we have not been able to link our experiment to the effects of a particular policy change in actual data. The existing limitations on data availability circumscribe the results of an experiment of these characteristics. Firm level data are not widely available in Spain, so studies of this sort has to be done confronting many limitations.

We are, of course, aware that, in Spain, the strictness of job security legislation for those under permanent contracts does not arise from long statutory notice periods by European standards and/or particularly generous mandatory severance pay, but from strong penalties (according to Dolado and Jimeno (1997) this penalties, on average, have gone from the equivalent to 4.5 months of salary in 1981 to the equivalent to one year salary in 1993) on unfair dismissals and a case law traditionally unfavorable to employers. But the Hopenhayn-Rogerson model cannot encompass all these three dimensions (notice period, severance payment and regulations of unfair dismissal) of firing costs. It cannot reflect either the dualism between the heavily protected workers under permanent contracts and the employees under fixed-term contracts (almost 35 per cent of Spanish employees). This is the reason we ask this results to be interpreted as a general reference only.

One more thing that could be argued regarding this kind of models is that there is no unemployment in them. This is not exactly true. There is a kind of unemployment that we could call "equilibrium unemployment". There are workers under permanent and fixed-term contracts unemployed along the path between steady states. In this paper, we do not carry out an analysis of the path towards the new steady state, but an exercise of this sort can be found in Díaz-Moreno and Galdón-Sánchez (1998b). Here, we assume that the adjustment between steady states has taken place, and that both types of workers are fired and hired in between, but we know nothing of how this adjustment has taken place.

The results obtained by Rogerson (1987) relate to those obtained in our paper, but from a different perspective. Rogerson concentrates on the role of dismissal costs over employment and investment. He concludes, as we do, that the main impact of dismissal costs is felt through a reduction of employment, which he shows is due to a lower level of investment. Bentolila and Bertola (1990) show, for four European countries, that the tax on dismissal does not have a strong effect on job turnover (we obtain the same result for Spain), although it severely affects the propensity of firms to hire new workers. Also, they do not consider the firm dynamics and the job destruction generated by the exit of firms.

Many interpretations, other than the lack of flexibility of the Spanish labor market, have been suggested as the main cause for the high Spanish unemployment rate. Many of them are partial equilibrium interpretations, such as Dolado and Jimeno (1997) who consider that the high unemployment rate is the result of the combination of a plausible mixture of different types of shocks and a extreme persistence in their propagation mechanism. Other use a completely different approach, such as Marimon and Zilibotti (1998) who suggest that the reason why Spain has created less net employment than other European countries over the last two decades is that Spain had a higher share of total employment in agriculture than other countries at the beginning of the 1970s. Moreover, some attempts have been done to link experiments to the effects of policy changes in actual data. Some of those experiments have studied the effects over employment of the adoption of flexibility measures, such as the introduction of temporary contracts, in the Spanish economy (see Bentolila and Saint-Paul, 1992, and Bentolila and Dolado, 1994).

Our results, with all their limitations, stress the necessity of a deeper reform of the Spanish labor market. This, of course, will be difficult to accomplish since it would impose severe burdens on some economic agents. However, the costs for the Spanish economy, specially on the people already working, seem high enough to be ignored. In addition, our results clearly highlight the importance of studying micro data to analyze employment related problems and the necessity of this kind of studies to effectively implement employment policies.

The rest of the paper is structured as follows. Section 2 describes the model (description, functional forms, and stationary state). In Section 3 we define the equilibrium. Sections 4 and 5 discuss the calibration of the model to the Spanish economy and the data and parameter choices, respectively. The paper ends with an explanation of the results obtained in Section 6 and the related conclusions.

2. The Model

The goal of this section is to present, for those not familiar with this type of approach, a general idea of the model on which the study is based, along with a justification for the functional forms used and some comments on its steady state equilibrium[2]. Those who are indeed familiar with these kind of models can skip Sections 2 and 3 and go directly to Section 4.

2.1 Description

This analysis is based in a simple general equilibrium model that allows for empirical studies at the plant level. There is only one good and one factor of production. Every firm[3] has the same production function, which depends on labor and an idiosyncratic technological shock. Differences between firms are the result of different realizations of the shock. Firms maximize the expected discounted value of profits following the equation[4]:

$$E_t \sum_{t=0}^{\infty} \left(\frac{1}{1+r_t} \right) \left[p_t f\left(s_t, n_t\right) - n_t - p_t c_f - g\left(n_t, n_{t-1}\right) \right] \qquad [1]$$

where E_t is the expectation as of period t, r_t is the period t interest rate, p_t is the output price at t, and $f\left(s_t, n_t\right)$ is the production function that depends on a first order Markov process (s_t), and the employment of the firm (n_t) at period t. The wage rate has been normalized to one. The parameter c_f is the fixed cost for the firm and its role is to make firms decide between remaining in the market or exiting. If c_f were zero, the firm would never exit the market -it would simply wait for a good shock without producing any amount of output. The function $g(\cdot)$ represents the adjustment cost of employment which is going to allow us to compare among different labor market regulations.

In every period t there is a continuum of firms which can enter the market. There is a fixed cost c_e of doing so. Once a firm pays c_e, it gets a draw $\left(s_t^0\right)$ from an initial distribution ν, and behaves like any other firm that was already in the market, but with lagged employment and fixed cost equal zero.

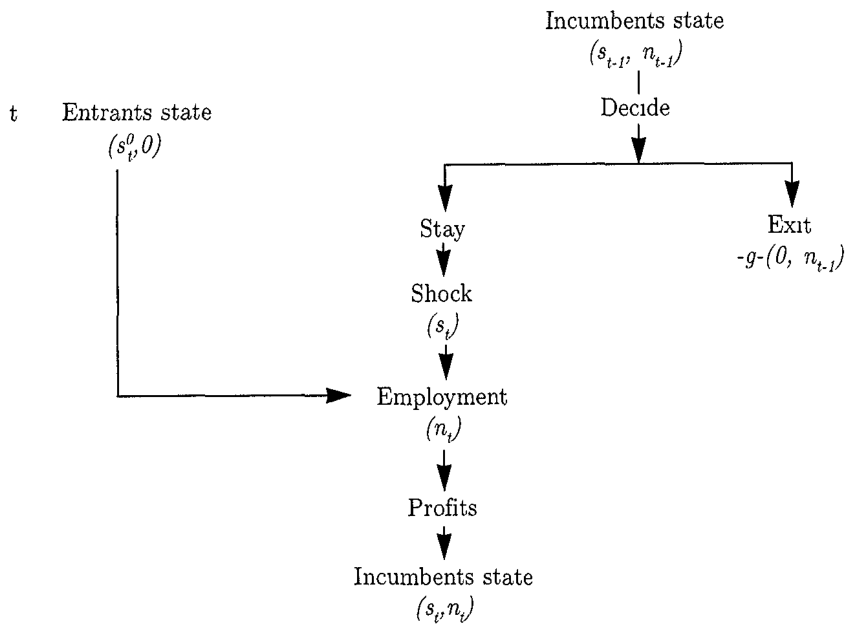
[2] Sections 2 and 3 rely heavily in Hopenhayn and Rogerson (1993)

[3] We will use the terms plant and firm interchangeably

[4] Notice that, contrary to the usual, the units of labor, and not the units of output, are used here as units of measure Because of that, the output price, p_t, appears in labor units, and the wage rate, w_t, is normalized to one

The timing of the decisions is as follows:

FIGURE 1
Timing of decisions



i) At the end of period $t-1$, the state vector for the incumbents is (s_{t-1}, n_{t-1}).

ii) At t:

The incumbents decide if they stay or exit the market:

• If they exit, they get $[-g(0, n_{t-1})]$.

• If they stay, the shock is realized for each one of them, then they decide employment and receive profits at the end of period t.

There is also a mass of entrants that pay c_e. Their state vector is $(s_t^0, 0)$. Once in the market, they behave as incumbents do. At the end of the period, the state vector for incumbents is (s_t, n_t).

iii) At period $t+1$, the process starts again.

To close the model, we assume a continuum of identical agents of measure one with preferences defined by:

$$\sum_{t=0}^{\infty} \beta^t \left(u(c_t) - v(n_t)\right) \qquad [2]$$

where c_t is consumption at t, and $n_t \in \{0,1\}$ is labor supply at t. It is also assumed that individuals choose lotteries and have access to markets to diversify idiosyncratic risk (see Rogerson, 1988, and Hansen, 1985). Therefore, we can consider the existence of a representative agent with utility function:

$$\sum_{t=0}^{\infty} \beta^t \left(u\left(c_t\right) - AN_t\right), \; A > 0, \qquad [3]$$

where N_t is the fraction of the population employed in t.

Therefore, the consumer's problem can be written in the following fashion:

$$\max \sum_{t=0}^{\infty} \beta^t \left(u\left(c_t\right) - AN_t\right) \qquad [4]$$

$$\text{s.t. } p_t c_t \leq N_t + \pi_t + T_t \qquad [5]$$

$$c_t \geq 0, \; N_t \in [0,1].$$

where π_t and T_t are, respectively, the total amount of profits and taxes originated by the dismissal cost, which are assumed to be redistributed lump sum to the identical agents.

2.2 *Functional Forms*

The functional forms used in this analysis are the same as those used by Hopenhayn and Rogerson (1993). These are:

$$f\left(s_t, n_t\right) = s_t n_t^{\theta}, \; 0 \leq \theta \leq 1 \qquad [6]$$

$$g\left(n_t, n_{t-1}\right) = \tau \max\left\{0, n_{t-1} - n_t\right\} \qquad [7]$$

$$\log\left(s_t\right) = \alpha + \rho \log\left(s_{t-1}\right) + \varepsilon_t, \qquad [8]$$

$$\varepsilon_t \sim N\left(0, \sigma_{\varepsilon}^2\right), \; \alpha \geq 0, \; 0 \leq \rho \leq 1$$

$$u\left(c_t\right) = \ln\left(c_t\right), \; v\left(n_t\right) = AN_t \qquad [9]$$

The production [6] and utility [9] functions are standard, given the assumptions used for this model. Equation [7] captures the cost of dismissals. The parameter τ is the fixed cost to lay-off an employee. The maximum function simply reflects the fact that there is no cost of hiring new workers.

The process followed by s is given by equation [8], where α is a constant, ρ represents the persistence of the shocks, and ε_t is a random variable with normal distribution. Since the process s is the same for all firms, it does not account for the differences in the behavior between large and small firms. We expect large firms to have more persistence and less variability (higher ρ and smaller σ_ε^2).

2.3 Steady State

We analyze the steady state of the model calibrated for the Spanish economy. Even though this model does not allow for analysis of the evolution of business cycles, it is a good tool to study the effects of alternative policies over the long run.

3. The Equilibrium

A steady state equilibrium with entry and exit for this economy is an output price $p^* > 0$, a mass of entrants $M^* > 0$, and a measure of incumbents μ^*, such that:

I) labor markets clear,

II) the measure of incumbents μ^* is constant given M^* and p^*, and

III) the value of entering the markets gross of entry cost has to be equal to the entry cost in units of output ($p^* c_e$).

In general, an equilibrium with entry and exit might not exist, however if there is one, it is unique. If there is no equilibrium with entry and exit, then there are generically multiple steady state equilibria without entry and exit, but they are not of interest since they are irrelevant for this empirical analysis.

4. Calibration

In order to simulate the Spanish economy, we need to choose parameter values for the model. These values are assigned in a way that the equilibrium of the model reproduces the basic data chosen for the economy.

The main difference with Hopenhayn and Rogerson (1993) is that given that in the US there is no cost to lay-off an employee, their exercise studies the effect of introducing such a cost in the economy. Therefore, they use as benchmark the case in which $\tau = 0$, and analyzed the introduction of a cost equivalent to 6 months' and one year's wages ($\tau = 0.1$ and $\tau = 0.2$, respectively). Our interest is just the opposite:

the effect of relaxing labor market regulations. Given that in Spain there exists a cost to lay-off an employee, the interesting exercise in our case is to analyze the reduction of such a cost. Therefore, we use as benchmark the case in which $\tau = 0.250$ (the equivalent to one year wages for the Spanish case[5]), and study the effects of the reduction of τ to a cost equivalent to 6 months' wages and to no cost at all ($\tau = 0.125$ and $\tau = 0$, respectively).

Given the problem for a surviving firm:

$$W(s,n;p) = \max_{n' \geq 0} \{psn'^{\theta} - n' - pc_f - \tau \max\{0, n - n'\} + \beta \max(E_s W(s',n';p), -\tau n')\}, \quad [10]$$

the parameters that have to be chosen are: θ, β, c_f, α, ρ, and σ_ε^2. There are also three more parameters in the model: the parameter in the preferences A, the fixed cost for an entrant firm c_e, and the initial distribution of incumbents ν.

The parameters θ and β are, respectively, the labor share in the total revenue and the inverse of the interest rate over the period of study. The constant in the utility function, A, is chosen to reproduce the Spanish ratio between employment and population.

The stationary state price is set to one and the rest of the parameter values are set in order to be consistent with this price. The reason behind this procedure is the difficulty in finding a steady state price from the price data. Therefore, since the shock and the price of the output enter multiplicatively in the production function, we can not observe the difference between a high price and a high mean value of the shock.

There is no straightforward meaning for the remaining parameters. For the case without adjustment cost, it would be easy to derive the employment decision rule for a surviving firm. From that one, we can identify ρ and σ_ε^2 in the data. In this case, the optimal decision rules for the firm would be:

$$\log(n_t) = \frac{1}{1-\theta}(\log\theta + \log p + \log s_t) \quad [11]$$

$$\text{Exit if } s \leq s^*, \text{ for some } s^*. \quad [12]$$

[5] According to Dolado and Jimeno (1997) penalties for unfair dismissals, on average, have gone from the equivalent to 4.5 months of salary in 1981 to the equivalent to one year salary in 1993

By [8], the employment decision for a surviving firm is:

$$\log(n_t) = \frac{1-\rho}{1-\theta}\left(\log\theta + \log p + \frac{\alpha}{1-\rho}\right) + \rho\log(n_{t-1}) + \frac{1}{1-\theta}\varepsilon_t \quad [13]$$

and regressing $\log(n_t)$ on $\log(n_{t-1})$ and a constant, we obtain an estimate of ρ and $\frac{\sigma_\varepsilon^2}{(1-\theta)^2}$.

In our case, this is no longer possible since we can not have analytical employment decision rules. However, there is still a strong relationship between the serial correlation in employment and the variance of growth at the equilibrium level, and the parameters of the firm's idiosyncratic shock.

In the same way, the values for c_f and α can not be determined analytically, but there is only one value for them that matches the exit rate and the average employment in the model. The distribution ν will generate a size distribution by cohorts in the equilibrium. We choose ν so that the distribution of firms in the first period corresponds to the distribution of new firms (0 to 4 years old) in the data. Finally, c_e will be chosen in a way such that condition (III) in the definition of equilibrium is satisfied, which guarantees an equilibrium with entry and exit.

There is no way to assign parameter values in a recursive way. The process followed is to choose a vector of values for the parameters, solve the model, compare the results with the values from the data, and update the initial vector until the results obtained match the values of the statistics chosen from the data[6].

5. Data and Parameter Assignments

The data used to assign parameter values at the firm level are from the *Fichero de Cuentas de la Seguridad Social* (FCSS) of Spain for the second quarter of 1990 and the first quarter of 1994. These data are collected via the Social Security System that compels employers to report every change occurring in the number of workers. There are legal sanctions for misreporting. The census covers "all" dependent employment in plants of more than five workers in the private sector, not including the agricultural sector or the public sector. Individual plants are assigned separate identification numbers, even when they

[6] A more detailed description of the computation can be found in Appendix A1

belong to the same firm[7]. The census covers all Spanish territory except Ceuta and Melilla.

Therefore, the length of the period considered for the analysis is four years. These were the only data made available to us. However, since we are interested in the stationary state of the model, this length seems good enough to avoid the effect of cyclical fluctuations since the data used correspond to two points close to the economy's trend.

Our data are similar to those in Hopenhayn and Rogerson (1993). The main difference, other than our time interval is 4 instead of 5 years, is that our data set contains not only manufactures, but also services and construction. This should be kept in mind when making comparisons between both countries.

Following the procedure highlighted in Section 4, we obtain the data and parameter assignments for the Spanish economy. Table 1 reproduces the values derived from the Spanish census. Comparing these data with the same data in Hopenhayn and Rogerson (1993), we find that there are big differences, as expected, in the variance of growth rates (0.28 for Spain and 0.53 for the US) and the mean employment (26.6 for Spain and 61.7 for the US). Both estimates are bigger for the US. The exit rate is higher in Spain (44 per cent against 37 per cent in the US). Exit is expected to be bigger for the Spanish economy given the period of economic crisis covered by our data. Two additional reasons are the facts that our data are restricted to firms of 6 or more workers and that the construction and services sectors, which have greater exit rates than manufacturing given the nature of their activities, are also included in our data set. Regarding the size distribution of firms, Spanish firms are smaller. In fact, the share of small firms is bigger in Spain than in the US even though we only have data for establishments from 6 to 19 employees, whereas the data reported for the US is for firms from 1 to 19 employees. The bigger size of US firms may be the result of the size of the market or the different technologies used in the sector where both countries have greater specialization. In this sense, it is important to remember that the US data are taken from *The Census of Manufactures* while our data set includes also services and construction sectors. Typically, firms in the service sector are smaller.

[7] In some cases, the census reconstruct the dispersion of the working places in a province

TABLE 1
Estimates derived from the census

Serial correlation in log employment	0 95
Variance in growth rates	0.28
Mean employment	26.6
Exit rate	44%
Size distribution for firms	
Employees	Share of total firms
6-19	0.8340
20-99	0.1550
100-499	0.0104
>500	0.0006

Note Estimates derived from the FCSS, firms aged (0-4) years

The rest of the parameters for the Spanish economy appear in Table 2. The series used to calculate them are the ones elaborated by the *Dirección General de Planificación Económica del Ministerio de Economía y Hacienda.* The parameters θ and β are, both, computed in the usual way, following the Real Business Cycle literature. The value of the parameter θ is 0.55 and, the value of β is 0.87, which implies an annual interest rate of 3.65 per cent. This value matches the long run evolution of the Spanish real interest rate.

TABLE 2
Parameter assignments

θ=0.55	c_f=16.5	ρ=0 9340	A=1.7
β=0.87	c_e=10.0976	σ^2_ϵ=0.2871	α=0 0552

6. Results

The rigidities in the Spanish labor market have been blamed for the high levels of unemployment that the Spanish economy has suffered secularly. These levels have been well above the average of the industrialized countries regardless the phase in the business cycle.

We consider the effects of the variation in the dismissal cost on the overall performance of the economy, paying attention not only to the aggregate level of employment, but also to price, output and productivity, and to effects at the firm level. This is one of the advantages of using a general equilibrium model to analyze these types of policies.

First, the model for the Spanish economy is calibrated for $\tau = 0.250$, the equivalent to one year's wage cost. Then, we are able to establish comparisons with the results obtained after reductions of the cost of lay-off. Since this is a highly stylized model, it is impossible to map the structure of the real dismissal cost in the Spanish economy to just one parameter value. We choose two values that can be used as reference.

Table 3 reports the results for the model with $\tau = 0.250$, our benchmark model[8]. As it shows, most firms are quite small. It is important to remember here, and throughout this discussion, that the analysis only considers firms with more than five workers, which means that the total percentage of small firms in the whole economy is much higher.

TABLE 3
Results for the model with τ=0.250

Average firm size				25.56
Coworker mean				186.50
Variance of growth rates (survivors)				0.2871
Serial correlation in log n (survivors)				0.9381
Exit rate of firms				0.4592
Turnover rate of jobs				0 2766
Fraction of hiring by new firms				0 5045
Average size of a new firm				8 1435
Average size of an existing firm				6 5813
Number of workers	6-19	20-99	100-499	≥500
Size distribution of firms	0 7304	0 2152	0 0515	0.0029
Size distribution of employment	0 2749	0 3254	0 3057	0 0940
Size distribution of hiring	0.2603	0.3944	0.2857	0.0596
Size distribution of firing	0 5037	0.2057	0.2143	0.0763
Size distribution by cohort				
One period	0.8109	0 1869	0.0021	0.0001
Two periods	0 5185	0 4355	0.0458	0.0002
Three periods	0.3685	0.4986	0 1293	0 0036
Four periods	0 3084	0 4908	0.1893	0 0115
Hazard rates by cohort				
One period	0 7500			
Two periods	0.3357			
Three periods	0.1901			
Four periods	0.1376			

As Table 3 shows, 32.5 per cent of the employment is concentrated in medium-size firms (20-49), while small firms (6-19) account for 27.44 percent of the employment, and larger firms (100-499) for 30.5 percent.

[8]Two observations will help to understand Table 3. A discussion of the methods used to obtain some of the variables contained in this table can be found in Appendix A2 Also notice that the minimum size firm is six workers in our data, which should be kept in mind when considering the value of the average size of a new firm

The pattern of hiring and firing is also worth noting: medium size firms account for 39.4 per cent of the firing and only 20.5 per cent of the hiring, while small firms account for 50.3 per cent of the firing and only 26 per cent of the hiring. For the rest of the firms, the proportion of firing and hiring is close.

With regard to the statistics related to cohorts, the results show, on one hand, that the probability of exit decreases with age and, on the other hand, that the size distribution of Spanish firms is stochastically increasing in age, which means that as the age of the cohort increases, the size distribution moves to the right.

To explore the effect of relaxing labor market regulations in Spain, we consider two alternative policies: $\tau = 0.125$ and $\tau = 0$. In terms of the model, these values correspond respectively to a cost of six months' wages and no cost at all. Table 4 reports the main results for Spain derived from the application of these alternative policies[9].

TABLE 4
Effect of changes τ for the Spanish economy

	τ=0 250	τ=0.125	τ=0
Price	1 00	0.9658	0.9234
Consumption (output)	100	104.55	110.59
Average productivity	100	101.38	102.28
Total employment	100	103.13	108.13
Utility adjusted consumption	100	101.69	103.28
Average firm size	26 56	25.11	24.58
Layoff costs/wage bill	0.1601	0.0894	0.0000
Job turnover rate	0.2766	0.3186	0.3523
Serial correlation in log (n)	0.9381	0 9140	0.9010
Variance in growth rates	0 2871	0.3276	0 3808

As it could have been expected, Table 4 shows that the total employment increases with respect to the model with cost equivalent to one year's wages ($\tau = 0.250$), and the creation and destruction of jobs are magnified. The quantitative size of the changes is important: the change in total employment is very significant increasing 8.13 per cent when the cost is reduced to $\tau = 0$. On the other hand, the average duration of a job increases with the tax burden. All these results are consistent with the Spanish experience in which the level of employment is low and the average duration of jobs is higher than in other industrialized countries.

[9] Refer to the Appendix A2 for the description of some of the variables that appear in Tables 4

It is also worth noting the results about the general efficiency of the economic system. The increase in consumption is high, around 4.55 per cent and 10.59 per cent for $\tau = 0.125$ and $\tau = 0$, respectively. And the total utility, considering that the amount of leisure is higher, goes up by 1.69 per cent and 3.28 per cent for each of the cases considered. Even though there are abstractions from distributional considerations, these increases are important and should be kept in mind.

Another interesting result is the change in productivity generated by the reduction in the tax. Since firms use resources more efficiently, labor productivity increases from 100 to 101.38 for the $\tau = 0.125$ case and to 102.28 for the $\tau = 0$ case. It should also be noted that although the change in employment depends on the form of the preferences chosen, this is not the case for the change in productivity. This is due to the fact that the preferences only affect the scale of activity.

In Table 5, we show the effects of changing τ over different size distributions. Note that the change in the distributional values for the firm are relatively small and follow expected directions.

TABLE 5
Effect of changes in τ over different size distributions for the Spanish economy

Number of workers	6-19	20-99	100-499	≥500
τ=0 125				
Size distribution of firms	0 7317	0.2252	0.0409	0.0022
Size distribution of employment	0 2752	0 3578	0.2834	0 0836
Size distribution of hiring	0 2559	0 4209	0.2697	0 0535
Size distribution of firing	0.4606	0 2516	0 2150	0 0728
τ=0 125				
Size distribution of firms	0 7765	0 1800	0.0412	0 0023
Size distribution of employment	0.3179	0.3111	0.2836	0 0874
Size distribution of hiring	0.2900	0 3805	0.2751	0 0544
Size distribution of firing	0 4609	0.2232	0 2330	0 0829

Previously, we have assumed that taxes were distributed lump sum to households. It might be argued that the effect of the dismissal cost would be different if taxes were used to subsidize firms. Subsidies take many forms in reality but whatever form they take, their effect is to increase the expected return of an incumbent or entry firm. In order to explore this possibility, we carry out two experiments. In the first one, we compare our benchmark economy to another where the taxes collected are distributed as a subsidy to entrant firms, therefore keeping a balanced budget. In the second one, the comparison is to an economy where the taxes are distributed uniformly lump sum to the exiting firms.

This implies that, in the first experiment, the free entry condition becomes:

$$pc_e = \int W(s, 0; p)\, d\nu(s) + \psi, \quad [14]$$

while the balanced budget condition requires:

$$\psi E_n = \tau N, \quad [15]$$

where ψ is the amount of the subsidy, E_n is the number of entry firms, and N is the total number of workers fired.

In the second experiment, the value of an incumbent firm increases in the amount of the subsidy, while again the balanced budget condition requires:

$$\psi F_i = \tau N, \quad [16]$$

where F_i is the number of incumbents.

Since the amount of subsidies given to the firms affect their decisions and, therefore, the taxes paid, the problem is to find a new stationary state in which the amount given in subsidies induced firms to pay exactly the same amount in taxes. For the first experiment, we know that such stationary state exists because, given the rest of the parameters in the model, the budget deficit is a strictly increasing continuous function of c_e, taking positive and negative values. The same result applies for our second experiment in which the budget deficit is a strictly increasing continuous function of c_f.

The results obtained stress the fact that the effects on the aggregate variables are small. Therefore, there are not big differences between using our economy with lump sum transfers or any of these two alternative scenarios as our initial starting point. However, there are some interesting changes in the distributional values for the firms. Most of the action takes place in the middle of the distribution. As it can be seen in Table 6, in both cases there are more firms in the second cell (firms between 20 and 99 workers) and they account for more employment, hiring and firing. To the contrary, in the third cell (firms between 100 and 499 workers) there are less firms and they account for less employment, hiring and firing. Surprisingly, there are almost no change in the first and fourth cells.

The reason behind the changes in the middle of the distribution is that the subsidies allow firms with lower shocks to enter or stay, so their growth is going to be slower than before. However, the firms with the higher shocks stay or enter in any case, which implies that the number of big firms is roughly the same.

TABLE 6
Change in distributional values for τ=0 250 in response to changes in ψ for the Spanish economy

Number of workers	6-19	20-99	100-499	≥500
Subsidy to incumbents				
Size distribution of firms	0.7308	0.2409	0.0255	0.0028
Size distribution of employment	0.2775	0 4250	0.2030	0.0945
Size distribution of hiring	0 2656	0 4882	0.1870	0 0592
Size distribution of firing	0 5093	0.2699	0 1436	0 0772
Subsidy to entrants				
Size distribution of firms	0 7308	0.2409	0.0255	0 0028
Size distribution of employment	0 2770	0.4238	0 2049	0 0943
Size distribution of hiring	0 2636	0.4880	0 1896	0 0588
Size distribution of firing	0 5075	0.2688	0 1475	0 0762

7. Conclusion

We have tried to show the effects of a reduction in the cost of firing on general employment. We have done that using a general equilibrium model with entry and exit and calibrating the model to Spanish data We take a microeconomic perspective in order to get results at the macroeconomic level.

Our results, even though with some limitations, seem to stress the fact that the cost of job destruction imposes a significant burden on the global performance of the economy. The reforms of 1994 and 1997 address some of these issues, however it seems that the first measures were the result of the worries awakened by the deep recession in which Spain was immersed in 1993, and not because of a deeper concern about the general inefficiency of the system. The level of subsidies to firms and employment creation in an attempt to reduce unemployment are a clear example of that point.

Unfortunately, we have not been able to link our experiment to the effects of a particular policy change in actual data. The existing limitations on data availability circumscribe the results of an experiment of these characteristics. Firm level data are not widely available in Spain, so studies of this sort has to be done confronting many limitations. But our results clearly highlight the importance of studying micro data to analyze employment related problems and the necessity of this kind of studies to effectively implement employment policies.

To consider any advances in the specification of persistence and variability for the 's-process' in terms of either firm heterogeneity or age effects would be interesting. Although most extensions of the basic Hopenhayn (1992) model keep the same structure for the 's-process', it looks flexible enough to accommodate these modifications at least if we only consider stationary states. In models such as this one, a firm's technology determines the input, so distinctions cannot be drawn between firm productivity and firm size. A big problem, however, would be the empirical analysis. Something similar happens to the possibility of adding other inputs to the firm's production function. We would like to add physical capital. This would be important since it would provide firms with the opportunity to use capital more intensively in adjusting to stochastic changes in productivity levels. This would also allows us to distinguish the size of a firm from its technology. However, data on capital at the firm's level were not available, making empirical analysis very difficult.

Therefore, analyses at the firm level seem to be critical to understand the dynamics of the Spanish economy, particularly with regard to employment. However, there is much to be done regarding these issues. First, we need reliable work on measurement. And second, we have to create richer models in order to evaluate the dynamic responses to alternative policies.

Appendix A1

This Appendix describes the algorithm used to compute the economy with dismissal costs. The algorithm consists of four steps:

Step 1. Fixing the price at an arbitrary value p, the value of the different types of firms (as a function of p) is obtained by solving the following functional equation:

$$\begin{aligned} W(s,n;p) &= \max_{n'\geq 0}\{psn'^{\theta} - n' - pc_f - \tau \max\{0, n-n'\} \\ &\quad +\beta \max\left(E_s W\left(s',n';p\right), -\tau n'\right)\}. \end{aligned}$$

The solution to this problem is computed using standard recursive methods. From the solution of this equation, we also get the employment, $n(s,n;p)$, and exit decision rules, $ex(s,n;p)$, as a function of p. Note that $ex(s,n;p)$ is an indicator function, taking the value 0 if the firm exits and 1 otherwise.

Step 2. We use condition (III) in the definition of equilibrium to find the price p^*. Given the value function $W(s,n;.)$ from step 1, the unique price

p^* that is consistent with entry in equilibrium satisfies:

$$pc_e = \int W(s, 0; p)\, d\nu(s).$$

Since W is strictly increasing and continuous in p, there is a unique p^* satisfying this condition.

Step 3. We consider a unit mass entry. Given the stationary state decision rules $n(s, n; p^*)$ and $ex(s, n; p^*)$, a measure μ is found that satisfies (for every measurable rectangle $E \times S$):

$$\mu(E \times S) = \int_{\{(s,n):n(s,n;p*)\in E\}} Q(s, S) \cdot (ex(s, n; p^*))d\mu + \nu(S)\chi_E(0),$$

where $Q(.,.)$ is the transition function for the shocks, and $\chi_E(0)$ is an indicator function that it is equal to 1 if $0 \in E$, and it is equal to 0 otherwise. This operator is affine and has at most one fixed point. The linear homogeneity in μ and the entry implies that if μ is a fixed point when entry is one, then $M\mu$ is a fixed point when entry equals M.

Step 4. Finally, we determine M^*. Given μ from step 3, M must be chosen so that the labor market clears. Since the labor demand is linearly homogeneous in M and the labor supply strictly decreasing in M, there exists a unique M^* that clears it.

Appendix A2

This Appendix defines some of the variables that appear in Tables 3 and 4.

Coworkers mean: mean number of coworkers that a worker has.

Turnover rate of jobs: inverse of the average duration of a job.

Hazard rate:

$$x_t^\tau = \frac{exit_t^\tau}{surviving_t^\tau}, t = 1, ..., n; \tau = \{0.25, 0.125, 0\},$$

where x_t^τ is the hazard rate at period t when the fixed cost to lay-off an employee is τ, and $exit_t^\tau$ and $surviving_t^\tau$ are the number of firms exiting and surviving in period t given τ, respectively.

Productivity:

$$y_t = \frac{\left(\frac{output}{employment}\right)_t}{\left(\frac{output}{employment}\right)_{t-1}} \times 100, t = 1, ..., n$$

where y_t is the productivity at period t and the other variables are self-explanatory.

Utility adjusted consumption:

$$U_t = \log(output_t) - A \cdot employment_t, t = 1, ..., n$$

where U_t is the utility adjusted consumption at period t and A is given by the relation between employment and population.

Layoff costs/ wage bill:

$$z_t^\tau = \frac{\text{layoff output}_t \cdot \tau}{\text{employment}_t \cdot w_t}, t = 1, ..., n; \tau = \{0.25, 0.125, 0\}$$

where z_t^τ is the ratio between lay-off costs and the wage bill at period t when the fixed cost to lay-off an employee is τ and the wage rate is w_t, even though in our case is normalized to one.

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Abstract

Los análisis macroeconómicos tradicionales del mercado de trabajo no han tenido éxito al intentar explicar el elevado desempleo de la economía española. En este artículo, se utiliza una perspectiva microeconómica, estudiando el comportamiento de entrada y salida de las empresas españolas y, por tanto, su comportamiento relativo a la creación y destrucción de trabajo. El modelo está calibrado a los datos de la economía española El resultado más importante es que la reducción del coste de despido del equivalente a un año de salarios a cero incrementaría el empleo un 8.13 por ciento, y la productividad un 2.28 por ciento.

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