

Reducing Severance Costs or Subsidizing Permanent Job Creation: Which Policy Is More Effective to Reduce Duality?

Victoria Osuna

Abstract

This paper introduces endogenous on-the-job training in the job creation and destruction model of the search and matching type by García-Pérez and Osuna (*Dual labour markets and the tenure distribution: Reducing severance pay or introducing a single contract*, 2014). The objective is to compare the effects of subsidizing permanent job creation with that of reducing the severance cost gap between permanent contracts (PCs) and temporary contracts (TCs) as a strategy to reduce labour market duality between PCs and TCs. The 2006 and 2012 Spanish labour market reforms are used as a benchmark. The results point to fact that subsidizing permanent job creation may not be the best option from a fiscal point of view to reduce labour market segmentation between PCs and TCs. In particular, the results of introducing the subsidized “entrepreneurs’ permanent contract” (EPC) in the 2012 labour market reform may have involved substantial deadweight effects. In fact, the reduction of the severance cost gap to a number close to 15 days of wages per year of service (p.y.o.s.) may generate the same effects, provided dismissals for objective reasons are effectively made easier to justify and firms make use of that option instead of agreeing to an indemnity closer to the amount paid for unfair dismissals. Finally, the model also shows the relevance of designing appropriate penalties for those firms that do not comply with the obligations that subsidies involve.

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Keywords Subsidies; severance costs gap; permanent and temporary contracts; duality; unemployment; tenure distribution; job destruction

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1 Introduction

Over the last three decades, the world economy has experienced an intense process of globalization and technological progress. Some Southern European countries, with Spain as the best example, reacted to these changes by introducing labor market flexibility at the margin through temporary contracts with very low severance costs. This strategy, together with the low degree of internal flexibility present in these labour markets, has generated dual labour markets with very perverse consequences in terms of volatility of employment, persistency of labour market segmentation, productivity growth and fiscal externalities (see, for instance, Costain et al. (2010) and Dolado et al. (2008) for further details). Triggered by the enormous increase in unemployment rates during the “Great Recession” and by the perverse consequences of duality, governments in these countries have recently opted for combining reductions in the severance costs gap between PCs and TCs with some fiscal measures, such as tax rebates for job conversions of TCs into PCs or subsidies for permanent job creation.

For instance, Spanish governments have introduced major changes concerning external and internal flexibility in the reforms that took place in 2010 and 2012, and some of these measures have been coupled with subsidies. Concerning external flexibility there has been a substantial reduction in the severance cost gap for unfair dismissals, from 37 to 21 days of wages p.y.o.s.¹ In addition, the reform introduced a new PC, which is referred to as the “entrepreneurs’ permanent contract” (EPC), with a one-year probationary period, zero severance costs during such period and large wage subsidies for younger and older workers hired by small firms. Regarding internal flexibility, these reforms have allowed for an internal devaluation by facilitating the adjustment of hours and wages to changes in a firm’s economic conditions as an alternative to job destruction. In particular, short-time work (STW) mechanisms have been made easier to implement and, again, they have been partially subsidized.

¹ The indemnity of workers with PCs decreased from 45 to 33 days of wages p.y.o.s. in case of unfair dismissal and became closer to the mean OECD compensation, which is 21 days of wages p.y.o.s (see OCDE (2013) for further details), whereas the indemnity of workers with TCs increased from 8 to 12 days of wages p.y.o.s.

The idea of subsidizing permanent job creation seems to be deeply rooted in Southern European countries. For instance, Spanish governments have lunched several labour market reforms over the last twenty years that have involved the provision of subsidies, either by directly hiring workers under PCs or by converting TCs into PCs with substantial rebates in social security contributions (see Bentolila et al. (2008) for a summary of these reforms). Also the recent Italian labour market reform (the “Jobs Act”) envisages, not only a substantial reduction in the severance costs of permanent workers, but also the availability of subsidies for three years in order to provide incentives for permanent job creation. The problem with subsidizing job creation is that it creates fiscal imbalances, which are not desirable in the actual economic context, and also their effectiveness is not clear because of the substitution and deadweight effects that they may induce. In fact, García-Pérez and Rebollo (2009) find that the permanent employment promotion contracts (PEPCs) introduced in the 1997 and 2006 labour market reforms, which qualified for social security rebates, have recorded a much higher job destruction rate than ordinary PCs.

The objective of this paper is to introduce endogenous on-the-job training in the job creation and destruction model of the search and matching type by García-Pérez and Osuna (2014) to study the effectiveness of subsidizing permanent job creation as a strategy to reduce duality. The ingredients of the model by García-Pérez and Osuna (2014), which intended to capture the specific features of the Spanish economy, were (i) the existence of a *segmented labour market* with two types of jobs (permanent and temporary) that differ in productivity, in the maximum length of the contract and in the associated severance costs; (ii) endogenous job conversion of TCs into PCs; (iii) severance costs modelled as a transfer from the firm to the worker and as a function of seniority; and (iv) downward wage rigidities such that severance costs have real effects.² The main contribution of the present paper is twofold. The first one is the modelling of on-the-job training as

² Lazear (1990) notes that if contracts were perfect, severance payments would be neutral. If the government forced employers to make payments to workers in the case of dismissal, perfect contracts would undo those transfers by specifying opposite payments from workers to employers. Thus, for severance pay to have an effect, some form of incompleteness is needed. Most studies have avoided this problem by modelling dismissal costs as firing taxes; thus, the effects cannot be undone by private arrangements.

an endogenous decision taken by firms. This is relevant for the question at hand because the addressed labour market reforms affect separation rates and thereby the incentives to train workers.³ The second one is the introduction of subsidies for permanent job creation in this type of framework, which will allow us to compare the effectiveness of reducing the severance costs gap and subsidizing permanent job creation. In this labour market, firms will be heterogeneous agents that take training decisions and use these two types of contracts to endogenously adjust their employment levels when facing idiosyncratic persistent shocks. I follow Mortensen and Pissarides (1994) by assuming one-job firms.

In addition, the Spanish case will be used as a benchmark to compare the effects of subsidizing permanent job creation, both in the 2006 and in the 2012 labour market reforms, with the effects of merely reducing the severance cost gap between permanent and temporary contracts as it has been the case in the 2012 labour market reform. The metric that will be used to measure the change in the degree of duality in the steady-state will be the changes in job destruction rates and the changes in the tenure distribution.

The steady-state results show that the reduction in the severance costs gap that was introduced in the 2012 labour market reform for unfair dismissals is as effective as the type of subsidies for permanent job creation introduced in the 2006 labour market reform in terms of reducing the unemployment rate and labour market segmentation, and it is much cheaper from a fiscal point of view. These results point to fact that subsidizing permanent job creation may not be the best option from a fiscal point of view to reduce labour market segmentation between PCs and TCs. In particular, the results of introducing the subsidized EPC in the 2012 labour market reform may have involved substantial deadweight effects. In fact, the reduction of the severance cost gap to a number close to 15 days of wages p.y.o.s may generate the same effects, provided dismissals for objective reasons are effectively made easier to justify and firms make use of that option instead of agreeing to an indemnity closer to the amount paid for unfair dismissals. Finally, the model also shows the relevance of designing appropriate penalties for those firms that do not comply with the obligations that subsidies involve.

³ I thank an anonymous referee and the editor for the suggestion of endogenizing this decision in this context.

The paper is organized as follows. The baseline model is presented in Section 2. In Section 3, the calibration strategy of the benchmark model and the reform scenarios is discussed. In Section 4, the steady-state analysis of the policies of interest is performed. Finally, some conclusions are drawn in Section 5.

2 The Model

2.1 Population

The economy is populated by a continuum of workers with a unit mass and a continuum of firms. Workers can either be employed or unemployed. Hence, out of the labour force is not considered as an additional state. Unemployed workers look for employment opportunities; employed workers produce and do not search for jobs. Firms post vacancies or produce. The cost of having a vacancy open is c_v . Posting a vacancy is not job creation unless it is filled. Each firm is a one-job firm, and the job may be occupied and producing or vacant. Free entry is assumed. The source of heterogeneity is due to the existence of matches with different productivities and durations. Therefore, the state space that describes the situation of a particular worker is $S = \{0, 1\} \times \mathcal{E} \times D \times TR$, where $\mathcal{E} = \{\varepsilon_1, \dots, \varepsilon_n\}$ is a discrete set for the quality of the match, $D = \{1, \dots, N\}$ is also a discrete set denoting the duration of a job (worker's seniority) and $TR = \{tr_0, tr_1\}$ can take two values, depending on whether the firm has trained the worker or not. Each quadruple indicates whether the worker is unemployed (0) or employed (1) and, in that last case, the quality and duration of the match and whether the worker has been trained.

2.2 Preferences

Workers have identical preferences, live infinitely and maximise their utility, which is taken to be linear in consumption. It is assumed that they supply work inelastically, that is, they will accept any opportunity that arises. Thus, each worker has preferences defined by $\sum_{t=1}^{\infty} \beta^t c_t$, where β is the discount factor ($0 \leq \beta < 1$) and c_t is individual consumption. Firms are further assumed to be risk neutral.

2.3 Technologies

Production Technology

Each job is characterised by an irreversible technology and produces one unit of a differentiated product per period whose price is $y(\varepsilon_t)$, where $\{\varepsilon_t\}$ is an idiosyncratic component, i.e., the quality of the match. This idiosyncratic component is modelled as a stationary and finite Markov chain. This process is the same for each match, and the realisations ε_{t+1} are independent and identically distributed with conditional transition probabilities $\Gamma(\varepsilon'|\varepsilon) = Pr\{\varepsilon_{t+1}|\varepsilon_t\}$, where $\varepsilon, \varepsilon' \in \mathcal{E} = \{1, 2, \dots, n_{\mathcal{E}}\}$. Each new match starts with the same entry level ε_e , and from this initial condition, the quality of the match evolves stochastically due to these idiosyncratic shocks. It is assumed that agents know the law of motion of the process and observe their realisations at the beginning of the period. Finally, the match productivity is also affected by the endogenous decision of training a worker. As in García-Pérez and Osuna (2014) and based on Spanish evidence, see, for instance, Albert et al. (2005) and Dolado et al. (2008), it is assumed that untrained workers are less productive than trained workers, and this feature is introduced through a productivity gap, γ . It is also assumed that training a worker is costly and, therefore productivity is lower in the period where training takes place by a factor τ . Last, it is assumed that once training has taken place, productivity grows with seniority. This is modelled through an experience function $\Lambda(d)$.

Matching Technology

In each period, vacancies and unemployed workers are stochastically matched. It is assumed that there exists an homogeneous of degree one matching function $m = m(u, v)$, increasing and concave in both arguments, where v is the number of vacancies and u is the number of unemployed workers, both normalised by the fixed labour force. Given the properties of the matching function, the transition rates for vacancies, q , and unemployed workers, α , depend only on $\theta = v/u$, a measure of tightness in the labour market. The vacancy transition rate, q , is defined as the probability of filling a vacancy, and the transition rate for unemployed workers, α , is defined as the probability of finding a job. These are given by

$$q(\theta) = \frac{m(v,u)}{v} = m\left(1, \frac{u}{v}\right); \alpha(\theta) = \frac{m(v,u)}{u} = m\left(\frac{v}{u}, 1\right).$$

2.4 Equilibrium

The concept of equilibrium as used herein is recursive equilibrium. Before showing the problems that agents solve, it is convenient to explain the timing and the agents' decisions. At the beginning of the period, firms' idiosyncratic shocks are revealed for existing matches. Firms and workers then renegotiate wages. Given these wages, firms choose between two options: i) to continue producing with the current match or ii) to terminate the match and dismiss the worker. The nature of the problem depends on whether the firm has a PC or a TC, and on whether the worker has been previously trained or not. PCs entail high severance costs that depend on the quality of the match and on the duration of the contract, while severance costs for TCs depend also on both dimensions but are, in comparison, very low. In addition, the problem is not the same for all firms with a TC. Let d denote the duration of the contract. It is assumed that a TC cannot last more than d_{max}^t periods, and thus, the maximum number of renewals is $d_{max}^t - 1$. Therefore, firms whose TCs cannot be renewed decide between these two options: i) to convert the TC into a PC, taking into account the consequences regarding future severance costs or ii) to terminate the match. In all the matches where workers have not been trained, firms also consider the option of paying the training cost in order to enjoy higher productivity in the future.

Once all these decisions have been made, production starts both in firms where workers have not been fired during this period and in those that were matched with unemployed workers at the end of the last period. Finally, search decisions are made, and firms post vacancies for which the unemployed workers apply. This search process generates new matches that will be productive over the next period. Accordingly, there follows a formal description of the problems faced by both firms and workers.

Vacancy Creation

Every job is created as a temporary job according to the following equation:

$$V = -c_v + \beta[q(\theta)J^{tc}(\varepsilon_e, 1, tr_0) + (1 - q(\theta))V],$$

where V is the value of a vacant job, $J^{tc}(\varepsilon_e, 1, tr_0)$ is the value function of a firm with a first-period TC and ε_e is the entry level match quality. All vacancies lead to TC jobs, which may later be transformed to PC jobs.

The Firm's Problem

The Problem of Firms with Untrained Workers in Temporary Contracts

The problem of a firm with an untrained temporary worker, whose contract length at the end of the last period was less than d_{max}^t , is

$$\begin{aligned}
 J^{tc}(\varepsilon, d, tr_0) = & \max\{y(\varepsilon)(1 - \tau) - w^{tc}(\varepsilon, d, tr_1)(1 + \xi^{tc}) + \\
 & \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon) J^{tc}(\varepsilon', d', tr_1), y(\varepsilon)(1 - \gamma) \\
 & - w^{tc}(\varepsilon, d, tr_0)(1 + \xi^{tc}) + \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon) J^{tc}(\varepsilon', d', tr_0), \\
 & - s^{tc}(\varepsilon, d, tr_0) - c_v + \beta(q(\theta)J^{tc}(\varepsilon_e, 1, tr_0) + (1 - q(\theta))V)\}
 \end{aligned}$$

$$g_{tr}^{tc}(\varepsilon, d, tr_0) = \begin{cases} tr_1 & \text{if the worker is trained} \\ tr_0 & \text{if the worker is not trained} \end{cases}$$

$$g^{tc}(\varepsilon, d, tr_0) = \begin{cases} 1 & \text{if the match continues} \\ 0 & \text{if the worker is fired} \end{cases}$$

where $J^{tc}(\varepsilon, d, tr_1)$, $J^{tc}(\varepsilon', d', tr_0)$ and $J^{tc}(\varepsilon', d', tr_1)$ are the value functions for this period and the next period of a firm with an untrained worker in a TC, $y(\varepsilon)(1 - \tau)$ is output if the worker is trained in the current period, $y(\varepsilon)(1 - \gamma)$ is output if the worker remains untrained in the current period, τ is the training cost, γ is a productivity gap between trained and untrained workers, $w^{tc}(\varepsilon, d, tr_1)$ and $w^{tc}(\varepsilon, d, tr_0)$ are the wages of trained and untrained workers, ξ^{tc} represents social security taxes paid by the firm, $\Gamma(\varepsilon'|\varepsilon)$ is the conditional transition probability for the match quality and $s^{tc}(\varepsilon, d, tr_0)$ is the severance cost of a worker that has not been trained. Note that a greater value of ε increases output and that both wages and severance costs are increasing in ε , d and tr .

If it is more profitable to train the worker in the current period, the decision rule will be $g_{tr}^{tc}(\varepsilon, d, tr_0) = tr_1$ and the worker will be trained. Otherwise, $g_{tr}^{tc}(\varepsilon, d, tr_0) = tr_0$ and the worker will not be trained. If it is more profitable to continue with the actual match, the decision rule will be $g^{tc}(\varepsilon, d, tr_0) = 1$ and the match will continue. Otherwise, $g^{tc}(\varepsilon, d, tr_0) = 0$, and the worker will be fired, whereby the firm incurs the severance cost, $s^{tc}(\varepsilon, d, tr_0)$, the vacancy cost and, with probability $q(\theta)$ at the end of this period, the firm will fill the vacant job with a TC that will be productive in the next period.

The Problem of Firms with Trained Workers in Temporary Contracts

The problem of a firm with a trained temporary worker, whose contract length at the end of the last period was less than d_{max}^t , is

$$J^{tc}(\varepsilon, d, tr_1) = \max\{y(\varepsilon)\Lambda(d) - w^{tc}(\varepsilon, d, tr_1)(1 + \xi^{tc}) + \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon) J^{tc}(\varepsilon', d', tr_1), -s^{tc}(\varepsilon, d, tr_1) - c_v + \beta(q(\theta)J^{tc}(\varepsilon_e, 1, tr_0) + (1 - q(\theta))V)\}$$

$$g^{tc}(\varepsilon, d, tr_1) = \begin{cases} 1 & \text{if the match continues} \\ 0 & \text{if the worker is fired} \end{cases}$$

where $J^{tc}(\varepsilon, d, tr_1)$ and $J^{tc}(\varepsilon', d', tr_1)$ are, respectively, the value functions for this period and the next period of a firm with a trained worker in a TC, $y(\varepsilon)\Lambda(d)$ is output for a worker that has been previously trained, and $\Lambda(d)$ is the experience function. The policy function $g^{tc}(\varepsilon, d, tr_1)$ has an analogous interpretation to the policy function in the previous section.

The Problem of Firms with Untrained Workers in Prospective Permanent Contracts

The problem is slightly different for a firm whose TC has reached its maximum length at the end of the previous period. If the worker is not fired at the beginning of this period, the TC will be automatically transformed into a PC. Note that in this case $d = d_{max}^t + 1$, where $d_{max}^t + 1$ denotes the first period in a PC, and that severance costs are given by $s^{tc}(\varepsilon, d, tr_0)$ because if the worker is not promoted, the severance cost corresponds to the period the worker has spent on a TC. The

problem of a firm with an untrained worker in a prospective permanent contract (PPC) can thus be written as

$$\begin{aligned}
 J^{ppc}(\varepsilon, d, tr_0) &= \max\{y(\varepsilon)(1 - \tau) - w^{ppc}(\varepsilon, d, tr_1)(1 + \xi^{pc}) + \\
 &\quad \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon) J^{pc}(\varepsilon', d', tr_1), y(\varepsilon)(1 - \gamma) \\
 &\quad - w^{ppc}(\varepsilon, d, tr_0)(1 + \xi^{pc}) + \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon) J^{pc}(\varepsilon', d', tr_0), \\
 &\quad - s^{tc}(\varepsilon, d, tr_0) - c_v + \beta(q(\theta)J^{tc}(\varepsilon_e, 1, tr_0) + (1 - q(\theta))V)\} \\
 g_{tr}^{ppc}(\varepsilon, d, tr_0) &= \begin{cases} tr_1 & \text{if the worker is trained} \\ tr_0 & \text{if the worker is not trained} \end{cases} \\
 g^{ppc}(\varepsilon, d, tr_0) &= \begin{cases} 1 & \text{if the firm promotes the worker} \\ 0 & \text{if the worker is fired} \end{cases}
 \end{aligned}$$

where $J^{ppc}(\varepsilon, d, tr_0)$, $J^{pc}(\varepsilon', d', tr_0)$ and $J^{pc}(\varepsilon', d', tr_1)$ are the firm's value function for this and the next period, ξ^{pc} represents social security taxes paid by the firm and $w^{ppc}(\varepsilon, d, tr_0)$, $w^{ppc}(\varepsilon, d, tr_1)$ are the wages. These equations have an analogous interpretation to the previous ones. If it is more profitable to train the worker, the decision rule will be $g_{tr}^{ppc}(\varepsilon, d, tr_0) = tr_1$ and the worker will be trained. Otherwise, $g_{tr}^{ppc}(\varepsilon, d, tr_0) = tr_0$ and the worker will not be trained. If it is more profitable to continue with the match, the decision rule will be $g^{ppc}(\varepsilon, d, tr_0) = 1$, and the temporary worker will be promoted to a PC. Otherwise, $g^{ppc}(\varepsilon, d, tr_0) = 0$, and the worker will be fired.

The Problem of Firms with Trained Workers in Prospective Permanent Contracts

$$\begin{aligned}
 J^{ppc}(\varepsilon, d, tr_1) &= \max\{y(\varepsilon)\Lambda(d) - w^{ppc}(\varepsilon, d, tr_1)(1 + \xi^{pc}) + \\
 &\quad \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon) J^{pc}(\varepsilon', d', tr_1), -s^{tc}(\varepsilon, d, tr_1) \\
 &\quad - c_v + \beta(q(\theta)J^{tc}(\varepsilon_e, 1, tr_0) + (1 - q(\theta))V)\}
 \end{aligned}$$

$$g^{ppc}(\varepsilon, d, tr_1) = \begin{cases} 1 & \text{if the match continues} \\ 0 & \text{if the worker is fired} \end{cases}$$

The interpretation of these equations is analogous to the previous ones.

The Problem of Firms with Untrained Workers in Existing PCs

This problem can be written as

$$\begin{aligned} J^{pc}(\varepsilon, d, tr_0) = & \max\{y(\varepsilon)(1 - \tau) - w^{pc}(\varepsilon, d, tr_1)(1 + \xi^{pc}) + \\ & \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon) J^{pc}(\varepsilon', d', tr_1), y(\varepsilon)(1 - \gamma) \\ & - w^{pc}(\varepsilon, d, tr_0)(1 + \xi^{pc}) + \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon) J^{pc}(\varepsilon', d', tr_0), \\ & - s^{pc}(\varepsilon, d, tr_0) - c_v + \beta(q(\theta)J^c(\varepsilon_e, 1, tr_0) + (1 - q(\theta))V)\} \end{aligned}$$

$$g_{tr}^{pc}(\varepsilon, d, tr_0) = \begin{cases} tr_1 & \text{if the worker is trained} \\ tr_0 & \text{if the worker is not trained} \end{cases}$$

$$g^{pc}(\varepsilon, d, tr_0) = \begin{cases} 1 & \text{if the match continues} \\ 0 & \text{if the worker is fired} \end{cases}$$

where $J^{pc}(\varepsilon, d, tr_0)$, $J^{pc}(\varepsilon', d', tr_0)$ and $J^{pc}(\varepsilon', d', tr_1)$ are the value functions for this period and the next period, $w^{pc}(\varepsilon, d, tr_0)$ and $w^{pc}(\varepsilon, d, tr_1)$ are the wages and $s^{pc}(\varepsilon, d, tr_0)$ is the severance cost.

The Problem of Firms with Trained Workers in Existing PCs

$$\begin{aligned} J^{pc}(\varepsilon, d, tr_1) = & \max\{y(\varepsilon)\Lambda(d) - w^{pc}(\varepsilon, d, tr_1)(1 + \xi^{pc}) + \\ & \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon) J^{pc}(\varepsilon', d', tr_1), -s^{pc}(\varepsilon, d, tr_1) \\ & - c_v + \beta(q(\theta)J^c(\varepsilon_e, 1, tr_0) + (1 - q(\theta))V)\} \end{aligned}$$

$$g^{pc}(\varepsilon, d, tr_1) = \begin{cases} 1 & \text{if the match continues} \\ 0 & \text{if the worker is fired} \end{cases}$$

The interpretation of these equations is analogous to the previous ones.

The Worker's Problem

The value functions of untrained workers in TCs, PPCs and PCs can be written as follows

$$\begin{aligned}
 W^{tc}(\varepsilon, d, tr_0) &= \tilde{\Phi}(g^{tc} = 1)[\Phi(g_{tr}^{tc} = 1)(w^{tc}(\varepsilon, d, tr_1) + \\
 &\quad \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon)W^{tc}(\varepsilon', d', tr_1)) + \\
 &\quad \Phi(g_{tr}^{tc} = 0)(w^{tc}(\varepsilon, d, tr_0) + \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon)W^{tc}(\varepsilon', d', tr_0))] \\
 &\quad + \tilde{\Phi}(g^{tc} = 0)[U + s^{tc}(\varepsilon, d, tr_0)]
 \end{aligned}$$

$$\begin{aligned}
 W^{ppc}(\varepsilon, d, tr_0) &= \tilde{\Phi}(g^{ppc} = 1)[\Phi(g_{tr}^{ppc} = 1)(w^{ppc}(\varepsilon, d, tr_1) + \\
 &\quad \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon)W^{pc}(\varepsilon', d', tr_1)) + \\
 &\quad \Phi(g_{tr}^{ppc} = 0)(w^{ppc}(\varepsilon, d, tr_0) + \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon)W^{pc}(\varepsilon', d', tr_0))] \\
 &\quad + \tilde{\Phi}(g^{ppc} = 0)[U + s^{tc}(\varepsilon, d, tr_0)]
 \end{aligned}$$

$$\begin{aligned}
 W^{pc}(\varepsilon, d, tr_0) &= \tilde{\Phi}(g^{pc} = 1)[\Phi(g_{tr}^{pc} = 1)(w^{pc}(\varepsilon, d, tr_1) + \\
 &\quad \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon)W^{pc}(\varepsilon', d', tr_1)) + \\
 &\quad \Phi(g_{tr}^{pc} = 0)(w^{pc}(\varepsilon, d, tr_0) + \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon)W^{pc}(\varepsilon', d', tr_0))] \\
 &\quad + \tilde{\Phi}(g^{pc} = 0)[U + s^{pc}(\varepsilon, d, tr_0)]
 \end{aligned}$$

The value functions of trained workers in TCs, PPCs and PCs can be written as follows

$$\begin{aligned}
 W^{tc}(\varepsilon, d, tr_1) &= \tilde{\Phi}(g^{tc} = 1)[w^{tc}(\varepsilon, d, tr_1) + \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon)W^{tc}(\varepsilon', d', tr_1)] \\
 &\quad + \tilde{\Phi}(g^{tc} = 0)[U + s^{tc}(\varepsilon, d, tr_1)]
 \end{aligned}$$

$$W^{ppc}(\varepsilon, d, tr_1) = \tilde{\Phi}(g^{ppc} = 1)[w^{ppc}(\varepsilon, d, tr_1) + \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon)W^{pc}(\varepsilon', d, tr_1)] \\ + \tilde{\Phi}(g^{ppc} = 0)[U + s^{tc}(\varepsilon, d, tr_1)]$$

$$W^{pc}(\varepsilon, d, tr_1) = \tilde{\Phi}(g^{pc} = 1)[w^{pc}(\varepsilon, d, tr_1) + \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon)W^{pc}(\varepsilon', d, tr_1)] \\ + \tilde{\Phi}(g^{pc} = 0)[U + s^{pc}(\varepsilon, d, tr_1)]$$

where $W^{tc}(\varepsilon, d, tr_0)$, $W^{ppc}(\varepsilon, d, tr_0)$ and $W^{pc}(\varepsilon, d, tr_0)$ denote untrained worker's value functions in TCs, PPCs and PCs, $W^{tc}(\varepsilon, d, tr_1)$, $W^{ppc}(\varepsilon, d, tr_1)$ and $W^{pc}(\varepsilon, d, tr_1)$ denote trained worker's value functions in TCs, PPCs and PCs, $\tilde{\Phi}(x)$ and $\Phi(x)$ are indicator functions that take value 1 if the assessment is true and zero otherwise, and U is the value function of an unemployed worker, whose equation is

$$U = b + \beta(\alpha(\theta)W^{tc}(\varepsilon_e, 1, tr_0) + (1 - \alpha(\theta))U)$$

where $W^{tc}(\varepsilon_e, 1, tr_0)$ is the value function of a worker in a first-period TC and the parameter b can be interpreted as an unemployment subsidy. Hence, an unemployed worker receives b today and, by the end of the period, the probability that the worker will find a job is $\alpha(\theta)$ whereas the probability that the worker will remain unemployed is $1 - \alpha(\theta)$.

Law of Motion for Unemployment

Given the previously shown policy rules, the law of motion for unemployment is

$$U_t = U_{t-1} + \sum_{i=1}^{N_{t-1}^{pc}} (1 - g_i^{pc}(\varepsilon, d, tr)) + \sum_{i=1}^{N_{t-1}^{ppc}} (1 - g_i^{ppc}(\varepsilon, d, tr)) + \\ \sum_{i=1}^{N_{t-1}^{tc}} (1 - g_i^{tc}(\varepsilon, d, tr)) - \alpha(\theta)U_{t-1},$$

where N_{t-1}^{PC} , N_{t-1}^{PPC} and N_{t-1}^{TC} denote the beginning of period- t employment levels in PCs, PPCs and TCs, respectively, and U_t is the level of unemployment at the end of period t . The interpretation of the equation is the following: unemployment at the end of period t , U_t , is given by the sum of the stock of unemployment at the beginning of period t , U_{t-1} , plus the inflows into unemployment (the three terms with indicator functions) during period t minus the outflow from unemployment during period t , $\alpha(\theta)U_{t-1}$. Note that the second RHS term sums up the values of the $g_i^{PC}(\varepsilon, d, tr)$ for every worker holding a PC at the beginning of period t , when the decision to continue or to fire takes place. For instance, for those workers fired at the beginning of period t , $g_i^{PC}(\varepsilon, d, tr) = 0$; therefore, they will be part of the unemployment pool. The third and fourth RHS terms have a similar interpretation, but for workers with prospective PCs and TCs, respectively.

Wage Determination

Wages are the result of bilateral bargaining between the worker and the firm, unless the legally imposed minimum wage, w_{min} , is binding.⁴ Bargaining is dynamic, i.e., wages are revised for each period based upon the occurrence of new shocks. The assumption of bilateral bargaining is reasonable due to the existence of sunk costs (search costs) once the match has been produced. This creates local monopoly power and generates a surplus to be split among the participants in the match. In TCs, this surplus is defined as

$$S^{tc}(\varepsilon, d, tr) = [J^{tc}(\varepsilon, d, tr) - (V - s^{tc}(\varepsilon, d, tr))] + [W^{tc}(\varepsilon, d, tr) - (U + s^{tc}(\varepsilon, d, tr))]$$

Wages are the result of maximising the following Nash product with respect to the wage

$$[J^{tc}(\varepsilon, d, tr) - (V - s^{tc}(\varepsilon, d, tr))]^{1-\pi} [W^{tc}(\varepsilon, d, tr) - (U + s^{tc}(\varepsilon, d, tr))]^{\pi}$$

The first order condition of this maximisation is such that the surplus is split into fixed proportions according to the worker's bargaining power, π

⁴ Downward wage rigidity is modelled here as a lower bound on the outcome of the wage negotiations. A wage floor needs to be imposed in order to prevent too much internalisation of severance payments.

$$(1 - \pi)S^{tc}(\varepsilon, d, tr) = J^{tc}(\varepsilon, d, tr) + s^{tc}(\varepsilon, d, tr)$$

$$\pi S^{tc}(\varepsilon, d, tr) = W^{tc}(\varepsilon, d, tr) - (U + s^{tc}(\varepsilon, d, tr))$$

By making the appropriate substitutions of firms' and workers' value functions, the wage of an untrained worker in a TC whose firm decides not to train him can be computed as

$$\begin{aligned} w^{tc}(\varepsilon, d, tr_0) = & \max\{w_{min}, \pi y(\varepsilon)(1 - \gamma) + (1 - \pi)U + s^{tc}(\varepsilon, d, tr_0) \\ & + \beta(\pi \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon)J^{tc}(\varepsilon', d, tr_0) \\ & - (1 - \pi) \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon)W^{tc}(\varepsilon', d, tr_0))\} \end{aligned}$$

while that of an untrained worker in a TC whose firm decides to train him can be computed as

$$\begin{aligned} w^{tc}(\varepsilon, d, tr_0) = & \max\{w_{min}, \pi y(\varepsilon)(1 - \tau) + (1 - \pi)U + s^{tc}(\varepsilon, d, tr_0) + \\ & \beta(\pi \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon)J^{tc}(\varepsilon', d, tr_1) \\ & - (1 - \pi) \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon)W^{tc}(\varepsilon', d, tr_1))\} \end{aligned}$$

On the other hand, the wage of a trained worker in a TC can be computed as

$$\begin{aligned} w^{tc}(\varepsilon, d, tr_1) = & \max\{w_{min}, \pi y(\varepsilon)\Lambda(d) + (1 - \pi)U + s^{tc}(\varepsilon, d, tr_1) + \\ & \beta(\pi \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon)J^{tc}(\varepsilon', d, tr_1) \\ & - (1 - \pi) \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon)W^{tc}(\varepsilon', d, tr_1))\} \end{aligned}$$

The wages in firms with trained and untrained workers in PPCs and PCs can be obtained following a similar procedure.⁵ Note that wages in PPCs are lower than those prevailing in the following periods because, as in Osuna (2005), firms try to internalise higher future wages (due to higher future severance costs) by pushing down wages in first-period PCs. Moreover, for any given productivity level, wages of untrained workers are lower than those of trained workers.

Definition of Equilibrium

A recursive equilibrium is a list of value functions $J^{tc}(\varepsilon, d, tr)$, $J^{ppc}(\varepsilon, d, tr)$, $J^{pc}(\varepsilon, d, tr)$, $W^{tc}(\varepsilon, d, tr)$, $W^{ppc}(\varepsilon, d, tr)$, $W^{pc}(\varepsilon, d, tr)$, V , U , transition rates $q(\theta)$, $\alpha(\theta)$, wages $w^{tc}(\varepsilon, d, tr)$, $w^{ppc}(\varepsilon, d, tr)$ and $w^{pc}(\varepsilon, d, tr)$, and decision rules $g^{tc}(\varepsilon, d, tr)$, $g^{ppc}(\varepsilon, d, tr)$, $g^{pc}(\varepsilon, d, tr)$, $g_{tr}^{tc}(\varepsilon, d, tr)$, $g_{tr}^{ppc}(\varepsilon, d, tr)$, $g_{tr}^{pc}(\varepsilon, d, tr)$ such that⁶

1. *Optimality*: Given functions $q(\theta)$, $\alpha(\theta)$, $w^{tc}(\varepsilon, d, tr)$, $w^{ppc}(\varepsilon, d, tr)$ and $w^{pc}(\varepsilon, d, tr)$ the value functions $J^{tc}(\varepsilon, d, tr)$, $J^{ppc}(\varepsilon, d, tr)$, $J^{pc}(\varepsilon, d, tr)$, $W^{tc}(\varepsilon, d, tr)$, $W^{ppc}(\varepsilon, d, tr)$ and $W^{pc}(\varepsilon, d, tr)$ satisfy the Bellman equations.
2. *Free entry*: This condition and the profit maximisation condition guarantee that, in equilibrium, the number of vacancies adjusts to eliminate all the rents associated with holding a vacancy; that is, $V = 0$, implying $c_v = \beta q(v) J^{tc}(\varepsilon_e, 1, tr_0)$.
3. *Wage bargaining*: Wages are the result of maximising the previously shown Nash product with respect to the wage for each type of contract.

⁵ We omit them for the sake of brevity.

⁶ Cole and Rogerson (1999) show that an equilibrium always exists when wages do not depend on the unemployment rate but only on the idiosyncratic shock. The intuition is that, given free entry, vacancies adjust to the number of unemployed, and the relevant variable becomes the ratio of unemployed workers to vacancies.

3 Calibration

In this section, the data set, the procedure for assigning values to the model's parameters and the selection of functional forms is explained.

3.1 The Data Set and Model Period

To calibrate the main parameters of the model, Spanish administrative data from the “*Muestra Continua de Vidas laborales*” (MCVL) are used. The calibration sample comes from the 2006 to 2011 waves and includes the complete labour career for a sample of more than 700,000 workers for the 2004 to 2011 period, a reasonable time span for measuring job transitions in steady state given that it comprises four years of expansion (2004–2007) and another four years of crisis (2008–2011). All employment and unemployment spells lasting more than six months are used. Regarding the filtering of the data the sample only has workers between 16 and 64 years old, and only for the standard regime, that is, we exclude the self-employed and the especial regimes. For reasons explained in García-Pérez (2008) that have to do with the reliability of the data, we also exclude from our sample those who report a zero level of qualification and a level of qualification greater than ten. Finally, we apply all the filters that are explained in García-Pérez (2008) to eliminate artificial unemployment spells. All these filters reduce the original sample by 25 – 30% percent. Finally, the model period is chosen to be a year for consistency with these data and because this choice is reasonable from a computational perspective.

3.2 Calibrated Parameters and Functional Forms

In this model there are two types of calibrated parameters: those that have a clear counterpart in the real economy and those that do not. For the former, I use the implied parameter values. For some of the latter, I use the values estimated in empirical studies, and for the rest, I use the simulated method of moments to calibrate their values.

Preferences

The utility function is linear in consumption, as is usual in this literature. The value of the discount factor, $\beta = .97$, is fixed so that it is consistent with the mean annual real interest rate in the reference period, 3%.

Production Technology

The production function is assumed to be linear in the idiosyncratic shock, $y(\varepsilon) = \varepsilon$. The idiosyncratic shock is modelled as a Markov chain, $\Gamma[(\varepsilon')|(\varepsilon)]$. In addition, five possible quality levels are assumed. In general, these two assumptions would imply 20 restrictions to fix the values of the conditional transition probabilities between different quality levels. Assuming that the expected duration of good and bad idiosyncratic shocks coincides, $\Gamma[(\varepsilon_1)|(\varepsilon_2)] = \Gamma[(\varepsilon_2)|(\varepsilon_1)]$, it is only necessary to estimate 15 transition probabilities. Given that there is no direct information on the quality of the match, the Tauchen (1986) procedure is used to parameterise the five quality levels and the transition probabilities. To apply this procedure, we need to know the mean (μ), the standard deviation (σ) and the autocorrelation coefficient (ρ) of the underlying idiosyncratic process. Wages for the 2004 to 2011 period are used to approximate this process, generating the following values for these parameters: $\mu = .33$, $\sigma = .11$ and $\rho = .75$. Finally, μ is normalised to the value of 1 to make the calibration more intuitive and more easily interpretable. Using the calibration sample, the productivity gap parameter is set to 12% based on the ratio between wages for permanent and temporary workers with equal experience (See García-Pérez and Osuna (2014) for a discussion on the robustness of this choice). Finally, the positive experience effect on the productivity of permanent workers is parametrized through the function $\Lambda(d) = (1 + \lambda(d - 1))$.

Matching Technology

A Cobb-Douglas homogeneous of degree one matching function, $m = m(v, u) = Av^\eta u^{1-\eta}$, is assumed, where A is the degree of mismatch and η is the value of the elasticity of the number of matches with respect to vacancies.

Unemployment Benefits

The parameter b is interpreted as the income flow of unemployment. I obtain $b = .2$ as the product of unemployment benefits and coverage for the 2004–2011 period, normalised by average productivity.⁷

Social Security

Social security taxes in permanent and temporary contracts are, respectively, 29.9% and 31.1% of the wage.

Minimum Wage

The parameter w_{min} is set using information on the average minimum wage set in collective agreements (see Lacuesta et al. (2012)). For the 2004–2011 period, this minimum wage is 860 Euros. Given a median wage of 1200 Euros, the ratio between the two is 0.72, which is the ratio that is imposed in the model to parameterise $w_{min} = .72$.

To summarise, the calibration exercise involves the assignment of values to two types of parameters. The discount rate, β , the parameters of the idiosyncratic process, (μ , σ and ρ), the productivity gap parameter, γ , unemployment benefits, b , and the minimum wage, w_{min} , are set independently from the rest as they have clear counterparts in the real economy (see Table 1). In contrast, the workers' bargaining power, π , the value for the elasticity of new matches with respect to the vacancy input, η , and the cost of posting a vacancy, c_v , are set using the values estimated in the empirical studies. Abowd and Lemieux (1993) estimate $\pi = 0.33$, the value for η usually lies in the range of $[0.4 - 0.6]$, and c_v is set as 26% of the average worker productivity, which is roughly the midpoint of the estimates suggested in the literature (see Costain et al. (2010)).

The three remaining parameters, training cost, τ , experience, λ , and mismatch, A , are calibrated using the method of simulated moments. Table 2 displays the

⁷ In the 2004–2011 period, the monthly average unemployment benefits and coverages are, respectively, 758 euros and 31%. The sources of these data are the Bulletin of Labour Statistics edited by the Ministry of Labour and Social Affairs, the Spanish Labour Force Survey, and the National Employment Office.

Table 1: Calibrated Parameters

Discount factor	β	0.97
Productivity shock (mean)	μ	1
Productivity shock (autocorrelation)	ρ	0.75
Productivity shock (standar deviation)	σ	0.11
Productivity gap	γ	0.12
Unemployment benefit	b	0.2
Minimum wage	w_{min}	0.72
Bargaining power	π	0.33
Matching elasticity	η	0.51
Vacancy cost	c_v	0.26
Training cost	τ	0.6
Experience effect on productivity	λ	0.005
Mismatch degree	A	0.64

three conditions that are imposed to set these parameters. This calibration exercise shows that the initial steady-state of the model (status quo) is a good starting point for investigating the behaviour of this economy because it matches the Spanish data fairly closely.

3.3 Policy Parameters: Severance Cost Functions and Subsidies

Severance Cost Function in the Status Quo

To compute equilibrium, I need a severance cost function that represents the severance costs in Spain for the period under study. I use the following pieces of information to estimate the severance cost function in PCs: legal compensations in fair dismissals (20 days of wages p.y.o.s. with a maximum of 12 monthly wages) and unfair dismissals (45 days of wages p.y.o.s. with a maximum of 42 monthly

Table 2: Calibration Results

Statistics	Spanish Data	Status Quo
JDp	8.1	7.4
JDt	26.6	26.6
u_{dur}	11.1	12.3

JDp and JDt denote permanent and temporary job destruction, respectively.
 u_{dur} denotes unemployment duration.

wages), procedural wages⁸ of approximately two months, and the fact that, on average, 74.3% of all severance processes were declared unfair during the 2004–2011 period.⁹ Regarding the dismissal distribution, on average, 7% were collective dismissals, 20.9% were agreed upon at the units of mediation, 57.6% followed the procedure specified in Spain’s Law 45/2002, and only 14.5% involved litigation.¹⁰ Using these observations and after rearranging terms, the following final expression of the severance cost function for PCs is obtained: $s^{pc} = 44.1 \frac{w}{365} (d - 1) + 23.2 \frac{w}{365}$, where d and w denote a worker’s seniority and annual wage, respectively.¹¹ Note, in particular, that the second additive term of the severance cost function displayed in

⁸ Procedural wages are those wages associated with the interim period between a workers dismissal, contested in court, and the judge decision declaring it unfair.

⁹ The distribution of dismissals is taken from the Bulletin of Labour Statistics.

¹⁰ The number of days actually agreed upon is not made public, but this number is presumed to be very close to the legal limit. In contrast, the 2002 reform (Law 45/2002) abolished the firm’s obligation to pay procedural wages when dismissed workers appeal to labour courts as long as the firm acknowledges the dismissal as unfair and deposits the corresponding severance pay within two days of the dismissal.

¹¹ To obtain the equation displayed in the text, one needs to rearrange terms in the following expression: $s^{pc} = 7\%[45 \frac{w}{365} (d - 1) + 60 \frac{w}{365}] + 20.9\%[45 \frac{w}{365} (d - 1) + 60 \frac{w}{365}] + 57.6\%[45 \frac{w}{365} (d - 1)] + 14.5\%[74.3\%(45 \frac{w}{365} (d - 1) + 60 \frac{w}{365}) + 25.7\%(20 \frac{w}{365} (d - 1))]$, which takes into account all the information provided above.

the main text is not multiplied by tenure because this term reflects procedural wages, and legal severance costs depend on the wage. Because making the severance cost function depend on wages is computationally very difficult, I take the quality of the match as an approximation of the wage.

Regarding TCs, they entail a severance cost of eight days of wages p.y.o.s and no procedural wages. Therefore, the severance cost function for TCs is $s^{tc} = 8 \frac{w}{365} (d - 1)$. Following Güell and Petrongolo (2007), d_{max}^t is set to three periods, which has been the usual practice in Spain since the introduction of TCs in 1984.

Subsidies in the 2006 Labour Market Reform

This reform basically enlarged the group of workers that were eligible for subsidies, either through the Permanent Employment Promotion Contracts (EPCs) that were introduced in 1997, or through job conversion of TCs into PCs. In particular, firms were allowed to hire workers in the age bracket 31 – 45 under PEPCs until the end of 2007. This reform entitled the firm to a rebate of 2400 euros in payroll taxes provided the PEPC lasts for at least four periods or the TC was converted to a PC. In order to compute the model, the equations of the firm's problem must be rewritten by adding a subsidy, ζ , to the payoff of producing with the actual match and by adding a penalty, $\kappa(d)$, if the TC is destroyed before being converted to a PC or if the PEPC is destroyed before complying with the four periods. For instance, the problem of a firm with an untrained worker in a PEPC is the following

$$\begin{aligned}
 J^{pepc}(\varepsilon, d, tr_0) = & \max\{y(\varepsilon)(1 - \tau) + \zeta - w^{pepc}(\varepsilon, d, tr_1)(1 + \xi^{pc}) + \\
 & \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon) J^{pepc}(\varepsilon', d', tr_1), \\
 & y(\varepsilon)(1 - \gamma) + \zeta - w^{pepc}(\varepsilon, d, tr_0)(1 + \xi^{pc}) + \\
 & \beta \sum_{\varepsilon'} \Gamma(\varepsilon'|\varepsilon) J^{pepc}(\varepsilon', d', tr_0), \\
 & -s^{pepc}(\varepsilon, d, tr_0) - \kappa(d) - c_v + \\
 & \beta(q(\theta)J^{tc}(\varepsilon_e, 1, tr_0) + (1 - q(\theta))V)\}
 \end{aligned}$$

The rest of the equations must be adjusted accordingly.

Severance Costs and Subsidies in the 2012 Labour Market Reform

The 2012 reform implies some changes both in the PC and in the TC severance cost function. The ordinary PC severance cost function must be adjusted in two dimensions. First, the 45 days of wages p.y.o.s are replaced with 33 days of wages p.y.o.s.; second, procedural wages are eliminated because the 2012 reform abolished them. This implies the following severance cost function in PCs: $s^{pc} = 33 \frac{w}{365} (d - 1)$.¹² In addition, the TC severance cost function must be adjusted to the current level of severance costs, that is, 12 days of wages p.y.o.s., because of the progressive increase in TC severance costs (one day a year until 12 days of wages p.y.o.s. in 2015), which was introduced in the 2010 reform. This implies the following severance cost function in TCs: $s^{tc} = 12 \frac{w}{365} (d - 1)$.

On the other hand, Law 3/2012, on urgent measures for reforming the Spanish labour market, introduced a new PC, which is referred to as the “entrepreneurs’ permanent contract” (EPC), with a one-year probationary period, zero severance costs during such period and large wage subsidies for younger and older workers hired by small firms (those with fewer than 50 workers).¹³ Under the EPC, once the first period has expired, the indemnity is the same than in ordinary PCs, that is, 33 days of wages p.y.o.s., implying the following severance cost function $s^{pc} = 33 \frac{w}{365} (d - 1)$. Again, in order to compute the model, the equations of the firm’s problem must be rewritten by adding a subsidy, ζ , to the payoff of producing with the actual match and by adding a penalty, $\kappa(d)$, if the EPC is destroyed before complying with the four periods in a similar fashion as in the previous section.

4 Main Findings

This section reports the answers to the questions posed. Section 4.1 shows the status quo (SQ) values of the set of statistics of interest. Section 4.2 shows the predicted steady-state effects of the 2006 labour market reform concerning the

¹² Based on the fact that most firings in the past reached an amount very close to the legal limit, 33 days of wages p.y.o.s are set for every firing regardless of whether the dismissal is fair or unfair.

¹³ Small firms receive an annual subsidy of approximately 1,167 euros during the first 3 years if they hire under the EPC younger than 30 years of age workers or long-term unemployed over the age of 44.

provision of subsidies for permanent job creation. Section 4.3 shows the predicted steady-state effects of the 2012 labour market reform concerning the reduction in the severance cost gap between PCs and TCs and the introduction of the EPC. And, finally, Section 4.4 discusses the need of designing penalties when subsidizing permanent job creation.

4.1 The Status Quo

Table 3 shows the status quo values of the statistics of interest: the unemployment rate and tenure distribution. The unemployment rate, u , is slightly higher when compared with the actual data.¹⁴ Regarding tenure distribution, the model reproduces reasonably well the average tenure for those employed with a tenure equal to or under six years, $\bar{d}_{d \leq 6}$, in the SQ. In fact, the model is able to reproduce quite accurately the proportion of workers, n_d , with seniorities $d = 2$, $d = 3$, $d = 4$ and $d = 5$, but it underestimates the proportion of workers with a tenure equal to or under one year, $n_{d=1}$.¹⁵

4.2 Steady-state Effects of the 2006 Labour Market Reform

This section shows the steady-state effects of the 2006 labour market reform (R-2006) focusing on the effects on unemployment rates, job destruction and the tenure distribution. Column 3 in Table 4 indicates that the 2006 labour market reform generates a 38.2% reduction of unemployment, from 17.3% to 10.7%. The main force driving this result is the fact that firms will train workers sooner than in the status quo, where workers only receive training in period four, once their TC has been converted into a PC. The provision of a subsidy for permanent job creation induces firms to bring forward their human capital investment and to train workers in the most productive matches in periods two and three, which translates into a lower job destruction rate at the beginning of periods two and three,

¹⁴ For comparability with the data, which include only workers affiliated with social security, the unemployment rate is computed by excluding from the employment series public servants who do not contribute to social security (those affiliated with MUFACE, the special regime for public servants).

¹⁵ This underestimation may be because, in reality, some low productivity matches may be destroyed immediately once their productivity is realised and not after one year, as it is assumed in this model.

Table 3: Data and Status Quo

Statistics	Data	Status Quo
u	14.6	17.3
JD	11.5	12.6
$n_{d=1}$	25.8	20.4
$n_{d=2}$	15.7	15.8
$n_{d=3}$	11.4	11.1
$n_{d=4}$	8.6	7.8
$n_{d=5}$	6.8	7.6
$\bar{d}_{d \leq 6}$	1.94	1.96
$\bar{d}_{d \leq 10}$	3.05	3.83

$n_{d=i}$ stands for the proportion of workers in period i and $\bar{d}_{d \leq 6}$ stands for the average tenure for those employed with a tenure equal to or under six years.

$JD_{d=2}$ and $JD_{d=3}$. Moreover, given the fact that some temporary workers already received training and, therefore, are much more productive than in the status quo, job destruction at the beginning of period four, $JD_{d=4}$, decreases by 60%. As a result, the temporary job destruction rate decreases by 65.5%, from 26.6% to 9.2%, and the tenure distribution becomes smoother (see Figure 1). In particular, the proportion of workers with a tenure of more than three years increases by 19.4%, from 52.7% to 62.9%.

Concerning the temporary employment rate, the model predicts a reduction of ten percentage points. Since these are steady states results, it is difficult to compare with the actual numbers. In fact, from the date the 2006 labour market reform was approved until 2008 there was a substantial reduction in the temporary employment rate, from 34.4% in 2006 to 29.4% in 2008. However, it is hard to disentangle whether this drop in the temporary job destruction rate was actually due to the rebates that were awarded during that transitory period or to the large

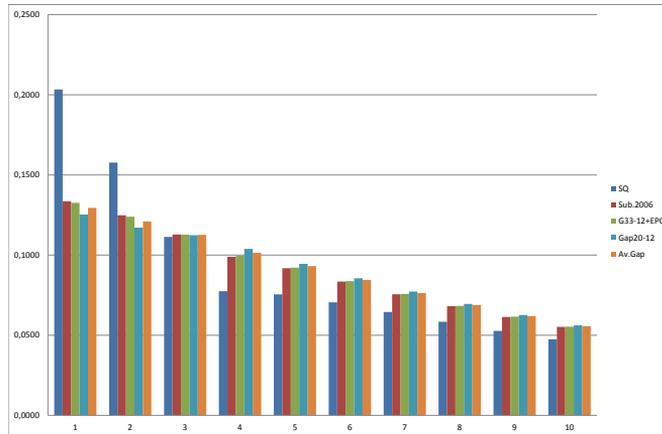


Figure 1: Tenure Distribution

destruction of temporary jobs in the construction industry, due to the burst of the housing bubble.

4.3 Steady-state Effects of the 2012 Labour Market Reform

This section shows the steady-state effects of the 2012 labour market reform (R-2012) concerning the changes in PCs and TCs employment protection and the introduction of a new subsidized permanent contract, the EPC. Table 4 shows that the sole reduction in the severance costs gap introduced in the 2012 labour market reform is as effective as the type of subsidies for permanent job creation introduced in the 2006 labour market reform.¹⁶ Aggregate job destruction, JD , decreases by 30.5%, as a result of a simultaneous increase in the permanent job destruction rate (JDp) and a decrease in the temporary job destruction rate (JDt). The temporary job destruction rate decreases as a result of two forces. First, the higher TCs severance costs induce less job destruction and more training in periods

¹⁶ The results of both scenarios are displayed in Column 3 in Table 4.

Table 4: Effects of the 2006 and 2012 Labour Market Reforms

Statistics	SQ Gap 45 – 8	R-2006 or R-2012 Gap 33 – 12	R-2012 Gap 33 – 12 + EPC	R-2012 Gap 20 – 12	R-2012 Gap 33 – 12 Gap 20 – 12
<i>u</i>	17.3	10.7	10.5	9.0	9.8
<i>u_{dur}</i>	12.3	10.8	10.7	10.3	10.5
<i>JD</i>	12.6	8.8	8.7	8.2	8.5
<i>JD_p</i>	7.4	8.6	8.7	9.0	8.8
<i>JD_t</i>	26.6	9.2	8.8	6.0	7.6
<i>JD_{d=2}</i>	22.3	6.5	6.5	6.5	6.5
<i>JD_{d=3}</i>	29.6	9.4	8.7	4.1	6.7
<i>JD_{d=4}</i>	30.4	12.2	11.7	7.5	9.9
<i>temp</i>	37.3	27.2	27.0	25.5	26.3
<i>n_{d=1}</i>	20.4	13.4	13.3	12.5	12.9
<i>n_{d=2}</i>	15.8	12.5	12.4	11.7	12.1
<i>n_{d=3}</i>	11.1	11.3	11.3	11.2	11.3
<i>n_{d=4}</i>	7.8	9.9	10.0	10.4	10.1
<i>n_{d=5}</i>	7.6	9.2	9.2	9.5	9.3
<i>n_{d=6}</i>	7.0	8.4	8.4	8.6	8.5
<i>n_{d=7}</i>	6.4	7.6	7.6	7.7	7.6
<i>n_{d=8}</i>	5.8	6.8	6.8	7.0	6.9
<i>n_{d=9}</i>	5.3	6.1	6.2	6.3	6.2
<i>n_{d=10}</i>	4.7	5.5	5.5	5.6	5.6
<i>n_{d>3}</i>	52.7	62.9	63.1	64.5	63.7
<i>n_{d>10}</i>	8.1	9.4	9.4	9.6	9.5

JD_{d=i} stands for job destruction at the beginning of period *i*.

n_{d=i} stands for the proportion of workers in period *i*.

temp stands for the temporary employment rate.

two and three: $JD_{d=2}$ changes from 22.3% to 6.5% and $JD_{d=3}$ changes from 29.6% to 9.4%. And second, the lower gap in severance costs, and the fact that some temporary workers have received training makes firms more prone to convert TCs into PCs: the job destruction rate in period four, $JD_{d=4}$, changes from 30.4% to 12.2%.

The opposite happens, however, for the permanent job destruction rate, which increases by 16%, from 7.4% to 8.6%, because firing permanent workers has become cheaper. These changes in job destruction rates have an impact on tenure distribution (see Figure 1). The proportion of workers with tenure equal to or under one year, $n_{d=1}$, is 34.3% lower than in the SQ, and the proportion of workers with tenure of more than three years, $n_{d>3}$, increases by 19.4%.

Adding the EPC to the reduction in the severance cost gap introduced by the 2012 labour market reform (see Column 4 in Table 4) hardly reduces the unemployment and the temporary job destruction rate more than in the previous scenario because only 12% of the contracts are of the EPC type. In fact, if only EPC contracts could be signed the unemployment rate predicted by the model would be 9% and the probability of being fired in contracts with a tenure equal to or below three years would decline by 2.2 additional points with respect to the previous scenario, from 8.8% in the scenario displayed in Column 4 to 6.0%.¹⁷ These additional reductions in the unemployment rate and in the probability of being fired in contracts with a tenure equal to or below three years are the result of an additional decrease in the job destruction rates at the beginning of period three and four, $JD_{d=3}$ and $JD_{d=4}$. These, in turn, are due to a better trained workforce and to the EPC subsidy, both of which raise the value of the match to the firm.

Column 5 in Table 4 shows the results of a further reduction in the severance cost gap to 8 days of wages p.y.o.s. The reason why this scenario may be of interest is because the 2012 labour market reform, in addition to the reduction in the severance cost gap in the case of unfair dismissals and the introduction of the EPC, has also made economic dismissals (with an entitlement of 20 days of wages p.y.o.s) easier to prove. The new definition of dismissals due to economic reasons will

¹⁷ Note that, strictly speaking, we cannot talk about JDt in an scenario with EPCs because the EPC is a PC. The equivalent concept is the probability of being fired in contracts with a tenure equal to or below three years.

allow firms with financial difficulties to make use of them more easily. Assuming an extreme situation, in which all the dismissals took place following this route, the reduction in the unemployment rate and in the temporary job destruction rate would be 48% and 77.3%, respectively. This additional reductions in the unemployment rate and in the temporary job destruction rate are due to the reduction in the job destruction rates at the beginning of periods three and four, $JD_{d=3}$ and $JD_{d=4}$, generated by the fact that TCs have become relatively more expensive and PCs relatively cheaper, which tends to induce more training in the early durations, and therefore also increase job conversion even more than in the previous scenario.

The results shown in Column 5 could be considered as an upper bound of the effects of the 2012 labour market reform concerning the adjustments on the external margin. Based on recent data on economic dismissals, a more reasonable assumption would be to consider that only half of them take this route. Column 6 in Table 4 displays the results for this case. In terms of the unemployment rate and the job destructions statistics the changes are a bit larger than those displayed in Column 4.

Just as a first approximation, one could say that if the 2012 labour market reform was effective in making dismissals for objective reasons easier to implement and, therefore, effectively reduced the severance cost gap between PCs and TCs to an average of 15 days of wages p.y.o.s (see Column 6), the introduction of the EPC may have been unnecessary. In fact, the data seems to confirm this assertion, because, on one hand the number of EPC contracts signed since the introduction of the 2012 labour market reform has been quite low and, on the other hand, economic dismissals have substantially increased.

4.4 Designing an Appropriate Penalty

As was mentioned in the calibration Section, under the subsidy policies analyzed in this paper, firms are assumed to pay a penalty if they do not keep the subsidized contract operating for a sufficiently long number or periods, or if they do not convert the TC into a PC. In fact, without penalties, the results would have been very different. For the 2006 labour market reform, Table 5 shows that the unemployment rate, the aggregate job destruction rate and the temporary job destruction rates are much higher in the scenario without penalties (see Columns 3 and 4 in Table 5).

Table 5: Penalty Design in the 2006 and 2012 Labour Market Reforms

Statistics	SQ	R-2006 penalty	R-2006 no penalty	R-2012-EPC yearly penalty	R-2012-EPC end penalty
<i>u</i>	17.3	10.7	15.7	9.0	9.8
<i>JD</i>	12.6	8.8	11.6	8.2	8.6
<i>JD_p</i>	7.4	8.6	7.4	9.0	8.9
<i>JD_t</i>	26.6	9.2	23.1	6.0	7.5
<i>JD_{d=2}</i>	22.3	6.5	6.6	6.5	6.5
<i>JD_{d=3}</i>	29.6	9.4	35.7	4.1	9.4
<i>JD_{d=4}</i>	30.4	12.2	30.9	7.5	6.5
<i>n_{d=1}</i>	20.4	13.4	18.7	12.5	13.0
<i>n_{d=2}</i>	15.8	12.5	17.4	11.7	12.1
<i>n_{d=3}</i>	11.1	11.3	11.2	11.2	11.0
<i>n_{d=4}</i>	7.8	9.9	7.7	10.4	10.2
<i>n_{d=5}</i>	7.6	9.2	7.6	9.5	9.4
<i>n_{d=6}</i>	7.0	8.4	7.0	8.6	8.5
<i>n_{d=7}</i>	6.4	7.6	6.4	7.7	7.7
<i>n_{d=8}</i>	5.8	6.8	5.8	7.0	6.9
<i>n_{d=9}</i>	5.3	6.1	5.3	6.3	6.2
<i>n_{d=10}</i>	4.7	5.5	4.8	5.6	5.6
<i>n_{d>3}</i>	52.7	62.9	52.7	64.5	64.0
<i>n_{d>10}</i>	8.1	9.4	8.1	9.6	9.6

If there is no penalty, job destruction rates at the beginning of periods three and four, $JD_{d=3}$ and $JD_{d=4}$, are much higher than in the scenario where there exists a penalty, because firms do not have to give back the subsidy if they destroy those jobs.

Even the design of the penalty is not innocuous. For instance, in the case of the 2012 labour market reform, the results when the penalty is imposed on a yearly basis (see Column 5 in Table 5) are different from the results when the penalty is only due if the contract does not last for at least four periods (see Column 6 in Table 5). In this last case, job destruction at the beginning of period three, $JD_{d=3}$, is much higher because firms know that job destruction in period three is not penalised. However, the fact that the job is destroyed one period later (at the beginning of period four) may have huge consequences in terms of the penalty, since the subsidies received would have to be given back. Thus, in terms of the match productivity, firms are much more demanding at the beginning of period three ($JD_{d=3}$ is higher) because they want to maximize the probability that they will not have to return the subsidy enjoyed. On the contrary, when the penalty is imposed on a yearly basis, firms are less reluctant to continue operating with the temporary worker in period three ($JD_{d=3}$ is lower) but, at the same time, it is less likely that the EPC lasts for four periods ($JD_{d=4}$ is higher) because the penalty is just the one associated with not having maintained the working relationship for one additional year. In the end, balancing these countervailing effects, it turns out that the temporary job destruction rate is lower in the scenario where the penalty is imposed on a yearly basis (see Column 5) and, therefore, also the unemployment rate.

The results also suggest that among the two policies that involve subsidies (subsidies that are in fact very similar in magnitude) the EPC is a much more effective strategy than the strategy introduced in the 2006 labour market reform, basically because of the change in the structure of severance costs and also because of the timing of the subsidy provision. While in the case of the 2006 labour market reform firms with TCs only received the subsidy once the TC was converted into a PC, in the case of the EPC the subsidy is provided on a yearly basis.

5 Conclusion

Triggered by the enormous increase in unemployment rates during the “Great Recession” and by the perverse consequences of duality in some Southern European countries, governments in these countries have recently opted for combining reductions in the severance costs gap between permanent (PCs) and temporary contracts (TCs) with some fiscal measures, such as tax rebates in the case of job conversion of TCs into PCs or subsidies for permanent job creation. This paper has evaluated the effectiveness of these measures in reducing the unemployment rate and the degree of segmentation in dual labour markets. For this purpose, an equilibrium search and matching model and the Spanish labour market reforms have been used as a benchmark. This rich structural model allows us to understand firms’ labour adjustment decisions in the face of temporary shocks to demand when dismissal costs and those associated with losing firms’ human capital are relevant.

The results point to fact that subsidizing permanent job creation may not be the best option from a fiscal point of view to reduce labour market segmentation between PCs and TCs. It is true that subsidies may have proved successful in the case of the 2006 labour market reform, by partly accounting for the decrease in the temporary employment rate, as the model shows. However, the model also suggests that a much more efficient way to fight against the duality in the labour market would be to reduce the severance costs gap between these two type of contracts to a number close to eight days of wages p.y.o.s, so that the effective indemnity be closer to the mean European indemnity, which is around 20 days of wages p.y.o.s. It is probably too early to judge whether the 2012 labour market reform has been successful in that respect. It is true that economic dismissals have increased, but this is not surprising given the bad economic situation that the Spanish economy has suffered. It remains to be seen whether during the recovery the tendency for firms to pay indemnities closer to those for unfair cases has really changed. Finally, the model also shows the relevance of designing appropriate penalties for those firms that do not comply with the obligations that the subsidies involve.

There is an important caveat that should be mentioned. In this paper adjustments along the intensive margin were not allowed. As was stated in the introduction, the 2012 labour market reform also introduced important changes

in the degree of internal adjustment.¹⁸ In a companion paper, García-Pérez and Osuna (2015) find that the availability of short-time work schemes, if properly subsidized, further reduces unemployment and the degree of segmentation between TCs and PCs. Of course, then the question is whether the increase in welfare may compensate for the fiscal cost, a question that the authors address by computing the transition in order to perform a cost benefit analysis.

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