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Abstract

This paper evaluates the effectiveness of short-time work (STW) schemes for preserving jobs and reducing the segmentation between stable and unstable jobs observed in dual labour markets. For this purpose, we develop and simulate an equilibrium search and matching model considering the situation of the Spanish 2012 labour market reform as a benchmark. Our steady-state results show that the availability of STW schemes does not necessarily reduce unemployment and job destruction. The effectiveness of this measure depends on the degree of subsidization of payroll taxes it may entail: with a 33% subsidy, we find that STW is quite beneficial for the Spanish economy because it reduces both unemployment and labour market segmentation. We also perform a cost-benefit analysis that shows that there is scope for Pareto improvements when STW is subsidized. Again, the STW scenario with a 33% subsidy on payroll taxes seems the most beneficial because more than 57% of workers improve. These workers also experience a significant increase in annual income that could be used to compensate the losers from this policy change and the State for the fiscal balance deterioration. This reform saves the highest number of jobs and has the lowest deadweight costs.

Keywords: Permanent and Temporary Contracts; Duality; Severance Costs; Short-time Work; Unemployment; Tenure Distribution; Job Destruction

JEL Code: J23, J32, J63, J64, J65, J68

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RESUMEN (NON TECHNICAL SUMMARY)

En este trabajo se evalúa la eficacia de los Expedientes de Reducción de Empleo basados en la reducción de la jornada de trabajo autorizados de manera completa tras la Reforma Laboral de 2012 en España. El objetivo de esta medida de flexibilidad interna es la conservación de puestos de trabajo cuando la empresa afronta dificultades de demanda que le obligan a ajustar el uso del factor trabajo en su proceso de producción. Esta medida se adoptó en una reforma donde, a la vez se llevaron a cabo diversas medidas de flexibilidad externa basadas en la reducción del coste de indemnización por despido a la vez que se introdujeron nuevas formas de contratación con el fin de reducir la segmentación entre empleos temporales e indefinidos que existe en España desde hace décadas.

Con este fin, desarrollamos y simulamos un modelo de búsqueda en equilibrio y se contrasta el modelo mediante técnicas de simulación numérica. El punto de partida es el equilibrio estacionario derivado de la situación en el mercado de trabajo español bajo el diseño institucional existente antes de la reforma de 2012. En comparación se simula el nuevo equilibrio que resultará cuando solo se adoptan las medidas de flexibilidad externa y, en segundo lugar, cuando a éstas se añaden las medidas de flexibilidad interna y que básicamente consisten en permitir a las empresas reducir unilateralmente la jornada de trabajo semanal a cambio de reducciones en el salario y, en algunos casos, con la percepción de bonificaciones en la cotización a la Seguridad Social que debe pagar el empresario.

Nuestros resultados muestran que la mera existencia de estas medidas de flexibilidad interna no reducen necesariamente el nivel de equilibrio en la tasa de desempleo de la economía al no producirse una reducción significativa en la tasa de destrucción de empleo. La eficacia de esta medida depende fundamentalmente del grado de subvención de las cotizaciones a la seguridad social que reciba el empresario. Así por ejemplo, con un subsidio del 33% a dichas cotizaciones, nos encontramos con las medidas de flexibilidad interna consiguen resultados bastante beneficiosos porque se reduce el desempleo (en un 24%) y la tasa agregada de destrucción de empleo (en un 28%). Por otra parte, la dualidad en el mercado laboral, medida como la reducción en la tasa de destrucción de empleo temporal, disminuye fuertemente, y la distribución de la antigüedad en la empresa se suaviza considerablemente al reducirse los empleos de muy corta duración y aumentar los que tienen duraciones de más de cuatro años.

Por último, realizamos un ejercicio de simulación para la transición desde el equilibrio pre-reforma al existente tras la implementación completa de la reforma aprobada. Los resultados de este ejercicio muestran que todos los escenarios de la reforma son Pareto eficientes, es decir, en la mayoría de los casos aumenta el bienestar de la mayoría de los agentes y cuando disminuye el bienestar de algún grupo poblacional existe la posibilidad de establecer una subvención a tanto alzado para compensar la pérdida de bienestar de dicho grupo. Así, concretamente, en el escenario con flexibilidad interna y subvenciones a las cotizaciones sociales del 33%, más del 57% de los trabajadores mejoran respecto a la situación actual. También experimentan un aumento significativo los ingresos anuales del sistema que podrían ser utilizados para compensar a los perdedores de este cambio de política y al Estado para compensar por el mayor gasto público vía subvenciones.

1 Introduction

There is some consensus about the fact that some labour markets, with Germany as the best example, have coped reasonably well with what is now referred to as the "Great Recession" (see, e.g. Hijzen and Martin, 2012; and Hijzen and Venn, 2011). Part of the reason for this adjustment has to do with the availability by the beginning of the crisis of short-time work (STW) schemes that helped to preserve jobs and, more importantly, firms' specific human capital. STW schemes also prevented aggregate demand from falling prey to a global decrease in production (see, e.g. Caliendo and Hogenacker, 2012; Contesi and Li, 2013; Möller, 2010; and Rinne and Zimmermann, 2012).

On the contrary, in countries such as Spain, modifying hours and wages was virtually impossible at the beginning of the crisis. This fact, together with the dual structure present in the Spanish labour market, has led to the highest rate of job destruction in the Euro Area (EA), particularly with regard to temporary jobs. This situation has also generated an enormous increase in unemployment, from 8% in 2007 to 25% in 2012.[1] Furthermore, the long-lasting duration of the crisis has generated a disproportionate rise in long-term unemployment with corresponding and worrisome deterioration in workers' skills.

It was only in 2010 and, more importantly, in 2012 that the Spanish government introduced major changes concerning internal flexibility.[2] 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, STW mechanisms have been made easier to implement due to the elimination of administrative approval for working-week reductions due to economic reasons of between 10% and 70%; these reductions have also been partially subsidized by the introduction of payroll taxes rebates for firms. In addition, the Unemployment Benefit System pays a subsidy to workers on STW so that their wage do not fall proportionally with the fall in hours.[3] These legal changes have generated an increase in the percentage of workers affected by STW mechanisms, especially from 2010 onwards (see Figure 1). Moreover, these reforms have introduced important changes in the system of collective wage bargaining agreements that have improved the way firms adapt to changing economic conditions, thereby preserving their specific in-

[1] In fact, the gap between the severance payments of workers with PCs (45 days of wages per year of seniority (p.y.o.s.) for unfair dismissal) and temporary workers (8 days of wages p.y.o.s.) accounts for almost 61% of total job destruction over the 2008-2012 period, when temporary contracts (TCs) were used as the basic adjustment mechanism (see Bentolila et al., 2012.)

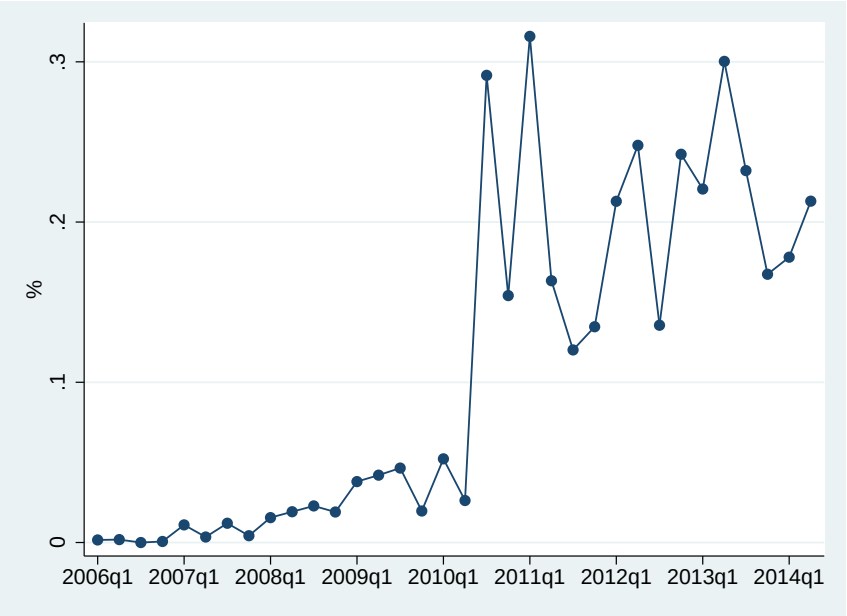
[2] External flexibility was also increased in 2012 through a considerable reduction in the severance cost gap for unfair dismissals, from 37 to 21 days of wages p.y.o.s. The indemnity of workers with PCs decreased from 45 to 33 days of wages p.y.o.s. and became closer to the mean OECD compensation, which is 21 days of wages p.y.o.s, (see OECD, 2013), whereas the indemnity of workers with TCs increased from 8 to 12 days of wages p.y.o.s.

[3] Other flexibility measures introduced by these reforms involved the possibility of unilaterally modifying working conditions, such as hours worked and wages for economic, technical or productivity reasons, and redistributing 10% of weekly hours on a yearly basis.

vestment in human capital.[4]

In García-Pérez and Osuna (2014), we evaluated the effects of the Spanish 2012 labour market reform on changes in employment protection. In this paper, we add the availability of STW schemes to evaluate the effectiveness of these policies for preserving jobs and reducing the segmentation in dual labour markets, using Spain as a benchmark.

Figure 1: Percentage of workers involved in STW schemes (over total number of workers affected by collective dismissal and/or retrenchment procedures)



The objective of this paper is twofold. First, we compute the steady-state effects on unemployment, job destruction and the tenure distribution of the 2012 Spanish labour market reform with regard to the reduction in severance costs and the availability of STW to illustrate the effectiveness of these schemes. Second, we perform a transition exercise to evaluate the changes in welfare and the costs of these policies to be able to talk about distributional issues.

Accordingly, we use an equilibrium model of job creation and destruction of the search and matching type that extends the one proposed in García-Pérez and Osuna (2014). The ingredients of that model, 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

[4]First, priority has been given to firms' own collective agreements; second, opt-out clauses have been introduced for firms experiencing economic difficulties; and third, the automatic extension of collective agreements once they expire has been reduced to one year.

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.[5] In this paper, we add the possibility of reducing the number of hours worked using STW schemes. In this labour market, firms will be heterogeneous agents and use these two types of contracts as well as the number of hours worked to endogenously adjust their employment levels when facing idiosyncratic persistent shocks. We follow Mortensen and Pissarides (1994) by assuming one-job firms.

There are only a few papers that address the theoretical effects of STW mechanisms. In most of them, the presence of production technologies that allow for some substitutability between workers and hours worked per employee imply that in the absence of STW arrangements, shocks that temporarily reduce demand are typically accommodated by reducing the number of workers rather than by work-sharing, inducing excessive layoffs from an efficiency point of view (see Boeri and Brucker, 2011; Burdett and Wright, 1989; Fitzroy and Hart, 1985; and Rosen, 1985). In addition, Abraham and Houseman (1994), Walsh et al. (2007) and Vroman and Brusentev (2009) emphasize that STW schemes are more equitable because they distribute the adjustment burden over a large number of workers.

These studies also note that STW schemes are likely to have more of an impact in the presence of relatively large fixed costs per worker, such as strong employment protection or experience-rated unemployment benefits, which increase the relative costs of external adjustment, whereas generous unemployment benefits would operate in the opposite direction.

On the contrary, the empirical literature is large, and results are mixed. Most papers address the effectiveness of STW in stabilising employment focusing on the "Great Recession" and on how well Germany has coped with it in comparison with other countries (see, e.g, Arpaia et al., 2010). In contrast, Bellman et al. (2012) for Germany and Calavrezo et al. (2009) for France find no evidence that STW increased labour hoarding by reducing layoffs. Boeri and Brucker (2011) and Hijzen and Venn (2011) find that the number of jobs saved is smaller than the full-time equivalent jobs involved by these programmes, pointing, in some cases, to sizeable deadweight costs. In addition, Brenke et al. (2012) indicate that the astonishing results of the German case cannot be transferable to other countries due to differences in other labour market institutions, such as employment protection legislation (EPL) and collective bargaining, which interact with STW. Möller (2010) adds to this examination the different weight that German firms may attribute to the loss of human capital given their export-oriented character, the scarcity of high-skilled workers and the high training costs. On the contrary, Cahuc and Carcillo (2011) indicate that countries that do not have these programmes could benefit from their introduction and favour including an experience-rating component in their design to reduce inefficient reductions in working

[5] 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.

hours that could hinder the necessary reallocation and future growth and to eliminate the perverse consequences on the prospects of outsiders if used too intensively. Hijzen and Venn (2011) warn about the increase in labour market segmentation induced by these measures, whereas Scholz (2012) finds that fears that STW is mainly applied to a certain group of workers are not confirmed.

To our knowledge, the effectiveness of STW schemes has not been theoretically analyzed using a search and matching dynamic framework. The previously mentioned literature has emphasised the importance of the dynamic dimension 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. Furthermore, there is no consensus about the effects of these measures for outsiders in a dual labour market. Therefore, it is not straightforward that STW is beneficial for the Spanish labour market because of the significant labour segmentation between PCs and TCs,[6] which introduces interesting distributional considerations. It may be the case that the availability of STW makes firms more prone to convert TCs into PCs because of the possibility of adjusting hours instead of adjusting permanent employment, which is very costly. Alternately, as in Hijzen and Venn (2011), firms may end up using STW schemes only for workers on PCs and use TCs to adjust employment because they are very cheap. This is precisely where the dynamic considerations presented above play a central role. The answer may depend on the structural characteristics of a particular economy and on the nature of the crisis. In this paper, we address these distributional issues and analyze the extent to which the 2012 reform and other STW schemes are able to reduce the duality of the Spanish labour market.

Our results show that the 2012 Spanish labour market reform, with regard to the reduction in severance costs, reduces steady-state unemployment and the aggregate job destruction rates by 11% and 6%, respectively, and smoothes the tenure distribution. Adding the availability of a short-time work policy does not result in a higher reduction in both the unemployment and job destruction rates unless payroll taxes are subsidised because the reduction in the wage does not compensate for the loss in production. In fact, when firms have to pay full social security taxes irrespective of the reduction in hours of work unemployment does not decrease further than under considering only the 2012 reduction in severance costs. Only when payroll taxes are subsidized, for instance by 33%, unemployment in full-time equivalent terms and aggregate job destruction drop substantially, by 24% and 28%, respectively, because now firms find it profitable to use this additional margin of adjustment instead of firing workers. Furthermore, duality in the labour market, measured as the reduction in the temporary job destruction rate, strongly decreases, and the tenure distribution becomes much smoother than in the scenario where only the severance cost is reduced. Finally, the transition shows that all the reform scenarios are Pareto improving: when welfare decreases, a lump sum subsidy could be used to compensate for the welfare loss; when the fiscal balance deteriorates, a lump sum tax could be levied on individuals. In the STW scenario with a 33% subsidy on payroll taxes, more than 57% of workers im-

[6] According to the European Labour Force Survey, the share of temporary workers over total employment in the last decade was 32.1% in Spain, whereas it was only 14.4% in the European Union.

prove. They also experience a significant increase in annual income that could be used to compensate the losers from this policy change and the State for the fiscal balance deterioration. This is the reform that saves the highest number of jobs and has the lowest deadweight costs.

The paper is organised as follows. In Section 2, we present the model. In Section 3, we discuss its calibration. In Section 4, we evaluate the reform and perform a sensitivity analysis. Finally, in Section 5, we draw some conclusions.

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, we do not consider being out of the labour force 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. We assume free entry.

The source of heterogeneity is due to the existence of matches with different quality levels and durations. Therefore, the state space that describes the situation of a particular worker is $S = \{\{0,1\} \times \mathscr{E} \times D\}$, where $\mathscr{E} = \{\varepsilon_1, ..., \varepsilon_n\}$ is a discrete set for the quality levels and $D = \{1, ..., N\}$ is also a discrete set denoting the duration of a job (worker's seniority). Each triple indicates whether the worker is unemployed (0) or employed (1), the quality and the duration of the match.

2.2 Preferences

Workers have identical preferences, live infinitely and maximise their utility, which is taken to be linear in consumption. We assume 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 ε, $\varepsilon' \in \mathscr{E} = \{1, 2, ..., n_\varepsilon\}$. 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. We assume that agents know the law of motion of the process and observe their realisations at the beginning of the period.

Matching Technology

In each period, vacancies and unemployed workers are stochastically matched. We assume the existence of a 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[7]. 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 three options: i) to continue producing with the current match, working at standard hours, ii) to continue producing with the current match at a reduced number of hours, or iii) to terminate the match and dismiss the worker. The nature of the problem depends on whether the firm has a PC or a TC. PCs entail high severance costs that depend on the quality of the match and on the duration of the contract, whereas severance costs for TCs also depend 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. We will assume that a TC cannot last more than d^t_{max} periods, and thus the maximum number of renewals is $d^t_{max} - 1$. Therefore, firms whose TCs cannot be renewed decide between these three options: i) to convert the TC into a full-time PC, taking into account the consequences regarding future severance costs, ii) to convert the TC into a PC at a reduced number of hours, or ii) to terminate the match. Once all these decisions have been made, production starts 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 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.

[7]The model is solved as in García-Pérez and Osuna (2014) using a fixed point algorithm and value function iteration.

2.4.1 Vacancy Creation

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

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

where V is the value of a vacant job, $J^{tc}(\varepsilon_e, 1)$ 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.

2.4.2 The Firm's Problem

The problem of firms with TCs

The problem of a firm with a TC, whose length at the end of the last period was less than d^t_{max}, is

$$\begin{aligned} J^{tc}(\varepsilon, d) \quad = \quad & max\{y(\varepsilon)(1-\gamma)h_{ft} - w^{tc}_{ft}(\varepsilon, d) - \xi^{tc}(w^{tc}_{ft}, w^{tc}_{pt}) + \beta \sum_{\varepsilon\prime} \Gamma(\varepsilon\prime|\varepsilon) J^{tc}(\varepsilon\prime, d\prime), \\ & y(\varepsilon)(1-\gamma)h_{pt} - w^{tc}_{pt}(\varepsilon, d) - \xi^{tc}(w^{tc}_{ft}, w^{tc}_{pt}) + \beta \sum_{\varepsilon\prime} \Gamma(\varepsilon\prime|\varepsilon) J^{tc}(\varepsilon\prime, d\prime), \\ & -s^{tc}(\varepsilon, d-1) - c_v + \beta(q(\theta)J^{tc}(\varepsilon_e, 1) + (1 - q(\theta))V)\} \end{aligned} \tag{2}$$

$$g^{tc}(\varepsilon, d) = \begin{cases} h_{ft} & \text{if the full-time match continues} \\ h_{pt} & \text{if the match continues at a reduced number of hours} \\ 0 & \text{if the worker is fired} \end{cases}$$

where $J^{tc}(\varepsilon, d)$ and $J^{tc}(\varepsilon\prime, d\prime)$ are, respectively, the firm's value function for this period and the next period when there is a TC, $y(\varepsilon)(1-\gamma)$ is output, h_{ft} and h_{pt} are standard hours (full-time job) and reduced hours (part-time job), respectively, $w^{tc}_{ft}(\varepsilon, d)$ and $w^{tc}_{pt}(\varepsilon, d)$ are full-time and part-time wages, $\xi^{tc}(w^{tc}_{ft}, w^{tc}_{pt})$ is a function that represents social security taxes paid by the firm in TCs, $\Gamma(\varepsilon\prime|\varepsilon)$ is the conditional transition probability for the match quality and $s^{tc}(\varepsilon, d-1)$ is the severance cost. As in García-Pérez and Osuna (2014) and based on Spanish evidence (Albert et al. (2005) or Dolado et al. (2012)), we assume that temporary workers are less productive than permanent workers, and we introduce this feature through a productivity gap, γ. Note that a greater value of ε increases output. In contrast, wages and severance costs are both increasing in ε and d.

If it is more profitable to continue with the actual match working standard hours (first row greater than second and third rows in Equation 2), the decision rule will be $g^{tc}(\varepsilon, d) = h_{ft}$, and the full-time match will continue. If it is more profitable to continue with the actual match at a reduced number of hours, $g^{tc}(\varepsilon, d) = h_{pt}$. Otherwise, $g^{tc}(\varepsilon, d) = 0$, and the worker will be fired, whereby the firm incurs the severance cost, $s^{tc}(\varepsilon, d-1)$, plus the

vacancy cost. 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 prospective permanent contracts (PPCs)

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, $d = d^t_{max} + 1$, where $d^t_{max} + 1$ denotes the first period in a PC, and severance costs are given by $s^{tc}(\varepsilon, d-1)$ because if the worker is not promoted, the severance cost corresponds to the period the worker has spent on a TC. As in García-Pérez and Osuna (2014), based on the evidence (see Albert et al. (2005), for example), we assume that firms incur a training cost, τ, in the first period of a PC that reduces the productivity of the job in that period. This problem can thus be written as

$$\begin{aligned} J^{ppc}(\varepsilon,d) \quad = \quad & max\{y(\varepsilon)(1-\tau)h_{ft} - w^{ppc}_{ft}(\varepsilon,d) - \xi^{pc}(w^{ppc}_{ft}, w^{ppc}_{pt}) + \beta \sum_{\varepsilon\prime} \Gamma(\varepsilon\prime|\varepsilon) J^{pc}(\varepsilon\prime, d\prime), \\ & y(\varepsilon)(1-\tau)h_{t} - w^{ppc}_{pt}(\varepsilon,d) - \xi^{pc}(w^{ppc}_{ft}, w^{ppc}_{pt}) + \beta \sum_{\varepsilon\prime} \Gamma(\varepsilon\prime|\varepsilon) J^{pc}(\varepsilon\prime, d\prime), \\ & -s^{tc}(\varepsilon, d-1) - c_v + \beta(q(\theta) J^{tc}(\varepsilon_e, 1) + (1-q(\theta))V)\} \end{aligned} \tag{3}$$

$$g^{ppc}(\varepsilon,d) = \begin{cases} h_{ft} & \text{if the firm promotes the worker to a full-time job} \\ h_{pt} & \text{if the firm promotes the worker to a part-time job} \\ 0 & \text{if the worker is fired} \end{cases}$$

where $J^{ppc}(\varepsilon,d)$ and $J^{pc}(\varepsilon\prime,d\prime)$ are, respectively, the firm's value function for this and the next period, $y(\varepsilon)(1-\tau)$ is output, $\xi^{pc}(w^{ppc}_{ft}, w^{ppc}_{pt})$ represents social security taxes paid by the firm and $w^{ppc}(\varepsilon,d)$ is the wage. This equation has an analogous interpretation to the previous one. If it is more profitable to continue with the actual match working standard hours, the decision rule will be $g^{ppc}(\varepsilon,d) = h_{ft}$, and the TC will be converted to a full-time PC. If it is more profitable to continue with the actual match at a reduced number of hours, $g^{ppc}(\varepsilon,d) = h_{pt}$. Otherwise, $g^{ppc}(\varepsilon,d) = 0$, and the worker will be fired.

The problem of firms with existing PCs

A firm with a PC must decide whether to continue with the actual match, either at the standard or reduced number of hours, or to dismiss the worker and search for a new one. This problem can be written as

$$\begin{aligned} J^{pc}(\varepsilon,d) \quad = \quad & max\{y(\varepsilon)\Lambda(d)h_{ft} - w^{pc}_{ft}(\varepsilon,d) - \xi^{pc}(w^{pc}_{ft}, w^{pc}_{pt}) + \beta \sum_{\varepsilon\prime} \Gamma(\varepsilon\prime|\varepsilon) J^{pc}(\varepsilon\prime, d\prime), \\ & y(\varepsilon)\Lambda(d)h_{pt} - w^{pc}_{pt}(\varepsilon,d) - \xi^{pc}(w^{pc}_{ft}, w^{pc}_{pt}) + \beta \sum_{\varepsilon\prime} \Gamma(\varepsilon\prime|\varepsilon) J^{pc}(\varepsilon\prime, d\prime), \\ & -s^{pc}(\varepsilon, d-1) - c_v + \beta(q(\theta) J^{tc}(\varepsilon_e, 1) + (1-q(\theta))V)\} \end{aligned} \tag{4}$$

$$g^{pc}(\varepsilon,d)=\begin{cases} h_{ft} & \text{if the full-time match continues} \\ h_{pt} & \text{if the match continues at a reduced number of hours} \\ 0 & \text{if the worker is fired} \end{cases}$$

where $J^{pc}(\varepsilon,d)$ and $J^{pc}(\varepsilon\prime,d\prime)$ are, respectively, the firm's value function for this period and the next period when there is a PC, $y(\varepsilon)$ is output, $\Lambda(d)$ is an experience function, $w^{pc}(\varepsilon,d)$ is the wage and $s^{pc}(\varepsilon,d-1)$ is the severance cost. As in García-Pérez and Osuna (2014), based on the evidence (Albert et al. (2005), for example), it is assumed that permanent workers are more productive as tenure increases. This feature is introduced through the experience function $\Lambda(d)$. Therefore, for a given value of ε, more tenure on the job makes the job even more productive. The interpretation of this equation is again analogous to the previous ones. If it is more profitable to continue with the actual full-time match, the decision rule will be $g^{pc}(\varepsilon,d)=h_{ft}$, and the match will continue. If it is more profitable to continue with the actual match but at a reduced number of hours, the decision rule will be $g^{pc}(\varepsilon,d)=h_{pt}$, and the match will continue. Otherwise, $g^{pc}(\varepsilon,d)=0$, and the worker will be fired.

2.4.3 The Worker's Problem

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

$$\begin{aligned} W^{tc}(\varepsilon,d) &= \tilde{\Phi}(g^{tc}=h_{ft})[w^{tc}_{ft}(\varepsilon,d)+\beta\sum_{\varepsilon\prime}\Gamma(\varepsilon\prime|\varepsilon)W^{tc}(\varepsilon\prime,d\prime)]+ \\ &\quad \tilde{\Phi}(g^{tc}=h_{pt})[w^{tc}_{pt}(\varepsilon,d)(1+\omega)+\beta\sum_{\varepsilon\prime}\Gamma(\varepsilon\prime|\varepsilon)W^{tc}(\varepsilon\prime,d\prime)]+ \\ &\quad \tilde{\Phi}(g^{tc}=0)[U+s^{tc}(\varepsilon,d-1)] \end{aligned} \tag{5}$$

$$\begin{aligned} W^{ppc}(\varepsilon,d) &= \tilde{\Phi}(g^{ppc}=h_{ft})[w^{ppc}_{ft}(\varepsilon,d)+\beta\sum_{\varepsilon\prime}\Gamma(\varepsilon\prime|\varepsilon)W^{pc}(\varepsilon\prime,d\prime)]+ \\ &\quad \tilde{\Phi}(g^{ppc}=h_{pt})[w^{ppc}_{pt}(\varepsilon,d)(1+\omega)+\beta\sum_{\varepsilon\prime}\Gamma(\varepsilon\prime|\varepsilon)W^{pc}(\varepsilon\prime,d\prime)]+ \\ &\quad \tilde{\Phi}(g^{ppc}=0)[U+s^{tc}(\varepsilon,d-1)] \end{aligned} \tag{6}$$

$$\begin{aligned} W^{pc}(\varepsilon,d) &= \tilde{\Phi}(g^{pc}=h_{ft})[w^{pc}_{ft}(\varepsilon,d)+\beta\sum_{\varepsilon\prime}\Gamma(\varepsilon\prime|\varepsilon)W^{pc}(\varepsilon\prime,d\prime)]+ \\ &\quad \tilde{\Phi}(g^{pc}=h_{pt})[w^{pc}_{pt}(\varepsilon,d)(1+\omega)+\beta\sum_{\varepsilon\prime}\Gamma(\varepsilon\prime|\varepsilon)W^{pc}(\varepsilon\prime,d\prime)]+ \\ &\quad \tilde{\Phi}(g^{pc}=0)[U+s^{pc}(\varepsilon,d-1)] \end{aligned} \tag{7}$$

where $W^{tc}(\varepsilon,d)$, $W^{ppc}(\varepsilon,d)$ and $W^{pc}(\varepsilon,d)$ denote workers' value functions in TCs, PPCs and PCs, $\tilde{\Phi}(x)$ is an indicator function that takes the value 1 if the assessment is true and zero otherwise, ω is a subsidy to which workers on short time are entitled, and U is the value function of an unemployed worker, whose equation is

$$U = b + \beta(\alpha(\theta)W^{tc}(\varepsilon_e,1) + (1-\alpha(\theta))U), \tag{8}$$

where $W^{tc}(\varepsilon_e,1)$ 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 $1-\alpha(\theta)$.

2.4.4 Law of Motion for Unemployment

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

$$U_t = U_{t-1} + \sum_{i=1}^{N_{t-1}^{pc}}(1-g_i^{pc}(\varepsilon,d)) + \sum_{i=1}^{N_{t-1}^{ppc}}(1-g_i^{ppc}(\varepsilon,d)) + \sum_{i=1}^{N_{t-1}^{tc}}(1-g_i^{tc}(\varepsilon,d)) - \alpha(\theta)U_{t-1}, \tag{9}$$

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 $g_i^{pc}(\varepsilon,d)$ 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, $g_i^{pc}(\varepsilon,d)=0$; 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.

2.4.5 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.[8] Bargaining is dynamic; that is, 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

[8]Downward wage rigidity is modelled here as a lower bound on the outcome of the wage negotiations. We need to impose a wage floor to prevent too much internalisation of severance payments.

$$S^{tc}(\varepsilon,d) = [J^{tc}(\varepsilon,d) - (V - s^{tc}(\varepsilon,d-1))] + [W^{tc}(\varepsilon,d) - (U + s^{tc}(\varepsilon,d-1))]. \quad (10)$$

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

$$[J^{tc}(\varepsilon,d) - (V - s^{tc}(\varepsilon,d-1))]^{1-\pi}[W^{tc}(\varepsilon,d) - (U + s^{tc}(\varepsilon,d-1))]^{\pi}. \quad (11)$$

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

$$(1-\pi)S^{tc}(\varepsilon,d) = J^{tc}(\varepsilon,d) + s^{tc}(\varepsilon,d-1) \quad (12)$$

$$\pi S^{tc}(\varepsilon,d) = W^{tc}(\varepsilon,d) - (U + s^{tc}(\varepsilon,d-1)). \quad (13)$$

By making the appropriate substitutions of firms' and workers' value functions, the wage in a full-time TC can be computed as

$$w^{tc}(\varepsilon,d) = max\{w_{min} \quad , \quad \pi y(\varepsilon)(1-\gamma)h_{ft} + (1-\pi)U + s^{tc}(\varepsilon,d-1) + \beta(\pi\sum_{\varepsilon\prime}\Gamma(\varepsilon\prime|\varepsilon)J^{tc}(\varepsilon\prime,d\prime) - (1-\pi)\sum_{\varepsilon\prime}\Gamma(\varepsilon\prime|\varepsilon)W^{tc}(\varepsilon\prime,d\prime))\}.$$

Following the same procedure, the wage in firms with full-time PPCs turns out to be[9]

$$w^{ppc}(\varepsilon,d) = max\{w_{min} \quad , \quad \pi y(\varepsilon)(1-\tau)h_{ft} + (1-\pi)U + s^{tc}(\varepsilon,d-1) + \beta(\pi\sum_{\varepsilon\prime}\Gamma(\varepsilon\prime|\varepsilon)J^{pc}(\varepsilon\prime,d\prime) - (1-\pi)\sum_{\varepsilon\prime}\Gamma(\varepsilon\prime|\varepsilon)W^{pc}(\varepsilon\prime,d\prime))\}.$$

Finally, in firms with PCs,

$$w^{pc}(\varepsilon,d) = max\{w_{min} \quad , \quad \pi y(\varepsilon)\Lambda(d)h_{ft} + (1-\pi)U + s^{pc}(\varepsilon,d-1) + \beta(\pi\sum_{\varepsilon\prime}\Gamma(\varepsilon\prime|\varepsilon)J^{pc}(\varepsilon\prime,d\prime) - (1-\pi)\sum_{\varepsilon\prime}\Gamma(\varepsilon\prime|\varepsilon)W^{pc}(\varepsilon\prime,d\prime))\}.$$

Note that wages in PPCs are lower than those that prevail in the following periods because of the associated training costs and because, as in Osuna (2005), firms attempt 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 in TCs are lower than in existing PCs because of the assumed productivity gap.

[9]Part-time wages are adjusted accordingly, that is, they are reduced in the same proportion as hours worked.

2.4.6 Definition of Equilibrium

A recursive equilibrium is a list of value functions $J^{tc}(\varepsilon,d)$, $J^{ppc}(\varepsilon,d)$, $J^{pc}(\varepsilon,d)$, $W^{tc}(\varepsilon,d)$, $W^{ppc}(\varepsilon,d)$, $W^{pc}(\varepsilon,d)$, V, U, transition rates $q(\theta)$, $\alpha(\theta)$, wages $w^{tc}(\varepsilon,d)$, $w^{ppc}(\varepsilon,d)$ and $w^{pc}(\varepsilon,d)$, and decision rules $g^{tc}(\varepsilon,d)$, $g^{ppc}(\varepsilon,d)$, $g^{pc}(\varepsilon,d)$ such that[10]

1. *Optimality*: Given functions $q(\theta)$, $\alpha(\theta)$, $w^{tc}(\varepsilon,d)$, $w^{ppc}(\varepsilon,d)$ and $w^{pc}(\varepsilon,d)$ the value functions $J^{tc}(\varepsilon,d)$, $J^{ppc}(\varepsilon,d)$, $J^{pc}(\varepsilon,d)$, $W^{tc}(\varepsilon,d)$, $W^{ppc}(\varepsilon,d)$ and $W^{pc}(\varepsilon,d)$ 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 $c_v = \beta q(v) J^{tc}(\varepsilon_e,1)$.

3. *Wage bargaining:* The equilibrium conditions from maximising the surplus in existing TCs are given in equations (12) and (13). Similar conditions hold for other types of contracts.

3 Calibration

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

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. The model period is chosen to be a year for consistency with these data and because this choice is reasonable from a computational perspective.

Figure 2 shows the Kaplan-Meier estimates of the exit from unemployment into both temporary and permanent employment based on our calibration sample. The exit from unemployment is highly decreasing on unemployment duration and much larger when the destination state is a temporary contract than when the worker exits to a permanent one. It is also striking how the exit from unemployment has decreased since the beginning of the crisis, that is, since 2008.

[10] 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.

Figure 2: Kaplan-Meier estimates of the exit from unemployment to temporary (left) and permanent (right) employment, by unemployment duration

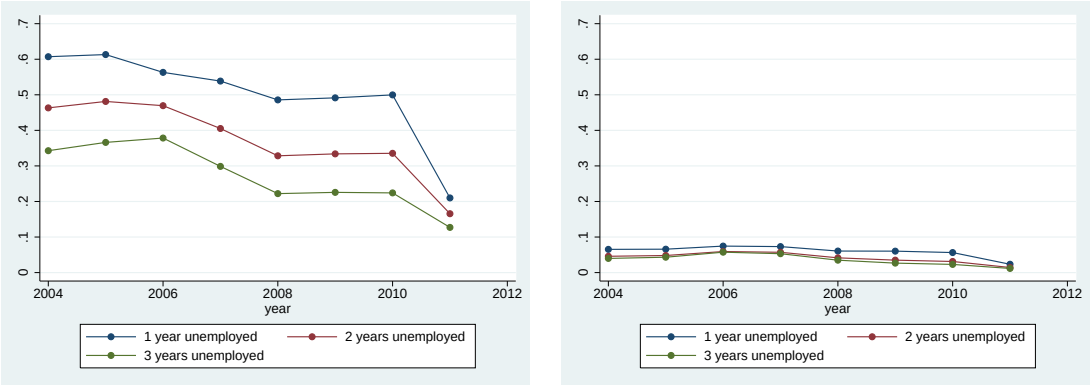
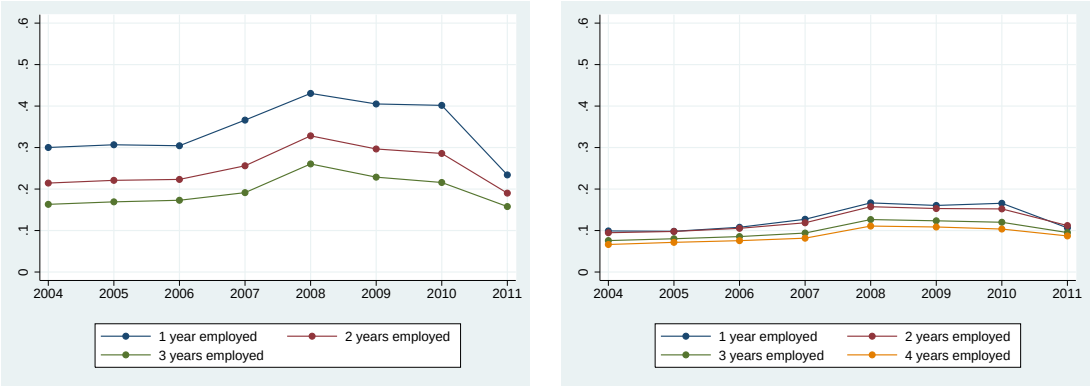


Figure 3 shows Kaplan-Meier estimates of the exit from employment to unemployment for both temporary and permanent workers. The exit from a temporary contract is much larger, at any employment duration, than the one from a permanent contract. These hazard rates have substantially increased since 2008, as a clear signal of the increasing firing risk during the recession.

Figure 3: Kaplan-Meier estimates of the transition from temporary (left) and permanent (right) employment to unemployment, by employment duration



3.2 Calibrated Parameters and Functional Forms

There are two types of calibrated parameters in our model: those that have a clear counterpart in the real economy and those that do not. For the former, we use the implied parameter values. For some of the latter, we use the values estimated in empirical studies, and for the rest, we 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, we assume five possible quality levels. 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, $\Gamma[(\varepsilon_1)|(\varepsilon_2)] = \Gamma[(\varepsilon_2)|(\varepsilon_1)]$, we need only estimate 15 transition probabilities. Given that we do not have direct information on the quality of the match, we use the procedure described in Tauchen (1986) 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. We use wages for the 2004 to 2011 period to approximate this process. The values for these parameters are to be $\mu = .33$, $\sigma = .11$ and $\rho = .75$. We normalise μ 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 13.5% based on the ratio between wages for permanent and temporary workers with equal experience.[11] Finally, the positive experience effect on the productivity of permanent workers is parametrized through the function $\Lambda(d) = (1 + \lambda(d-3))$ for $d > 3$.

Matching Technology

We assume a Cobb-Douglas homogeneous of degree one matching function, $m = m(v,u) = Av^{\eta}u^{1-\eta}$, 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. We obtain $b = .2$ as the product of unemployment benefits and coverage for the 2004-2011 period, normalised by average productivity.[12]

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 we impose in the model to parameterise $w_{min} = .72$.

[11] See García-Pérez and Osuna (2014) for a discussion on the robustness of this choice.

[12] 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	0.135
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	0.007
Mismatch degree	A	0.64

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 we set c_v 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 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 Severance cost and social security functions

Status Quo Severance Cost Function

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

Table 2: **Calibration results**

Statistics	Spanish Data	Status Quo
JDp	8.1	7.4
JDt	26.6	26.7
u_{dur}	11.1	12.3

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

of wages p.y.o.s. with a maximum of 42 monthly wages), procedural wages[13] of approximately two months, and the fact that, on average, 74.3% of all severance processes were declared unfair during the 2004-2011 period.[14] 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.[15] Using these observations and after rearranging terms, we arrive at the following final expression of the severance cost function for PCs is $s^{pc} = 44.1\frac{w}{365}(d-1) + 23.2\frac{w}{365}$, where d and w denote a worker's seniority and annual wage, respectively.[16] Note, in particular, that the second additive term of the severance cost function displayed in 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, we take the quality of the match as an approximation of the wage.

Finally, TCs 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), we have set $d^t_{max} = 3$, which has been the usual practice in Spain since the introduction of TCs in 1984.

[13] Procedural wages are those wages associated with the interim period between a workers dismissal, contested in court, and the judges decision declaring it unfair.

[14] The distribution of dismissals is taken from the Bulletin of Labour Statistics.

[15] 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.

[16] 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 2012 Reform Severance Cost Function

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, we replace 45 days with 33 days of wages p.y.o.s.; second, we eliminate procedural wages because the 2012 reform abolished them. This implies the following severance cost function in PCs: $s^{pc} = 33\frac{w}{365}(d-1)$.[17] In addition, the TC severance cost function must be adjusted to the current level of severance costs, that is, eleven 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: $s^{tc} = 11\frac{w}{365}(d-1)$.

Social Security and Wage Subsidy Parameters

In the Status Quo, social security taxes in PCs and TCs are, respectively, 29.9% and 31.1% of the wage. We will refer to the proportion of social security taxes that is used to pay for the health and the public pension system as "payroll taxes" (ξ_{cc}) to distinguish it from the rest, "unemployment taxes" (ξ_u), which are used to pay unemployment benefits. This distinction will matter when we consider STW schemes because only payroll taxes may be subsidized. The general function presented in the model section that is used to represent social security taxes, $\xi^{pc}(w_{ft}^{pc}, w_{pt}^{pc})$ and $\xi^{tc}(w_{ft}^{tc}, w_{pt}^{tc})$, will adopt a particular form depending on the availability and the amount of the subsidy to which firms are entitled (see Table 3).

Table 3: **Social security functions in PCs and TCs**

	SQ	STW-No subsidy	STW-33% subsidy	STW-Prop. subsidy
$\xi^{tc}(w_{ft}^{tc}, w_{pt}^{tc})$	$(\xi_{cc}+\xi_u)w_{ft}^{tc}$	$(\xi_{cc}+\xi_u)w_{ft}^{tc}$	$(0.67*\xi_{cc}+\xi_u)w_{ft}^{tc}$	$\xi_{cc}w_{pt}^{tc}+\xi_u w_{ft}^{tc}$
$\xi^{pc}(w_{ft}^{pc}, w_{pt}^{pc})$	$(\xi_{cc}+\xi_u)w_{ft}^{pc}$	$(\xi_{cc}+\xi_u)w_{ft}^{pc}$	$(0.67*\xi_{cc}+\xi_u)w_{ft}^{pc}$	$\xi_{cc}w_{pt}^{tc}+\xi_u w_{ft}^{pc}$

To avoid drastic reductions in net income as a result of STW schemes, workers are usually entitled to a wage subsidy, which in Spain amounts to 50% of the wage and is paid by the Unemployment Benefit System, implying $\omega = 0.5$. Firms under STW schemes, although getting a substantial reduction in wage costs, have to continue paying full social security taxes irrespective of the reduction in hours of work, unless any tax rebate from the Government is received.

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

Table 4: **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	11.2
$n_{d=4}$	8.6	7.7
$n_{d=5}$	6.8	7.5
$\bar{d}_{d\leq 6}$	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.

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 changes in EPL implied by the 2012 labour market reform. Section 4.3 combines these effects with those of STW schemes and shows some robustness exercises. Finally, Section 4.4 shows the welfare implications and the cost of these policies.

4.1 The Status Quo

Table 4 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.[18] 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, $n_{d=1}$.[19]

[18] For comparability with the data, which include only workers affiliated with social security, we have computed the unemployment rate 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).

[19] 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 assumed in our model.

4.2 Steady-state Effects of the 2012 Reform: EPL Changes

This section shows the steady-state effects of the 2012 reform concerning the changes in PCs and TCs employment protection, focusing on the effects on unemployment rates, job destruction and tenure distribution.

Column 3 in Table 5, referred to as Reform A, indicates that this reform reduces unemployment by 11.2%, from 17.3% to 15.4%. In contrast, aggregate job destruction, JD, decreases by 6.2% as a result of a simultaneous increase in the permanent job destruction rate (JDp) and a decrease in the temporary job destruction rate (JDt). In fact, the temporary job destruction rate decreases by 17.1%, from 26.7% to 22.2%, because the lower gap in severance costs makes firms more prone to convert TCs into PCs. The reduction in the severance cost gap diminishes the pervasive incentives to destroy jobs at the beginning of period four: the job destruction rate $JD_{d=4}$ changes from 30.6% to 10.6%. The opposite happens, however, for the permanent job destruction rate, which increases by 8.4%, from 7.4% to 8.0%, because firing permanent workers has become cheaper. These changes in job destruction rates have an impact on tenure distribution. The proportion of workers with tenure equal to or under one year, $n_{d=1}$, is 11% lower, and the proportion of workers with tenure of more than three years, $n_{d>3}$, increases by 10%, from 52.7% to 57.9%.

4.3 Steady-state Effects of the 2012 Reform: EPL Change and STW

In this section, we add the availability of STW schemes to prevent firings when firms are hit by negative idiosyncratic shocks. In particular, firms have the option of reducing hours worked by 10%, 40% or 70% depending on the magnitude of the adverse shock. In Table 5, we show the effects of three different STW schemes. In the first one (Reform B), firms pay full social security taxes irrespective of the reduction in hours of work. In the second one (Reform C), payroll taxes are subsidised by 33%. In the third one (Reform D), payroll taxes are reduced in the same proportion as hours worked. We simulate these three STW scenarios for the following reason. Reform B is the STW scheme that can be considered the rule for the Spanish economy. Reform C was introduced in the 2012 labour market reform, but only for the period of January 2012 to December 2013 as a response to the "Great Recession". Finally, the extreme scenario, Reform D, has been implemented in a number of countries to provide more incentive to adopt this measure during the recent crisis (see Arpaia et al. (2010)).

Table 5 shows that external and internal flexibility, when combined, do not necessarily induce a higher reduction in the unemployment rate than when only the increase in external flexibility is considered. This is true under Reform C and Reform D, that is, when STW is subsidised, but not under Reform B. Furthermore, in full-time equivalents, the unemployment rate under Reform B is higher than under Reform A, 16.6 versus 15.4, where only the change in EPL is considered. In fact, in the absence of the additional flexibility provided by Reform B, firms convert some TCs into PCs full-time jobs, whereas under Reform B, the same number of jobs are converted, but to part-time jobs instead. In the transition exercise, we show the amount of this deadweight loss.

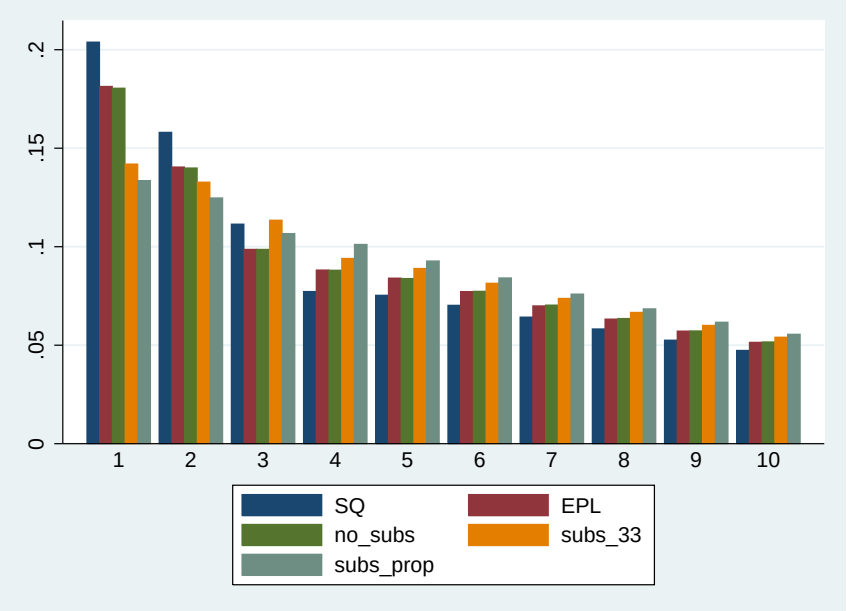
Table 5: **Effects on unemployment, JD, and tenure distribution**

Statistics	SQ	EPL change (*Reform A*)	EPL change + Short-time No subsidy (*Reform B*)	EPL change + Short-time 33% subsidy (*Reform C*)	EPL change + Short-time Prop. subsidy (*Reform D*)
u	17.3	15.4	15.9	12.4	11.8
u_{equiv}	17.3	15.4	16.6	13.1	14.2
JD	12.6	11.9	11.8	9.3	8.9
JDt	26.7	22.2	22.0	12.3	8.9
JDp	7.4	8.0	8.0	8.2	8.9
$JD_{d=2}$	22.5	22.5	22.4	6.5	6.6
$JD_{d=3}$	29.5	29.8	29.5	14.5	14.5
$JD_{d=4}$	30.6	10.6	10.7	17.1	5.2
$n_{d=1}$	20.4	18.1	18.1	14.2	13.4
$n_{d=2}$	15.8	14.1	14.0	13.3	12.5
$n_{d=3}$	11.2	9.9	9.9	11.4	10.7
$n_{d=4}$	7.7	8.8	8.8	9.4	10.1
$n_{d=5}$	7.5	8.4	8.4	8.9	8.3
$n_{d=6}$	7.0	7.7	7.7	8.2	8.4
$n_{d=7}$	6.4	7.0	7.0	7.4	7.6
$n_{d=8}$	5.8	6.3	6.4	6.7	6.9
$n_{d=9}$	5.3	5.7	5.7	6.0	6.2
$n_{d=10}$	4.7	5.2	5.2	5.4	5.6
$n_{d>10}$	8.1	8.8	8.8	9.2	9.5
$n_{d>3}$	52.7	57.9	58.1	61.2	63.5
$\bar{d}_{d\leq 6}$	1.96	1.99	1.99	2.06	2.08
$\bar{d}_{d\leq 10}$	3.83	4.02	4.03	4.19	4.27

u_{equiv} stands for unemployment measured in full-time equivalents.
$JD_{d=i}$ stands for job destruction at the beginning of period i.
$n_{d=i}$ stands for the proportion of workers in period i.
$\bar{d}_{d\leq 6}$ for the av. tenure for those with a tenure equal to or under six years.

On the contrary, in scenarios where payroll taxes are partly subsidised (Reforms C and D), the unemployment and the temporary job destruction rates decrease substantially. In particular, under Reform C, the temporary job destruction rate decreases by 54% (66% under Reform D) versus 17% when only external flexibility is considered (Reform A). In the status quo, the temporary job destruction rate is higher because of the larger gap in severance costs and because of the impossibility of reducing hours worked. The additional flexibility provided by these reforms make firms more prone to continue with the matches, albeit at a reduced number of hours worked in some instances. With regard to the effects on job destruction rates in the early durations, $JD_{d=2}$, $JD_{d=3}$ and $JD_{d=4}$ decrease dramatically to 6.6%, 14.5% and 5.2% under Reform D. Consequently, the tenure distribution changes drastically, becoming much smoother (see Figure 4). The proportion of workers with one year of tenure decreases from 20.4% to 13.4%, and the proportion of workers with more than three years of tenure increases from 52.7% to 63.5%. In contrast to what Hijzen and Venn (2011) find, the availability of STW seems to be beneficial for the Spanish economy because it reduces labour market segmentation.

Figure 4: Tenure Distribution under different simulation scenarios



At first sight, it would seem that unemployment decreases less under Reform C than under Reform D, 28% versus 32%. However, the picture changes if we compare unemployment in full-time equivalents: the reduction in the unemployment rate is larger under Reform C, 24% versus 18% under Reform D. This result is due to the different incentives that these two STW schemes induce. Under Reform C, the reduction in payroll taxes is independent of the reduction in hours worked, whereas under Reform D, the reduction in

payroll taxes is proportional to the reduction in hours worked, thereby creating an incentive to preserve more short-time jobs. In fact, both the temporary job destruction rate and the job destruction rate at the beginning of period four are lower under Reform D because job conversion is higher, but at the expense of significantly reducing the number of hours.

To summarize, with the exception of Reform B, adding internal flexibility implies lower unemployment, lower aggregate and temporary job destruction rates and a smoother tenure distribution. Without a measurement of welfare and of the cost of these policies, it is not possible to provide a policy recommendation. It seems clear that Reform B is the worst in terms of these statistics, even worse than the sole reduction in EPL. However, Reforms C and D are more difficult to judge with the information provided because average hours worked are higher under the Reform C scenario, but more jobs are preserved under Reform D.

4.3.1 Robustness

In this section, we explore whether the findings of the previous sections are specific to the baseline model economy or whether they also hold for some variations of the model.[20] We show the results of the sensitivity analysis for a lower firing cost gap and a lower productivity gap (γ), and for alternative values for the vacancy, training, experience and bargaining cost parameters.[21] To perform our robustness tests, we change one parameter at a time.

4.3.1.1 Lower firing cost gap

According to the OECD (see OECD, 2014), fair dismissals increased from 30% to 60% of total dismissals after the implementation of the 2012 reform. Hence, it may be that severance payments for permanent contracts are now closer to 20 days p.y.o.s. than to 33. To have a sense of the range of the effects, we provide the results of steady-state analysis for a higher reduction in the severance cost gap given a reduction in the severance cost of PCs from 45 to 20 days of wages p.y.o.s.

Table 6 shows that the qualitative results are very similar to those of the baseline model; that is, the STW policy with a 33% subsidy leads to lower unemployment (also in full-time equivalents), lower temporary job destruction and a smoother tenure distribution. The higher reduction in the severance cost gap makes firms more prone to convert TCs into PCs and reduces STW incidence because firing permanent workers has become cheaper. This result is in line with the point mentioned by Boeri and Bruecker (2011): STW schemes are likely to have more of an impact in the presence of relatively large fixed costs per worker, such as strong employment protection. Therefore, a larger reduction in the severance cost gap should reduce the incidence of STW.

[20] To ease comparisons, Table 6 and Table 7 show the results only for the most relevant statistics.

[21] The sensitivity analysis concerning the rest of the parameters is available upon request.

Table 6: **Robustness checks 1**

Statistics	SQ	Reform A	Reform B	Reform C	Reform D
Baseline					
u	17.3	15.4	15.9	12.4	11.8
u_{equiv}	17.3	15.4	16.6	13.1	14.2
JD	12.6	11.9	11.8	9.3	8.9
JDt	26.7	22.2	22.0	12.3	8.9
JDp	7.4	8.0	8.0	8.2	8.9
$n_{d=1}$	20.4	18.1	18.1	14.2	13.4
$n_{d>3}$	52.7	57.9	58.1	61.2	63.5
Lower firing cost gap					
u	17.3	12.4	15.3	11.8	11.8
u_{equiv}	17.3	12.4	15.5	12.7	12.6
JD	12.7	9.3	11.8	8.8	8.9
JDt	26.7	12.4	22.1	8.9	8.9
JDp	7.4	8.2	8.0	8.8	8.9
$n_{d=1}$	20.4	14.2	18.1	13.3	13.4
$n_{d>3}$	52.7	61.2	57.9	63.5	63.5
Productivity gap $\gamma = 0.10$					
u	17.0	15.7	14.2	12.7	17.1
u_{equiv}	17.0	15.7	15.4	16.2	23.6
JD	12.7	11.6	10.8	10.2	18.7
JDt	26.8	23.0	18.3	12.4	18.3
JDp	7.4	7.4	8.0	9.5	18.8
$n_{d=1}$	20.5	18.6	16.5	14.5	19.8
$n_{d>3}$	52.6	52.7	58.1	60.3	50.0
Vacancy cost $c_v = 0.29$					
u	18.7	12.8	16.3	10.8	12.7
u_{equiv}	18.7	12.8	16.3	14.5	14.5
JD	12.6	9.3	11.6	4.9	8.9
JDt	26.7	12.4	22.2	8.8	8.9
JDp	7.4	8.2	8.0	3.4	8.9
$n_{d=1}$	20.4	14.2	18.2	12.1	13.4
$n_{d>3}$	52.7	61.2	57.9	66.9	63.5
Vacancy cost $c_v = 0.21$					
u	17.0	17.0	15.3	12.4	12.4
u_{equiv}	17.0	17.0	16.0	13.1	20.4
JD	7.4	7.4	8.0	8.2	8.2
JDt	26.8	26.8	22.1	12.4	12.3
JDp	7.4	7.4	8.0	8.2	8.2
$n_{d=1}$	20.4	20.4	18.1	14.2	14.2
$n_{d>3}$	52.6	52.6	58.0	61.2	61.2

Table 7: **Robustness checks 2**

Statistics	SQ	Reform A	Reform B	Reform C	Reform D
Baseline					
u	17.3	15.4	15.9	12.4	11.8
u_{equiv}	17.3	15.4	16.6	13.1	14.2
JD	12.6	11.9	11.8	9.3	8.9
JDt	26.7	22.2	22.0	12.3	8.9
JDp	7.4	8.0	8.0	8.2	8.9
$n_{d=1}$	20.4	18.1	18.1	14.2	13.4
$n_{d>3}$	52.7	57.9	58.1	61.2	63.5
Training parameter $\tau = 0.45$					
u	17.0	12.4	13.8	12.4	12.4
u_{equiv}	17.0	12.4	13.8	12.4	14.0
JD	12.7	9.3	10.5	9.3	9.3
JDt	26.7	12.3	16.9	12.4	12.4
JDp	7.5	8.2	8.1	8.2	8.2
$n_{d=1}$	20.4	14.2	16.0	14.2	14.2
$n_{d>3}$	52.6	61.2	60.6	61.2	61.2
Experience parameter $\lambda = 0$					
u	18.4	17.2	15.5	12.4	13.3
u_{equiv}	18.4	17.2	16.2	13.8	16.0
JD	12.6	12.6	11.8	9.3	9.3
JDt	26.7	26.7	22.1	12.4	12.3
JDp	7.4	7.4	8.0	8.2	8.2
$n_{d=1}$	20.4	20.4	18.1	14.2	14.2
$n_{d>3}$	52.7	52.7	58.0	61.2	61.2
Bargaining parameter $\pi = 0.4$					
u	19.0	20.0	16.2	15.4	23.8
u_{equiv}	19.0	20.0	17.3	16.6	26.6
JD	12.6	15.0	11.8	10.8	20.3
JDt	26.8	26.8	22.1	18.3	26.7
JDp	7.4	10.7	8.0	8.0	17.9
$n_{d=1}$	20.4	22.3	18.1	16.5	23.9
$n_{d>3}$	52.6	48.2	58.0	58.2	44.6
Bargaining parameter $\pi = 0.25$					
u	12.4	12.4	10.4	9.5	8.6
u_{equiv}	12.4	12.4	14.7	12.4	14.5
JD	9.3	9.3	4.0	2.4	1.3
JDt	12.4	12.3	8.8	8.8	4.9
JDp	8.2	8.2	2.6	0	0
$n_{d=1}$	14.2	14.2	11.6	10.5	9.4
$n_{d>3}$	61.2	61.2	68.2	71.4	72.6

4.3.1.2 Productivity gap parameter

The productivity gap parameter (γ) is the most difficult to justify because it relies on the association of productivity and wages. As mentioned in the calibration section, we believe that the range of possible values for parameter γ is $[0.1 - 0.14]$. Within this range, the qualitative results of the steady-state analysis are very similar to those of the baseline scenario. Concerning the quantitative results, as we decrease the value of the productivity gap parameter, the changes in the variables of interest are generally smaller because job conversion does not pay as much as before. Note that as the value of the productivity gap diminishes, the incentives to convert TCs into PCs diminish as well because permanent and temporary workers are more similar in terms of productivity and because job conversion into a PC implies higher severance costs in the future. This results in a higher temporary job destruction rate, especially at the beginning of period four.

4.3.1.3 Vacancy cost parameter

This parameter may be of interest because one of the reasons for introducing a STW policy is that by reducing the costs associated with keeping jobs on bill when firms are hit by negative shocks, an STW policy prevents firms from incurring additional costs related to vacancy post and search activities.

For lower values of the vacancy cost, e.g., $c_v = 0.21$, job conversion is lower than in the baseline under Reform A. The results of Reforms B and C do not change with respect to the baseline. In Reform D, there is less job conversion and some deadweight costs because some PCs and TCs are maintained, but at a lower number of hours. The intuition is that as c_v diminishes, there is less incentive to keep jobs on bill because it is less costly to open new vacancies. It is still true that adding internal flexibility implies lower unemployment (also in full-time equivalents), lower temporary job destruction rates and a smoother tenure distribution than with the sole reduction in employment protection.

For higher values of the vacancy cost, e.g., $c_v = 0.29$, job conversion is the same as in the baseline under Reform A, but temporary job destruction is lower. In scenarios B and D, the number of workers on STW is the same, but the number of hours worked is higher, whereas in scenario C, more jobs are preserved. Thus, we find that as vacancy posting becomes more expensive, firms are more reluctant to fire workers and more prone to make use of STW.

4.3.1.4 Training cost parameter

The training cost parameter may also be of interest for a reason similar to the vacancy cost parameter. Excessive layoffs driven by negative shocks may be inefficient, especially when training costs are high. In fact, some authors (e.g., Moeller, 2010) have argued that the "German miracle" was possible because export-oriented German firms heavily employed STW schemes to keep their high-skilled workers because training costs for these workers

are very high.

For this reason, it is interesting to examine whether the results follow for lower values of the training cost parameter, e.g., $\tau = 0.45$. In this case, adding a subsidised STW policy to the reduction in the severance cost gap does not further reduce unemployment and temporary job destruction. In fact, the tenure distribution is the same as with the sole reduction in EPL. The reduction in the training cost parameter implies lower temporary job destruction than in the baseline in all the scenarios except in the status quo and a lower incidence of STW in TCs. That is, firms are more prone to keep and convert TCs into PCs because the cost of training these workers has become cheaper.

4.3.1.5 Experience parameter

The experience parameter is also related to the importance of keeping the workforce when a negative shock hits the firm. As we decrease the experience parameter, there is less job conversion because it does not pay as much as in the baseline. When STW is available, firms tend to make intensive use of STW to reduce hours; that is, there are some deadweight costs. The qualitative results of the steady-state analysis for the extreme case of $\lambda = 0$ are very similar to those of the baseline scenario (see Table 7).

4.3.1.6 Bargaining power parameter

Considering the robustness of the results with respect to this parameter may be important because the 2012 labour market reform, by providing additional internal flexibility to firms, may have also reduced workers' bargaining power (see footnotes 3 and 4 in the introduction). As we increase the bargaining parameter, there is more job destruction and less job conversion; alternately, job conversion takes place, but at a lower number of hours than in the baseline. For $\theta = 0.4$, the sole reduction in the severance cost gap implies a higher permanent job destruction than in the baseline, leading to a higher unemployment rate. In Reforms B and C, permanent job destruction is lower than in reform A thanks to the STW policy.

As we decrease the bargaining parameter, job conversion tends to be higher and the temporary job destruction rate tends to be lower, even in the status quo. In particular, for $\theta = 0.25$, the sole reduction in severance costs does not improve the statistics with respect to the status quo, whereas the availability of a STW policy, even without any subsidy, substantially improves the statistics: job conversion is higher, and many jobs are prevented from being destroyed. Again, the STW policy with a 33% subsidy outperforms the other two in terms of the reduction in unemployment in full-time equivalents.

4.4 The Transition

As is well known, an assessment of a policy cannot be conducted based on steady-state comparisons. To assess the implications of the policies, we perform a transition exercise.

For this purpose, we take a sub-sample of workers from the MCVL data set previously described who began working in 2010 and who differ in several dimensions, such as whether they are employed or unemployed, the type of contract, tenure on the contract and productivity level (proxied by qualification), and we follow them for 12 years. We compare the convergence of this particular initial distribution, which is not in steady state, to five different steady states: the status quo, the 2012 reform with only external flexibility, and the 2012 reform with both external and internal flexibility with the three scenarios already discussed in the previous section. In every scenario, workers are subject to the same shocks, but their employment histories are different because the policy rules are different.

To gauge the welfare change induced by these reforms, we compute the equivalent variation (EV) expressed as an income annuity. For each individual, we rewrite his/her utility along the transition as an income annuity that generates the same welfare level along the same period. Then, we measure the "welfare change" induced by a particular reform simply as the difference in the individual annuity values in the two institutional settings (the annuity value in the status quo minus the annuity in the reform). A positive value implies a larger utility in the status quo. Furthermore, the change in welfare is expressed in euros, which allows for easy comparison to the financial calculations discussed below. To obtain an aggregate welfare figure, we compute an average of the individual "welfare changes" across all the individuals in the sample.

To obtain a complete picture, we also compute the costs implied by the status quo and by the reform scenarios as a constant annuity to facilitate comparison with the welfare measurement defined above. In this case, we compute the net cost that each individual represents for the public system. This cost is assessed by computing the present discounted value of all payments that will be received along the transition, net of all contributions to be made in the same period. The calculation reflects the fact that workers can change their labour state in the future as a result of the exogenous sources of uncertainty in the model and takes into account that individuals will react optimally according to the institutional environment.

4.4.1 Reform A: EPL Change

This reforms seems to be Pareto improving because welfare increases due to the increase in average income, and the fiscal balance significantly improves. According to the EV measure, individuals will be willing to pay 105 euros to implement the reform.

Average income increases mainly as a result of the increase in the average wage, which is coherent with the Lazear result: the decrease in severance costs is compensated by higher wages.[22] In contrast, the amount of average unemployment benefits (State $Cost_{u-benefits}$) is lower because of the reduction in the unemployment rate, and the average indemnity is lower both because severance costs are lower and because there are fewer firings.

Regarding the costs for the State, this reform is the cheapest because there are no wage

[22]These effects are probably an upper bound because the model does not allow for changes in bargaining power once the policy is implemented.

Table 8: **The 2012 Reform: costs and welfare**

Statistics	SQ	EPL change (*Reform A*)	EPL change + Short-time No subsidy (*Reform B*)	EPL change + Short-time 33% subsidy (*Reform C*)	EPL change + Short-time Prop. subsidy (*Reform D*)
Average Income	17,793	17,898	17,786	17,957	17,465
Income *%var*	–	0.6%	0%	0.9%	-1.8%
Average Wage	16,143	16,427	16,188	16,038	15,897
Average Indemnity	784	717	717	724	747
Firm $Cost_{ss-cc}$	3,487	3,577	3,547	3,606	3,651
Firm $Cost_{ss-u}$	903	911	911	941	948
State $Cost_{u-benefits}$	866	754	799	627	560
State $Cost_{wage-sub}$	0	0	82	567	261
State $Cost_{ss-cc}$	762	679	709	657	612
State Total Cost	1,628	1,434	1,590	1,852	1,434
State Revenue	4,390	4,487	4,458	4,547	4,599
Fiscal balance	2,763	3,054	2,867	2,695	3,166
Fiscal bal. *%var*	–	10.5%	3.8%	-2.4%	14.6%
Fiscal bal. variation	–	291	105	-67	403
Equivalent variation	–	-105	7	-164	329
STW take up rate	–	–	1.8%	8.1%	6.1%
Deadweight Costs	–	–	100%	0%	45%

State $Cost_{u-benefits}$, State $Cost_{wage-sub}$ and State $Cost_{ss-cc}$ stand for unemployment benefits, wage subsidies and social security contributions paid by the State, respectively.
Firm $Cost_{ss-cc}$ and Firm $Cost_{ss-u}$ stand for social security contributions pais by firms.

subsidies paid to workers ($StateCost_{wage-sub}$) for the reductions in hours worked, as is the case under Reforms B, C and D. In terms of unemployment benefits and social security contributions made by the State on the part of the unemployed, this reform is not very costly (although it is costlier than Reforms C and D). It is, in fact, cheaper than Reform B, despite having very similar statistics, because average unemployment duration is lower in this case. Finally, the amount of payroll taxes paid by firms (Firm $Cost_{ss-cc}$) is lower than under Reforms C and D because there is more unemployment and consequently less revenue.

4.4.2 Reform B: EPL Change and Short-time with No Subsidy

In this case, the small welfare loss could be compensated by the improvement in the fiscal balance. This reform is not very costly when compared to the other reforms that allow for STW because the average wage subsidy paid to workers under STW is relatively small despite the higher payments made by the State in terms of unemployment benefits and social security contributions.

However, this reform does not make much sense because it is worse in all dimensions than the reform that only changes EPL. As shown in Table 4, unemployment and the job destruction statistics are higher, average tenure is lower and the tenure distribution is not as smooth. In addition, welfare is lower, and the fiscal balance does not improve as much as in Reform A.

Moreover, Table 9 shows that STW take-up rate is very low (1.8%) compared to STW take-up rates in Reforms C and D (8.1% and 6.1%, respectively), and there are some deadweight costs in the job conversion decision. That is, in the absence of the policy concerning the reduction in hours worked, job conversion for some productivity levels would have still taken place, but to full-time jobs.

4.4.3 Reform C: EPL Change and Short-time with a 33% Subsidy

In this reform, the welfare improvement is greater than the fiscal balance deterioration. Therefore, a lump sum tax could be levied on individuals to compensate for the passing of the reform. However, this reform is very costly for the State. In terms of revenue, it is second after Reform D. The costs are enormous, mainly because of the wage subsidies paid to workers , which are quite substantial given the high STW take-up rate (8.1%).

The other costs, the amount of unemployment benefits and the social security contributions made by the State on the part of the unemployed, are quite low because of the significant reduction in the unemployment rate. In fact, along the transition, the average number of jobs saved amounts to 8% of employment, and there are no deadweight costs.

4.4.4 Reform D: EPL Change and Short-time with a Proportional Subsidy

In this case, the negative welfare impact measured as the EV (329 euros) does not exceed the costs saved (403 euros). There are resources available to compensate for the losses

created by the institutional change. Average income is lower in this case due to the lower wages in short-time jobs and the lower amount of unemployment benefits given the low unemployment rate. Furthermore, the average job subsidy is relatively low because the reduction in hours worked is quite substantial in some cases.

Regarding the costs for the State, they are relatively low because of the low unemployment rate. The fact that firms receive a proportional reduction in the payroll tax when they put workers on short-time does not deteriorate the fiscal balance position because a significant amount of jobs are prevented from being destroyed (deadweight costs amount to 45%); therefore, revenue is large.

To see who actually gains or loses from the implementation of these reforms, we provide additional information on the average increase/decrease in annual income, with respect to the status quo, once the transition has been completed. We perform this exercise for every worker in the sample and group them according to their employment status at the beginning of the transition (permanent, temporary or unemployed worker).

Table 9 shows the results for all the scenarios. Once the transition to Reform A is completed, 50% of the workers are better off in terms of income. In the transition to Reforms B and C, these percentages increase to 54.6% and 57.7%, respectively. In the transition to Reform D, only 38.2% are better off and 55% are worse off due to the existence of jobs with very short durations and, therefore, very low wages.

For the winners, the average increase in annual income is greatest in scenario C (658 euros), as is the proportion of workers that are better off (57.7%). For the losers, the average decrease in annual income is greatest in scenario D (896 euros), as is the proportion of workers that are worse off (55%).

All worker types that experience an increase in average annual income are much better off in scenario C in terms of the average increase in income. Temporary workers experience the best performance in terms of the proportion of workers who improve (61.5%) and in terms of the average increase in income (932 euros) because the probability of preserving a temporary job and that of promoting to a full-time job (or, at least, to a short-time job with a high number of hours worked) is the highest.

All worker types that lose after the transition are much worse off in scenario D, both in terms of the proportion of workers that are worse off and in terms of the average decrease in annual income. The worst performance is that of the unemployed: more than 55% experience a decrease in annual income of approximately 1032 euros.

Taking these distributional results into consideration as well as the previous results concerning the changes in welfare and the costs of these policies, it seems that Reform C shows the best performance. A majority of workers improve (57.7%), and they experience a significant increase in annual income (658 euros) that could be used to compensate for the losses experienced by the 35.3% who are jeopardised. We also find that this is the reform that saves the highest number of jobs because there are no deadweight costs and the STW take-up rate is the highest among the STW reforms studied.

Table 9: **Winners and Losers**

	all		Permanent		Temporary		Unemployed	
Reform A vs. SQ	%	Mean	%	Mean	%	Mean	%	Mean
↑ income	50.0	413	48.2	360	48.8	450	55.1	483
↓ income	28.8	337	29.7	249	28.7	438	26.6	439
Reform B vs. SQ								
↑ income	54.6	252	54.4	213	50.8	291	59.8	296
↓ income	35.7	408	35.9	327	37.2	474	33.3	531
Reform C vs. SQ								
↑ income	57.7	658	56.1	489	61.5	932	57.0	683
↓ income	35.3	615	36.3	534	31.7	697	37.5	717
Reform D vs. SQ								
↑ income	38.2	431	37.6	352	39.2	532	38.5	487
↓ income	55.0	896	54.9	798	54.0	976	56.3	1032

Notes: The columns with the percentage change sign indicate the percentage change of workers experiencing the change indicated with the arrows on the left. The numbers below "Mean" indicate the average increase/decrease in income (in euros).

5 Conclusion

This paper has evaluated the effectiveness of STW schemes in preserving jobs and reducing the segmentation in dual labour markets. For this purpose, we used an equilibrium search and matching model and the Spanish 2012 labour market reform 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 steady-state results have shown that the availability of STW schemes does not necessarily reduce unemployment and job destruction. The effectiveness depends on the degree of subsidisation of payroll taxes it may entail. In contrast, the cost-benefit analysis has shown that STW creates some welfare costs, but there is scope for Pareto improvements. However, in some cases, a lump sum subsidy is necessary to compensate for the welfare loss caused by the reform.

Overall, STW with 33% subsidies for payroll taxes with the approved change in EPL (Reform C) seems to be the best option. Both the steady-state and the transition analysis point in this direction for several reasons. First, the reduction in the unemployment rate in equivalent terms is the highest; that is, there are no deadweight costs. Second, it reduces the duality in the labour market, measured as the reduction in the temporary job destruction rate, and it smoothes the tenure distribution to a substantial degree. Third, a majority of workers improve and experience a significant increase in annual income that could be used

to compensate the losers and the State for the fiscal balance deterioration. It turns out that this reform is the most similar to the one that was implemented in Germany by the beginning of the "Great Recession".

We believe that this paper makes important contributions to the debate on the effectiveness of this type of reform. First, the possibility of studying the functioning of STW schemes using a dynamic general equilibrium search and matching model has allowed us to test some of the hypotheses suggested by this growing literature. For instance, Boeri and Brucker (2011) have mentioned that a possible interpretation for the higher numbers found in the micro estimates is that the latter do not take into account the general equilibrium effects of STW in the sense that STW also acts on the job creation margin by reducing hiring rates. We are able to confirm this presumption. We find that STW schemes increase unemployment duration despite the increase in the value of the job given the additional flexibility margin. However, we disagree with these authors on the following issue: they find a negative correlation between STW take-up and the share of fixed-term contracts, which they attribute to the low employment protection in TCs. Based on this result, they argue that the problem of dualism should be addressed by other reforms, such as the graded employment security scheme, the so-called "single contract" (SC).

Interestingly, we find that once we add the availability of STW schemes, particularly under Reform C, the steady-state results are better than the ones we obtained for the SC in García-Pérez and Osuna (2014) in terms of the reduction in unemployment and in the degree of segmentation in the labour market. Of course, this conclusion hinges upon the particular SC that is implemented; a SC with severance payments increasing in a more gradual way (See García-Pérez and Osuna, 2011) than the one we studied in García-Pérez and Osuna (2014) delivers better results that are more similar to the ones we found for Reform C. It is true that Reform C is costly for the State, but from a political economy perspective, it is easier to implement than the SC. In fact, it has been already in place (from January 1, 2012 to December 31, 2013), and the incidence of STW has been substantial (see Figure 1). We believe that the main reason for the discrepancy between Boeri and Brucker (2011) and our paper may lie in the way training costs and experience effects are modelled, which, in this model, attempts to replicate the pattern observed for the Spanish economy (see Albert et al., 2005). The fact that temporary workers are expected to be more productive in the near future (especially once they are promoted to a PC) in addition to the possibility of adjusting through STW in the face of a temporary fall in demand makes firms more prone to keep these workers on bill.

Finally, there are certain caveats to our findings. Unfortunately, within this framework, we cannot perfectly test the hypothesis suggested by Eichhorst and Marx (2009) and Contesi and Li (2013) in the sense that the implementation of STW is a way to make standard jobs more cost attractive and to reduce the demand for alternative types of employment. It is true that job conversion increases, but it is also true that in the model, firms do not have the choice of the type of contract in the first place (every worker starts as a temporary worker). Another interesting question that is out of the scope of this paper, but that could alter its conclusions, is the modelling of the human capital investment decision as an endogenous

variable. The line of reasoning is similar to the one in García-Pérez and Osuna (2014). One could argue that the availability of STW schemes may induce firms to invest in human capital earlier, which may lead to an increase in productivity and lower unemployment and may contribute to preventing aggregate demand from falling in the face of a temporary shock.

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