Temporary Contracts, Incentives, and Unemployment*

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Abstract

We provide a novel explanation of why allowing temporary contracts can generate higher unemployment even where reducing firing costs would actually reduce unemployment. We argue that, if minimum wages are kept at high levels, temporary contracts have an effect not unlike that of increased unemployment benefits. By increasing the flows into and out of unemployment into relatively highly paid temporary jobs, they increase the value of being unemployed. This has a negative effect on permanent workers' incentives to work, increases their wages, and reduces the willingness of firms to create employment. We present empirical evidence compatible with the model's implications.

Keywords: Fixed-term and permanent contracts, renewal rate, minimum wage, firing costs, unemployment benefits.
JEL Classification codes: J41, J42, J63.

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1 Introduction

European labor markets have typically been characterized by widely used permanent contracts with high regulated firing costs, which, from a political perspective, are difficult to reduce. During the 1980s, a common way to reform labor markets was to introduce or extend the legal form of fixed-term (temporary) contracts with negligible firing costs at termination, even for nonseasonal jobs.[1] Since then, temporary contracts have played an important role in the labor market, because these account for most new hirings and are used in all sectors and occupations (OECD, 2002).[2] In addition, the transition rate from temporary to permanent contracts is relatively low,[3] and more generally the labor market has become segmented.[4] However, despite the intensive use of temporary contracts, the functioning of the labor market has not improved. With hindsight, it seems clear by now that temporary contracts have not been successful at reducing average unemployment (see Kahn, 2010).

Thus, since the onset of the most recent recession, in several countries a policy debate centered on the elimination of temporary contracts has arisen. Given the weak evidence supporting temporary contracts, it is remarkable that so many voices, from both the employer and the trade union side, have defended their continuation.

This paper provides a novel and intuitive explanation for why temporary contracts can actually increase unemployment in an efficiency wage model. Furthermore, the mechanism that we stress provides higher utility to the unemployed (which lies at the root of the mechanism). Thus, it offers a partial understanding of the political resilience of the legal form of temporary contracts. Our point is very simple, but it offers a novel approach to understanding the effects of temporary contracts. The intuition behind our idea is as follows.

In order to make the problem appealing, we model an environment in which firing costs increase unemployment. Specifically, firing costs decrease employment because they increase the incentives

[1] See Grubb and Wells (1993) and OECD (1993, 1994, 1999, and 2002) for a detailed description of temporary contract regulations in Europe.

[2] In Spain, between 1986 and 1992, an average of 98% of newly registered contracts were temporary contracts (see Bentolila and Saint-Paul, 1992). In France, in 1992, 80% of all entries were hirings on temporary contracts (see Goux, Maurin, and Pauchet, 2001).

[3] See column (4) in Table 2 and OECD (2002).

[4] See OECD (2002), chart 3.1. For instance, from the mid-80s until 2000, the share of temporary contracts rose from 11% to 32% in Spain, from 5% to almost 15% in France, and from 5% to 10% in Italy.

to shirk (because fired shirking workers would partly appropriate the firing costs) and thus increase the efficiency wage.

If there is no lower bound on wages, the incentive problem could be solved via the introduction of temporary contracts. Actually, the first best could be restored with low enough temporary wages. Workers would have to buy their right to a temporary contract by accepting a wage that is substantially lower than their productivity. Thus, the value of holding a temporary contract would be very low—so low in fact that the contract structure would solve the incentive problem effectively and unemployment would disappear. Temporary contracts would improve the structure of incentives. Temporary workers would have very low (perhaps negative) current income but would relish the possibility of obtaining a permanent job. Unemployed workers would be very unhappy but would accept a temporary job precisely in the hope of becoming permanently employed. Finally, the incentive structure of permanent workers would be more efficient because of the threat of losing their permanent job.

The presence of a minimum wage, however, radically distorts this mechanism. Temporary contracts combined with a high enough minimum wage *increase* the value of being unemployed, thus distorting the incentive scheme. This is because **(1)** temporary contracts increase the flows in the market, and **(2)** the high minimum wage ensures that the current income is quite decent while workers hold a temporary job. The high initial minimum wage forces firms to change the structure of the timing of payments to their workforce, moving it forward, which, combined with the high market flows induced by temporary contracts translates into unemployment being less painful. This worsens the effectivity of dismissal as a deterrent to shirking, forcing an increase in the efficiency wages of permanent workers and decreasing overall employment.

In short, temporary contracts can increase unemployment. Albeit both the unemployed and the permanently employed are happier than they would be in a universe without these contracts, temporary contracts generate a large mass of workers holding temporary jobs with a wage that is too high to ease incentive problems, but that is lower than what they would obtain in a world that disallowed these contracts.

In light of our model, the introduction of temporary contracts acts in a manner not unlike that of an increase in unemployment insurance. By allowing us to review the political economy of employment protection, our model may help us to understand why temporary contracts have failed

to boost employment as well as to understand the current resistance by unions and employers to remove them.

A large and growing literature examines the effects of temporary contracts on different aspects of the labor market.[5] The traditional answer to why temporary contracts might not reduce unemployment assumes that temporary contracts are equivalent to a reduction in firing costs. Since the effect of firing costs on aggregate employment is ambiguous (e.g., Bentolila and Bertola, 1990), because they reduce both hirings and firings, so is the impact of introducing temporary contracts. We believe that temporary and permanent contracts differ along several crucial dimensions other than lower firing costs (e.g., wages, duration, renewal prospects). In particular, the flows in the labor market differ dramatically in both cases (temporary contracts or low firing costs), and temporary contracts generate segmentation in the labor market. Few other papers have also considered temporary contracts beyond lower firing costs and studied their effect on the level of unemployment.[6] An attractive feature of our model is that we endogenously incorporate most of these aspects of temporary contracts and provide a very simple explanation for their effects on unemployment. Furthermore, in our framework firing costs imply higher efficiency wages for permanent workers and thus higher unemployment. This makes the problem interesting: lower firing costs would reduce unemployment, yet temporary contracts may fail to improve employment outcomes.

We show that introducing temporary contracts is not equivalent to reducing firing costs and that their impact depends on the interaction with other existing labor market institutions such as the minimum wage. We analyze the incentives effects (good and bad) of temporary contracts and the consequences for labor market outcomes. We contribute to the rather scarce theoretical literature on the effects of temporary contracts on the level of unemployment by exploring a new effect, unexplored in the literature, which tends to increase unemployment. Our paper also contributes to the also rather scarce literature on the interaction of different labor market institutions (see Bertola and Rogerson, 1997, for a notable exception).

[5] See, for example, Aguirregabiria and Alonso-Borrego (1999), Alonso-Borrego, Fernández-Villaverde and Galdón-Sánchez (2004), Bentolila and Dolado (1994), Berson and Ferrari (2015), Berton and Garibaldi (2012), Cabrales and Hopenhayn (1997), Cahuc, Charlot and Malherbet (2016), Cao, Shao and Silos (2013), Costain, Jimeno, and Thomas (2010), Saint-Paul (1996), and Wasmer (1999).

[6] See, for instance, Blanchard and Landier (2002) and Cahuc and Postel-Vinay (2002) for matching models in which temporary contracts increase both job creation and job destruction and the latter has a larger impact on unemployment the higher firing costs in permanent contracts are (relative to those in temporary contracts). More recently, in the same vein, see Bentolila, Cahuc, Dolado, and Le Barbanchon (2012).

We believe that efficiency wage models are well suited for examining the main differences between temporary and permanent contracts. Contract duration is an important source of incentives. Introducing an incentive problem implies that a link between temporary contracts and permanent contracts emerges endogenously. In our model, the instrument that allows the provision of incentives in temporary contracts is not their wage but their renewal rate into permanent contracts. Differently, in the existing literature, the link between temporary and permanent contracts has often been assumed exogenous. In most countries, temporary contracts cannot be used continuously and forever because firms have to convert them into a permanent contract or fire the worker at contract expiration. The link between temporary and permanent contracts allows to understand that, despite the introduction of *flexibility at the margin* that temporary contracts represent, these contracts are nevertheless affected by the unchanged regulations of the labor market. This constrains their potential to increase employment.

The rest of the paper is organized as follows. In section 2, the general setup of the model is introduced. Section 3 analyzes a system where only permanent contracts are available. Then, section 4 analyzes a system where both permanent and fixed-term contracts are available. Equilibrium employment in the two systems is compared in section 5. In section 6, some evidence is provided for the main empirical implications of the model. Section 7 concludes.

2 The model: general setup

The model is a modified version of the shirking model of Shapiro and Stiglitz (1984) with two types of contracts: temporary contracts and permanent contracts, which differ in length and firing costs. Additionally, there is a minimum wage. We do not take this to be literally the legal minimum wage. It could be the minimum wage that needs to be paid due to social, exogenous, and not-in-the-model conventions. For instance, it could be simply that it is not feasible to charge a *negative* wage, since we will see that with temporary contracts the market might desire to do so.

We first analyze an economy in which only permanent contracts are legal (the one-tier system) and then we analyze an economy in which both permanent and temporary contracts are legal (the two-tier system). Variables in the model, whenever relevant, will be denoted with subscript $c = \{P, T\}$ to refer to the *contract* ($c = P$ for a permanent contract and $c = T$ for a temporary

contract). Additionally, if necessary, variables will be denoted with subscript $s = \{1, 2\}$ to refer to the *system* ($s = 1$ for the one-tier system and $s = 2$ for the two-tier system).

The general assumptions of the model are as follows:

1. The model is set in continuous time.
2. All workers are identical and have a constant productivity $\widetilde{y}$.[7]
3. Workers are risk neutral and their instantaneous utility function is $U(\tilde{w}_c, e) = \tilde{w}_c - e$, where $\tilde{w}_c$ is the wage in contract c and e is the cost of providing an effort level e. Workers' effort is not perfectly observable. The required effort to perform the job is e, which is the same in any contract. If workers shirk, they exert zero effort and production is zero.
4. There is a minimum wage, $\tilde{w}_{\min}$, that all contracts must satisfy.
5. The number of vacancies in the economy is endogenous. Creating a position has a fixed cost C. The rate at which workers are hired is a. In equilibrium, there are never more vacancies than unemployed workers. Thus, vacancies are filled and the unemployed may take time in finding a job. The number of unemployed who find a job per unit of time equals the number of firms posting vacancies (and instantaneously filling them) per unit of time. This will generate a nonarbitrage condition determining the number of positions filled in the economy, since the value of a position must be equal to the creation cost C.
6. To simplify, we assume that unemployment benefits are zero.

3 One-tier system: only permanent contracts legal

In the one-tier system, the only possible contract is a permanent one (ψ_P), which is defined by its wage: $\psi_P = \tilde{w}_P$.

The termination of the relationship between workers and firms occurs for two reasons. First, workers face a rate b of being separated from their job because the match becomes exogenously

[7] We do not consider the possible use of temporary contracts to observe workers' characteristics. Since in most countries contracts can include a probation period with no firing costs, we implicitly assume that this period has already elapsed and has been useful for this matter. In Spain, a worker can be in the same firm under a temporary contract for a maximum of three years. Most renewals of temporary into permanent contracts occur at this legal limit, which suggests that firms are using temporary contracts mostly because they provide a cheaper option than permanent contracts rather than for screening purposes (see Güell and Petrongolo, 2007).

unproductive. Second, there is an imperfect detection technology that catches shirking workers with some exogenous rate q. Workers found shirking are dismissed. We assume that employment protection legislation requires firms to compensate workers with a payment F *whenever* fired.[8] This implies that firing costs reduce the cost of shirking, which translates into firing costs having a negative effect on unemployment in the world with only permanent contracts. This will make the problem of introducing some firing-cost-free contracts interesting.

3.1 Wage restrictions in permanent contracts

In a permanent contract, the wage $\tilde{w}_P$ that the firm pays to the worker has two restrictions:

1. **Minimum wage:** $\tilde{w}_P \geq \tilde{w}_{\min}$
2. **Incentive constraint**: In order to induce the worker to exert the effort, the firm needs to pay an efficiency wage. We analyze this in the next subsection.

3.1.1 Incentive constraint for permanent contracts

The present discounted values of shirking and not shirking for a permanent worker are as in a standard efficiency wage model, except that here workers always receive F whenever fired. Let V_P^n be the present discounted value of not shirking for a permanent worker. And let V_U be the present discounted value of being unemployed, which firms take as given. The following definitions would be useful for the rest of the paper.

Definition 1. *Let Δ be the smallest difference between the value of working and of being unemployed that induces a permanent worker not to shirk:* $\Delta \equiv \left(\frac{e}{q} + F\right)$.

Definition 2. *Let w_P be the wage net of the effort cost and the present discounted value of the firing cost (that sooner or later will revert to the worker):* $w_P = \tilde{w}_P - e + bF$.

Definition 3. *Let the minimum wage net of the effort cost be:* $w_{\min} = \tilde{w}_{\min} - e$.

Definition 4. *Let $\hat{w}_P(V_U)$ be the lowest wage (net of effort and the present discounted value of*

[8] See Galdón-Sánchez and Güell (2003) for a model and some evidence of dismissals due to workers shirking not being costless.

firing cost) that induces the worker in a permanent contract not to shirk:

$$\hat{w}_P\left(V_U\right) = \left(r+b\right)\Delta + rV_U. \tag{1}$$

Remark 1. *The no-shirking condition for permanent workers (NSCP) can be written as*

$$\left(V_P^n - V_U\right) \geq \left(\frac{e}{q} + F\right) = \Delta \iff w_P \geq \hat{w}_P\left(V_U\right) = \left(r+b\right)\Delta + rV_U. \tag{NSCP}$$

For a detailed derivation, see appendix (A.1).

This is as in Shapiro and Stiglitz (1984), except for the part related to firing costs. Since workers who are caught shirking are fired and compensated with F, effectively, this is as though firms had a worse monitoring technology. Thus, the opportunity cost of shirking is reduced exactly by F. And the rent to be paid in order to provide incentives, Δ, is augmented by F with respect to the standard efficiency wage model.

3.2 Value of the firm and worker in the one-tier system

3.2.1 Value of the firm

Let J_P be the value in steady state of having a position filled by a permanent worker. Realizing that there is production only if $w_P \geq \hat{w}_P\left(V_U\right)$, this is given by

$$rJ_P = \tilde{y} - \tilde{w}_P + b\left(J_P - F - J_P\right).$$

Definition 5. *In order to simplify notation, we define the output net of the effort cost:* $y = \tilde{y} - e$.

Remark 2. *In the one-tier system, the wage of a permanent contract is*

$$w_P = \max\{w_{\min} + bF, \hat{w}_P\left(V_U\right)\}, \tag{2}$$

and the value of the firm depends on whether it is paying the efficiency wage or the minimum wage:

$$rJ_P = y - \max\left\{w_{\min} + bF - \widehat{w}_P(V_U), 0\right\} - \widehat{w}_P(V_U). \tag{3}$$

For a detailed derivation, see appendix (A.2).

From equation (3), notice that if the minimum wage is not binding (i.e., $w_{\min} + bF \leq \widehat{w}_P(V_U)$), then the value of the firm is decreasing with V_U (because it increases the efficiency wage). Instead, if the minimum wage is binding, then the value of the firm does not decrease with V_U, but it does decrease with $w_{\min}$.

3.2.2 Value of being unemployed

Unemployed workers find a job at rate a and get no income while unemployed. By definition, the value of being unemployed is given by $rV_U = a\,(V_P - V_U)$.

Remark 3. *In the one-tier system, the value of being unemployed in equilibrium depends on whether the minimum wage is binding or not and is given by*

$$rV_U = a\left\{\Delta + \frac{\max\left\{w_{\min} + bF - \widehat{w}_P(V_U), 0\right\}}{r+b}\right\}. \tag{4}$$

For a detailed derivation, see appendix (A.3).

If the minimum wage is not binding, given a, the value of being unemployed depends on the rent paid to permanent workers in order to avoid shirking (that is, $(V_P - V_U) = \Delta$). If the minimum wage is binding, given a, the value of being unemployed is increasing in the minimum wage. Let a_1 and V_{U1} be the equilibrium job finding rate and the value of being unemployed, respectively.

3.3 Labor market flows

All employment in the one-tier system is permanent, denoted by L. Let U_1 be the level of unemployment in the one-tier system, where $U_1 = (1 - L)$. The steady-state level of unemployment is determined from the following equations: $\dot{U}_1 = bL - a_1\,(1 - L)$ and $\dot{L} = a_1\,(1 - L) - bL$. The measure of unemployment that we will use is the employment-to-unemployment ratio, which in steady state is given by

$$E_1 = \frac{L}{U_1} = \frac{a_1}{b}. \tag{5}$$

3.4 Equilibrium

In equilibrium, the hiring rate a has to be such that: **(i)** the wage is given by equation (2), **(ii)** the value of unemployment is determined by equation (4), and finally **(iii)** the value of the firm, determined by equation (3), has to be equal to the creation cost C. We characterize the equilibrium in the following result.

Result 1. *In the one-tier system, the minimum wage is never binding; if the minimum wage* $w_{\min}$ *is larger than* $y - rC - bF$*, there is no production. If the minimum wage* $w_{\min}$ *is smaller than* $y - rC - bF$*, and productivity* y *is larger than* $rC + (r + b)\,\Delta$*, then employment is decreasing with the firing cost* F*. Formally:*

- *If* $w_{\min} > y - rC - bF$*, then* $U_1 = 1$*,* $E_1 = 0$*.*
- *If* $w_{\min} \leq y - rC - bF$*, then*

$$\begin{aligned} w_P &= y - rC, \\ a_1 &= \frac{\{y - rC - (r + b)\,\Delta\}}{\Delta}, \\ U_1 &= \frac{b\Delta}{\{y - rC - (r + b)\,\Delta\} + b\Delta}, \\ E_1 &= \frac{\{y - rC - (r + b)\,\Delta\}}{b\Delta}, \\ rV_{U_1} &= y - rC - (r + b)\,\Delta. \end{aligned}$$

Proof. See appendix (A.4). ■

In order to ensure that production takes place in the one-tier system, worker productivity has to be large enough. In particular, productivity net of the creation cost has to be larger than the minimum wage (i.e., $w_{\min} + bF < y - rC$). Remarkably, if the minimum wage were binding, it would be so large that there would be no production; thus it is never binding. Moreover, productivity net of the creation cost has to be large enough to make up for the combination of the unhappiness of working, the annuity of the cost of the capital, and the incentive cost (i.e., $(r + b)\Delta$). Thus, our first parametric assumption is as follows.

Assumption 1.

$$\max\{w_{\min} + bF, (r + b)\,\Delta\} \leq y - rC$$

Firing costs have a real effect because they reduce the cost of shirking (see the NSCP). They increase the incentive rent, Δ, and thus reduce the hiring rate a. Firing costs imply higher wages and thus lower equilibrium employment. Unlike Lazear (1990), this effect cannot be undone through a deposit scheme because workers would shirk at lower wages. Notice that a reduction of the firing cost F would reduce unemployment. So, in this context, the introduction of temporary contracts without firing costs is meaningful and, at first sight, this policy may seem to be one that could lead to a reduction in unemployment. At least this seems to have been the line of reasoning of the regulators that introduced these contracts in the mid-1980s. In the next sections, we will see that this line of reasoning is deeply flawed if other policies (e.g., minimum wage) are left in place.

4 Two-tier system: permanent and temporary contracts

In this section, we consider a modification of the institutional framework that aims to capture the introduction of temporary contracts in many European countries during the 1980s: the legalization of a firing-cost-free temporary contract while leaving the other labor market regulations unchanged. In particular, mandated firing costs of permanent contracts and the legal minimum wage are not modified by the introduction of temporary contracts.

Environment description When meeting a worker, firms can now choose to offer a temporary contract (TC, hereafter) or a permanent contract (PC, hereafter). Permanent contracts offered to unemployed workers would be exactly as in the one-tier system, but they are never offered in equilibrium. Temporary contracts are defined as follows.

- TCs expire at an exogenous rate λ. Agents cannot bargain on it because it is an institutional restriction. Labor regulation establishes that firing costs are zero[9] when a temporary contract expires whereas these costs would be the same as those of a permanent contract if a temporary contract was broken before its expiration date. Thus, given that TCs can be made sufficiently short,[10] it can be realistically assumed that firms wait until the expiration date whenever they need to separate from a temporary worker.[11] Thus, we make the following convenient

[9] Or very small (and never higher than for permanent contracts) in some countries.

[10] Most temporary contracts in OECD countries are issued for less than a year (see OECD, 2002).

[11] It is true that firing costs are proportional to job tenure and, therefore, the firing costs associated with an early

modeling assumption: TCs terminate at their expiration date and not by any other event. This is not unrealistic: Güell and Petrongolo (2007) document that in Spain promotion decisions (and thus firing decisions) of temporary contracts mainly coincide with the end of the duration of temporary contracts. Therefore, the expiry rate of the PC, b, does not affect λ. Thus, TCs cannot be terminated before their due date. Shirking temporary workers are detected with an exogenous probability Q. This can only happen at the moment in which the temporary contract is terminated. So, λ is independent of whether the worker is shirking or not, but if he is shirking, he can be detected once the expiration date arrives.[12] Again, this is a convenient assumption, but it does not literally mean that there are different monitoring technologies for different contracts.

- Formally, the TC bounds the firm and the worker only during the duration of the contract. Nevertheless, in practice firms and workers are aware that upon expiration of the TC, it is possible to transform it into a PC (as the one in the one-tier system).[13] A worker can only be hired once by the same firm under a TC. When this contract expires, the firm has to decide whether to renew the worker via a PC or fire him. Renewal into a PC happens with endogenous probability R.[14] As in standard efficiency wage models, we assume that firms commit to a future wage. Moreover, we also assume that firms commit to future renewal rates of temporary contracts into permanent ones. In subsection (4.6), we show that this is an innocuous assumption.

- Thus, temporary contracts may have two *phases*—a temporary one and a permanent one—and are characterized by the triplet

$$\psi_T = \{\widetilde{w}_T, R, \widetilde{w}_P\},$$

where $\widetilde{w}_T$ and $\widetilde{w}_P$ are the wages during the temporary and permanent phases of such contract.

separation of a temporary worker would be lower than those of a permanent worker. Still, the potential cost of going to court as well as the reputation costs for the firm make separation costs of temporary contracts before its expiration date not negligible.

[12] Notice that given that all the shocks are Poisson, the individual either shirks all the time or never shirks.

[13] The expected duration of the permanent contract is the same independently of whether there was a temporary part or not. It is determined solely by b.

[14] Assuming that the TC can be renewed into further a TC would not alter the results because, as will be shown, it is necessary that at some point the TC gets renewed into a PC.

The incentive-compatible contract for the permanent phase (PC) is characterized exactly as in the one-tier system. To analyze the firm's choice of contracts, we first need to characterize an incentive-compatible contract for the temporary phase. We do this in the next subsection.

4.1 Wage restrictions in temporary contracts

Definition 6. *It is convenient to define the wage of the temporary phase net of effort levels as* $w_T = \tilde{w}_T - e$.

In a temporary contract, three restrictions should be taken into account:

1. **Minimum wage:** wages in any of the phases of the TC must be at least the minimum wage:

$$\begin{bmatrix} \tilde{w}_{\min} \leq \tilde{w}_T \\ \tilde{w}_{\min} \leq \tilde{w}_P \end{bmatrix} \Longleftrightarrow \begin{bmatrix} w_{\min} \leq w_T \\ w_{\min} + bF \leq w_P \end{bmatrix}$$

2. **Incentive constraint for the permanent phase.** In order to induce the worker to exert effort while in the permanent phase of the contract, the firm needs to pay an efficiency wage. This is exactly as in the one-tier system. Thus, the NSCP must be satisfied.

3. **Incentive constraint for the temporary phase.** In order to induce the worker to exert effort while in the temporary phase of the contract, the firm needs to promise a large enough renewal rate. We analyze this in the next subsection.

4.1.1 Incentive constraint for the temporary phase

Provided that the NSCP is satisfied in the permanent phase of the contract, the values for the worker of shirking and not shirking during the temporary phase are, respectively,

$$\begin{aligned} rV_T^s &= \tilde{w}_T + \lambda \left[R\left(1-Q\right)\left(V_P - V_T^s\right) + \left[1 - R(1-Q)\right]\left(V_U - V_T^s\right)\right] \\ rV_T^n &= \tilde{w}_T - e + \lambda \left[R\left(V_P - V_T^n\right) + \left(1-R\right)\left(V_U - V_T^n\right)\right]. \end{aligned}$$

Note that not being caught shirking is a necessary condition to be renewed into a PC and allows entering into the renewal lottery.

Result 2. *The no-shirking condition for the temporary phase (NSCT) is independent of the temporary wage w_T. The NSCT is that the renewal rate R is large enough. Formally,*

$$(V_T^n - V_T^s) \geq 0 \Longleftrightarrow R\,(V_P - V_U) \geq \frac{e}{\lambda Q}. \tag{NSCT}$$

Proof. *It follows directly from V_T^s and V_T^n.* ■

The intuition for this result is simple: no action of the worker determines the length of time she is going to receive the temporary wage, so the stream of income from the temporary phase of the contract is essentially lump sum. Thus, the temporary wage does not provide incentives. Incentives in the temporary phase are provided by the expected future gains of becoming a permanent worker (and getting the efficiency wage). So, firms need to commit to a sufficiently high renewal rate into a permanent contract. If workers always become unemployed at the end of the temporary phase (independently of the effort exerted), then there would be no way to motivate them. This is not unrealistic.

4.1.2 Wage in the temporary phase

The wage in the temporary phase of the contract has no incentive role. Thus, it will be set equal to the maximum of: (i) the minimum wage and (ii) the wage that satisfies the participation constraint: $w_T : V_T \geq V_U$. As we will see in section (4.5), for low levels of the minimum wage, the temporary wage will determined by the (binding) participation constraint, and for high levels of the minimum wage, the temporary wage will be equal to the legal minimum wage.

4.1.3 All incentive restrictions together

A temporary contract must satisfy both the NSCT and the NSCP, represented in figure (1). We can check graphically when both conditions hold.

Assumption 2. *Clearly, in order to ensure that the NSCT and the NSCP conditions can simultaneously hold with a renewal probability in the interval $[0, 1]$, we need to assume that*

$$\frac{e}{\lambda Q} < \frac{e}{q} + F.$$

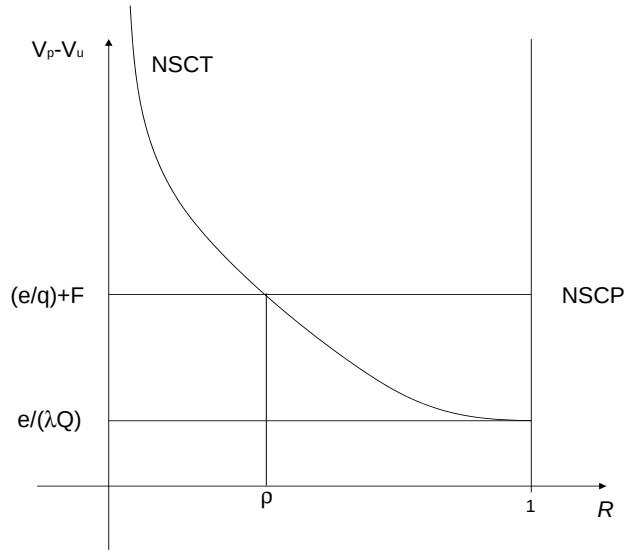

Figure 1: Incentive restrictions in a temporary contract.

A high enough firing cost ensures that this assumption holds.

Definition 7. *Let ρ be the renewal probability if both incentive restrictions bind:*

$$\rho = \frac{e/\lambda Q}{e/q + F} \in (0, 1)\,.$$

Definition 8. *It is useful to make the following definition:*

$$\gamma = \frac{r + b}{r + b + \lambda\rho} \in (0, 1)\,.$$

The larger that γ is, the smaller that the renewal rate is relative to the discount rate.

4.2 Choice of contracts

It follows from result (2) that temporary wages have no incentive role and thus will not be larger than permanent wages:

$$\tilde{w}_T \leq \tilde{w}_P(V_U). \tag{6}$$

So, it is straightforward that, given V_U (and, thus, given permanent wages), in the two-tier system, firms cannot be worse off by offering contract ψ_T instead of contract ψ_P. Thus:

Result 3. *In the two-tier system, given V_U (and, thus, given $\widetilde{w}_P$), firms always prefer to offer workers a temporary contract (i.e., $\psi_T = \{\widetilde{w}_T, R, \widetilde{w}_P\}$) rather than a permanent one (i.e., $\psi_P = \{\widetilde{w}_P\}$).*

Proof. *It follows directly from condition (6) and the fact that at the end of the temporary phase of contract ψ_T, no firing costs are involved.* ■

The temporary contract ψ_T is incentive compatible for all workers: workers in the temporary phase are motivated by the possibility of becoming permanent (since permanent wages are not lower than temporary wages), and workers in the permanent phase are motivated to keep their jobs in order to avoid (i) becoming unemployed (as in standard efficiency wage models) as well as, in our model, (ii) restarting with a temporary contract (since the only way to exit unemployment is through a temporary contract).

4.3 Value of the firm and worker in the two-tier system

4.3.1 Value of the firm

Firms offer a temporary contract ψ_T, and therefore a position in the firm may be in one of the following two circumstances: filled by a temporary worker (i.e., workers being in the temporary phase of the contract); or filled by a permanent worker (i.e., workers that have been renewed and are in the permanent phase of the contract). Let the value functions of each circumstance be J_T and J_{P2}, respectively.

- If $w_P \geq \hat{w}_P(V_U)$ (there is production), the value of having a permanent worker in the two-tier system is

$$rJ_{P2} = \widetilde{y} - \widetilde{w}_P + b(J_T - F - J_{P2}). \tag{7}$$

- Given that the NSCP holds, there is production only if $\lambda RQ(V_P - V_U) \geq e$, then the value of having a temporary worker is

$$rJ_T = y - w_T + \lambda[R(J_{P2} - J_T) + (1 - R)(J_T - J_T)]. \tag{8}$$

In what follows, we assume that both incentive constraints are binding, and later we show that in equilibrium that is the case (see appendix (A.7)).

Remark 4. *Assuming that both the NSCP and the NSCT are binding, the value of the firm is given by*

$$rJ_T = y - [\gamma \ w_T + (1-\gamma) \ \hat{w}_P(V_U)] \tag{9}$$

This remark follows from the value functions of firms (7) and (8).

As in the one-tier system, if the minimum wage is not binding, the value of the firm is decreasing with V_U (because it increases the efficiency wage paid in the permanent phase of the contract and may increase the temporary wage). If the minimum wage is binding, then the value of the firm decreases with w_{min}.

4.3.2 Value of being unemployed

The difference in the value of being unemployed in the two systems will play a key role in our results. Let a_2 be the job finding rate and V_{U2} be the value of being unemployed in equilibrium in the two-tier system. All transitions from unemployment to employment are through a temporary contract ψ_T. Thus, the value of being unemployed is given by $rV_{U2} = a_2(V_T - V_{U2})$.

Remark 5. *In the two-tier system, if both NSCP and NSCT are binding, the value of being unemployed is*

$$rV_{U2}\frac{r+\lambda+a_2}{a_2} = w_T + \lambda\rho\Delta. \tag{10}$$

For a detailed derivation see appendix (A.5).

Equation (10) states the value of being unemployed as a function of the contract ψ_T. If the minimum wage is binding, given a_2, the value of being unemployed is increasing in the minimum wage.

4.4 Labor market flows

In the two-tier system, all firms offer the temporary contract ψ_T, and thus there is temporary employment (denoted by L_T) as well as permanent employment (denoted by L_P). Let U_2 be the level of unemployment in the two-tier system, where $U_2 = (1 - L_T - L_P)$. The flows of the labor

market are determined from the following equations:

$$\dot{U}_2 = bL_P + \lambda(1-R)L_T - a_2(1-L_P-L_T)$$
$$\dot{L}_P = \lambda R L_T - bL_P; \dot{L}_T = a_2(1-L_P-L_T) - \lambda L_T.$$

In steady state, $L_T = \frac{a_2}{\left(\frac{a_2}{b}\lambda R + a_2 + \lambda\right)}$ and $L_P = \frac{\frac{a_2}{b}\lambda R}{\left(\frac{a_2}{b}\lambda R + a_2 + \lambda\right)}$; thus, the employment-to-unemployment ratio is given by

$$E_2 = \frac{1-U_2}{U_2} = \frac{a_2}{b}\frac{(b+\lambda R)}{\lambda}. \tag{11}$$

Comparing equations (5) and (11) shows how different the labor market flows are once temporary contracts have been introduced.

4.5 Equilibrium

In equilibrium, assuming that the NSCT and NSCP are binding (later we show that in equilibrium this is the case), the hiring rate a_2 has to be such that

(1) The temporary wage is given by the maximum of: (i) $w_{\min}$ and (ii) $w_T : V_T \geq V_{U2}$.

(2) The permanent wage is the efficiency wage $\hat{w}_P(V_U)$.

(3) The value of being unemployed is determined by equation (10).

(4) The value of the firm, determined by equation (9), has to be equal to the creation cost C.

Remark 6. *In any equilibrium where NSCP and NSCT are binding, the following expression must hold:*

$$r(J_T - C) = y - rC - \frac{(r+\lambda)\gamma + a_2}{r+\lambda+a_2}(w_T + \lambda\rho\Delta). \tag{12}$$

This remark follows directly from equations (9) and (10).

Expression (12) characterizes the equilibrium in the two-tier system. As in the one-tier system, in equilibrium the value of the firm (which equals C) is determined by the value of unemployment, whereas the value of unemployment is determined by the contract offered to workers and a_2.

The equilibrium depends critically on the value of the minimum wage because it determines the temporary wage w_T. In what follows, we do comparative statics exercises (only in steady states) considering different minimum wage levels. A case with a "low" minimum wage and a case with a "high" minimum wage will become relevant.

4.5.1 Low minimum wage: no unemployment

Result 4. *If $w_{\min} \leq y - rC - \lambda\rho\Delta$, then: the minimum wage does not bind either in the temporary phase or in the permanent phase; there is no unemployment. Both NSCP and NSCT bind, and in equilibrium we have*

$$\psi_T = \{w_T, R, w_P\} = \{y - rC - \lambda\rho\Delta, \ \ \rho, \ \ y - rC + \Delta(r + b)\}$$

$$a_2 \to \infty; U_2 = 0; \ \ E_2 \to \infty$$

$$rV_{U_2} = rV_T = y - rC, \ \ rV_P = y - rC + r\Delta$$

$$J_T = C; \ \ J_{P2} = C - \Delta.$$

Proof. *For $w_{\min} = y - rC - \lambda\rho\Delta$, the equilibrium condition (12) can only hold with $a_2 \to \infty$, thus establishing the inexistence of unemployed workers.*

For $w_{\min} < y - rC - \lambda\rho\Delta$, the equilibrium condition (12) is incompatible with $a_2 \geq 0$ unless the wage is bid up to $w_{\min} = y - rC - \lambda\rho\Delta$. The minimum wage is so low that it is very attractive to create a firm. For given $w_{\min}$, it is so attractive that too many firms would be created and they would have to queue for workers. But firms would bid up temporary wages up to the point where there would be no more unemployed in order to avoid queuing (and having unused capital). Thus, $\forall w_{\min}$ such that $w_{\min} \leq y - rC - \lambda\rho\Delta$, full employment is reached.

We prove that NSCT and NSCP bind in appendix (A.7). ■

Unlike one-tier systems and standard efficiency wage models, here full employment is compatible with incentives. The first best is achieved. The contract structure solves the incentive problem. Notice that this happens for a very low minimum wage given workers' productivity, perhaps even negative. There are no unemployed workers, but having a temporary job is bad enough. Workers in the temporary phase are willing to *pay* to get a job and later obtain higher payments. This has the positive side effect of solving the incentive problems without the need for unemployment: to lose your job is very bad because even if you find a job immediately after being fired, you can only restart with a very low-paid temporary job. Workers in the permanent phase are motivated to avoid being fired and having to restart their career (in some other firm) with a temporary contract

(and perhaps paying a fee again).

In our model, temporary contracts have an upward-sloping earnings profile (wages are higher when renewed to a permanent contract). Carmichael (1985) argued that entrance fees or bonds can restore full employment in efficiency wage models. Explicit up-front performance bonds are rarely seen in reality, although upward-sloping earnings profiles could act as an implicit bond. Akerlof and Katz (1989) argue that these two are not always perfect substitutes. In our model, the implicit bonding that temporary wages represent is a perfect substitute for a first-best contract. The reason is that in our model, temporary wages have no incentive role. If the minimum wage is low, they are determined by the participation constraint. Unemployment becomes "unnecessary" because it loses all incentive roles.

4.5.2 High minimum wage: unemployment

Result 5. *If* $y - rC - \lambda\rho\Delta \leq w_{\min} \leq y - rC - bF$ *then: the minimum wage binds in the temporary phase, but not in the permanent phase; there is unemployment. Unemployment is increasing in the minimum wage. Both NSCP and NSCT bind, and in equilibrium we have*

$$\psi_T = \{w_T, R, w_P\} = \left\{ w_{\min},\ \rho,\ \frac{(y - rC) - \gamma\ w_{\min}}{1 - \gamma} \right\}$$

$$a_2 = (r + \lambda)\,\frac{(y - rC) - \gamma\,(w_{\min} + \lambda\rho\Delta)}{(w_{\min} + \lambda\rho\Delta) - (y - rC)};$$

$$U_2 = \frac{\lambda b[(w_{\min} + \lambda\rho\Delta) - (y - rC)]}{\lambda b[(w_{\min} + \lambda\rho\Delta) - (y - rC)] + (b + \lambda\rho)(r + \lambda)[(y - rC) - \gamma(w_{\min} + \lambda\rho\Delta)]};$$

$$E_2 = \frac{(b + \lambda\rho)}{\lambda}\frac{(r + \lambda)}{b}\frac{(y - rC) - \gamma\,(w_{\min} + \lambda\rho\Delta)}{(w_{\min} + \lambda\rho\Delta) - (y - rC)};$$

$$rV_U = \frac{(y - rC) - \gamma\,(w_{\min} + \lambda\rho\Delta)}{1 - \gamma};$$

$$rV_T = \frac{\lambda\,(y - rC) - [(\lambda + r)\gamma - r]\,(w_{\min} + \lambda\rho\Delta)}{(1 - \gamma)(\lambda + r)};$$

$$rV_P = \frac{(y - rC) - \gamma\,(w_{\min} + \lambda\rho\Delta) + r\Delta(1 - \gamma)}{1 - \gamma};$$

$$J_T = C;\ \ J_{P2} = \frac{C}{1 - \gamma} - \frac{(y - rC - w_{\min})}{\lambda\rho}.$$

Proof. *Given the large enough level of the minimum wage considered, the only way of making*

equilibrium condition (12) hold is by making workers queue for firms, whereas firms find them instantaneously. Everything else follows. We prove that NSCT and NSCP bind in appendix (A.7).

The efficiency wage of the permanent phase is decreasing in the minimum wage but always is larger than the minimum wage (in all of this range). Notice that the largest possible value of the minimum wage allowed by assumption (1) is $y - rC - bF$*, in which case* $\tilde{w}_P - \tilde{w}_{\min} > 0$. ■

Assumption 3. *The largest possible value of the minimum wage allowed by assumption (1) is* $y - rC - bF$*. In order to ensure that there exist values of the minimum wage such that (i) production takes place in the one-tier system and (ii) there is unemployment in the two-tier system, we need to make the following assumption (see result 5):*

$$\Delta\lambda\rho - bF > 0.$$

The larger the minimum wage is, the less interesting it is to create firms, ceteris paribus, because fewer profits can be extracted in the temporary phase. Thus, there is less firm creation. From the workers' point of view, the higher the minimum wage, the less the impact of holding a TC. Therefore, unlike when the minimum wage is low, temporary contracts do not solve the incentive problem. Unemployment is necessary. Unemployment eases the incentive problem by lowering the prospects of (hypothetical) shirking workers who hold a permanent contract, who have to wait to get a job, as in all efficiency wage models in the Shapiro-Stiglitz tradition. Unemployment becomes the threat that solves the incentive problem of the firm.

Remark 7. *If* $y - rC - \lambda\rho\Delta \leq w_{\min} \leq y - rC - bF$*, the value of all agents is decreasing in* $w_{\min}$.

The larger the minimum wage, the larger unemployment is, and the lower the value of *all* workers is. Unemployed workers are worse off because they have to wait longer to get a job. Permanent workers are worse off because their value has a fixed wedge with the value of being unemployed. Even workers in the temporary phase (and earning the minimum wage) are worse off. This is because the necessary increase in unemployment (to overcome the more stringent incentive problem) lessens the value in the temporary phase by implying more time spent on unemployment over the lifetime of the individual, which does not compensate with higher pay while employed. Recall that the *probability of accessing the permanent contract is constant and independent of the*

minimum wage (see NSCT).

Notice how much the equilibrium outcome depends on the value of the minimum wage.

If the minimum wage is "low", holding a temporary contract is very bad. This is so costly for workers that it solves all the incentive problems and unemployment disappears. The temporary wage could be negative, in which case workers would be "paying" their way into employment by paying a fee during the temporary phase of the contract. Firms are able to pay relatively low efficiency wages to workers in the permanent phase, and the first best is reached.

If the minimum wage is "high", workers in the temporary phase of the contract are having fun because their wages are "large". Being a temporary worker would not seem like such a bad state anymore, and thus the prospects of becoming one are not bad enough to pose a significant threat that forces permanent workers to provide effort. The efficiency wage paid to permanent workers needs to be larger *for any given level of unemployment*. Larger wages induce lower value to the firms and thus demand unemployment in order to decrease the outside option of permanent workers and allow the value of a firm with a temporary worker to equal the creation cost C. Notice that firms do not hire workers directly into a permanent contract because the minimum wage, albeit being too high to be a perfect threat, is still lower than the efficiency wage and can be offered only in the temporary phase.

Thus, minimum wages larger than $y - rC - \lambda\rho\Delta$ induce unemployment in the two-tier system. And the larger the minimum wage, the larger the unemployment level. Moreover, the large minimum wage destroys the ability of temporary contracts to solve the incentive problem. Consequently, *all* workers lose from increases in the minimum wage.

4.6 Commitment

Two commitment-related issues arise. First, irrespective of the minimum wage, the value of a firm with a permanent worker is lower than the creation cost C. One might conclude that this would induce firms to close at this stage. Notice, however, that the value of the firm with a permanent worker is positive if C is large enough. Thus, if C is large enough, firms have no incentive to declare bankruptcy once workers access the permanent phase. This is true regardless of whether there is limited liability (in which case the threshold value to declare bankruptcy would be 0) or not (in which case it would be $-F$). Thus, C can prevent firms from having an incentive to break up when

workers are in the permanent phase.

A second issue is that firms have incentives to breach the contract ψ_T at the time of expiration of the temporary phase. The firm's value of having a permanent worker is always lower than a temporary one. Thus, we have to consider the possibility that the firm may not renew the temporary phase of the contract into the permanent phase, or to do so with a probability lower than ρ. If there were no fixed costs for firm creation, this time inconsistency problem would be a serious concern, but a fixed creation cost C solves it insofar as the lottery is publicly observable.

Result 6. *If the renewal probability of temporary contracts is publicly observable (i.e., if the probabilities in the lottery can be monitored) and the creation cost C is not smaller than Δ, there exists an equilibrium in the repeated game with memory in which the firms do offer and enforce the contract ψ_T.*

Proof. *The value of a firm with a permanent worker is larger than zero whenever $C > \Delta$. Consider a strategy in which workers of a firm that in the past has renewed a contract with a probability lower than ρ would never exert effort anymore. This would bring the firm's value to zero. It is then clear that insofar as workers can commit to such a strategy, there exists an equilibrium with firms offering and not breaching contract ψ_T.* ■

The equilibrium is not renegotiation proof, and thus it demands (like any other non-Markov equilibrium in any repeated game) commitment to the strategy on the part of the workers, which we simply assume. In this context, this is not completely unreasonable, since no firm offers a permanent contract directly and it is quite easy to get a temporary contract (the hiring rate is higher than it is without temporary contracts).

We also assume here that the lottery is observable: the true probabilities are observed as in a national lottery or a casino. This simplifies the algebra, but it is not necessary to obtain the result. We could just as well assume that firms were "large" and had a minimum size involving a positive mass of workers, so that in each period the fraction of agents that the firm is renewing could be observed, and thus it could be observed whether the firm is complying with the contract. Alternatively, we could assume that agents observed the past behavior of the firm and judge whether the historic renewal rate deviates from ρ (i.e., learning of firms that breach the contract). Either alternative would involve substantially longer algebra without adding new insights.

5 Comparative statics of the introduction of temporary contracts

The point of this paper is to compare the level of steady state unemployment in a universe where temporary contracts are allowed with another universe where they are not, *for a given minimum wage*. We have seen that if the minimum wage is low or does not exist, the unemployment level is lower in the universe with temporary contracts, because they ease the incentive constraints of the economy. On the other hand, we have also seen that the larger the minimum wage, the larger unemployment is in the universe with temporary contracts. It remains to be seen whether for relatively high levels of the minimum wage, the steady state unemployment level is larger in the universe with temporary contracts. The following result shows that this is indeed the case.

Result 7. $\exists w^* : \ y - rC - \lambda\rho\Delta < w^* < y - rC - bF$, *and* $\forall w_{\min} > w^* \implies U_2 > U_1$ *for at least some positive values of* b.

Under this condition, if the minimum wage is large enough, the steady state unemployment level is larger if temporary contracts are allowed than if they are not.

Proof. See appendix (A.6). ■

Therefore, the introduction of temporary contracts can imply worse employment outcomes if the minimum wage is high enough. In particular, b being sufficiently low (the permanent contract being permanent enough) is a sufficient condition to ensure that a certain wage threshold exists, such that if the mandatory minimum wage is above it, unemployment is higher in the universe where temporary contracts are available.

This result may seem surprising, because in the universe without temporary contracts, a reduction of firing costs would necessarily reduce unemployment. Indeed, this was precisely the reasoning that induced many countries to create or extend the legal form of temporary contracts. Our point is that this reasoning is incorrect. Moreover, it is incorrect even if it is correct that when the minimum wage is low (or negative or it does not exist), temporary contracts do reduce unemployment levels. Interestingly, the reason why it is incorrect is precisely because temporary contracts increase the flows to and from unemployment.

Temporary contracts are destroyed often and consequently, are created often. This implies that unemployed workers expect to get a temporary job in a relatively short time if TCs are allowed. Furthermore, the probability that the contract is renewed into a permanent one is independent of

the minimum wage, because it is used as an incentive device during the temporary phase. This means that if the minimum wage is high, an unemployed worker knows that with a relatively high probability, she is going to soon access a *relatively* highly paid job. Thus, to be unemployed is not so bad. This has a negative effect on the structure of incentives, because it increases the efficiency wage and reduces the willingness of firms to create jobs.

This can be seen in the following remark, which follows after some algebra from comparing results 1 and 5.

Remark 8. *For any given $w_{\min}$, the value of being an unemployed worker in the universe with temporary contracts is always higher than in the universe without them.*

If the minimum wage is low, the results of the introduction of temporary contracts are not unlike those with an increase in the provision of unemployment insurance: increasing the value of the unemployed complicates the incentive structure of the economy. Higher unemployment appears as an incentive device.

In order to see the intuition for this result, imagine that the unemployment level were the same in both systems (with and without TCs). Total unemployment being the same, GDP and average consumption would also be the same in both worlds, since firms' value at creation is zero. Nevertheless, unemployed workers would value both worlds very differently. In the universe where temporary contracts are forbidden, the unemployed need to wait for a long time in order to obtain income. In the universe with temporary contracts, the *timing* of their income flows is very different, albeit their average income would be the same. In the two-tier system (even if, as in the one-tier system, it also takes time to get a PC),[15] the unemployed have rapid access to income thanks to the faster arrival of temporary contracts. A high minimum wage means that a large share of total income goes to (temporary) workers faster than in the one-tier system. Given discounting, this necessarily makes the unemployed happier in the two-tier system than in the one-tier system. Given our assumption of constant unemployment, the unemployed have the same level of consumption over their lifetime, but they consume much sooner. This difference in the *timing* of income flows, plus discounting, is what makes the effects of TCs similar to those with unemployment insurance.

The bad news is that this worsens the incentive problem faced by the firms, which need to pay

[15] Recall that the renewal rate is fixed by the NSCT.

higher efficiency wages for any given unemployment level. That is, permanent workers are more expensive in the two-tier system than in the one-tier system. Recall that the only difference in the equilibrium wages of permanent workers in the two systems comes from the potential differences in the value of being unemployed (see equation (1)). So, in the two-tier system with a high minimum wage, the efficiency wages of permanent contracts that are compatible with any given level of unemployment are larger than in the one-tier system, which implies lower job creation and potentially (for minimum wages high enough) lower employment than in the one-tier system.

6 Empirical implications

We provide some suggestive evidence that is compatible with the main empirical implications of the model.

(1) A central implication of the model is that when the minimum wage is too high, then the introduction of TCs increases unemployment. This implies that, for a given level of the minimum wage in the economy, the distortion will be higher for low-skilled workers than for high-skilled ones.

In order to test this implication, we focus on the Spanish labor market, which is an ideal testing ground (see, for instance, Dolado, García-Serrano and Jimeno, 2002). In the mid-1980s, Spain had an unemployment rate of around 20% of the labor force, the highest among OECD countries. It also ranked second in terms of strictest employment protection legislation (OECD, 1999). This situation triggered the introduction of TCs in 1984. Spain is an extreme case in terms of the incidence of TCs: soon after their introduction, more than 90% of newly created contracts were TC. This translated into a rapidly growing stock of temporary employment: from 11% in 1983 to approximately 35% by the early 1990s, which is more than three times the European average (see OECD, 1993). The 1984 reform constituted the main labor market reform in Spain in the 1980s.[16]

The empirical strategy we follow to test this prediction is to analyze the evolution of the difference in unemployment rates by skill groups before and after the introduction of TCs in 1984. We use data from the Spanish Labor Force Survey (*Encuesta de la Población Activa,* EPA), which

[16] Another relevant fact is found in Dolado and Felgueroso (1997). They show that between 1989 and 1995, the share of workers for whom the minimum wage was binding increased from 9 to 56% among workers aged 16-19 and from 2 to 9% among workers aged 20 to 24. This fact is consistent with the increase of TCs. The incidence of TCs among these age groups is particularly high. Although there were some changes in the minimum wage legislation for workers aged 16-17 in 1989, it does not seem that this alone could explain the facts.

is carried out quarterly on a sample of some 60,000 households. This survey is designed to be representative of the total Spanish population and contains very detailed information about the labor force status of individuals.

The sample we use includes individuals in the labor force during the 1980s.[17] We exclude inactive individuals as well as workers above retirement age (65 years old). The dependent variable takes value one for all the unemployed and zero otherwise. The model includes skill dummies, year dummies, and interaction of skill dummies with a reform dummy (value one for all years after 1983). Year dummies absorb any evolution in unemployment that is common to the different skill groups. Skill dummies capture differences in unemployment levels across skill groups. The coefficient on the skill dummies with the post-reform dummies hence captures the differential change before and after the reform in unemployment rates between skill groups. Three skill dummies are included: $unskilled1$ is a dummy for completed secondary school and no tertiary education; $unskilled2$ is a dummy for completed primary school and uncompleted secondary school; and $unskilled3$ is a dummy for education less than primary. The omitted category is university education or above. According to the model, the coefficient on the interaction of skill dummies with the reform dummy (the differential effect of the reform with respect to the reference category) should be positive. Moreover, it should be lower for more skilled workers than for less skilled ones (for instance, $unskilled1$ and $unskilled3$).

One obvious objection to this model is that the treatment variables might capture the effect of time changes in skill-specific unemployment rates that do not depend on the effect of the reform. If unemployment rates happened to increase more for unskilled workers than for skilled ones before and after 1984 for reasons other than the introduction of TCs, the estimates are likely to be biased. A natural candidate for the rise in unemployment rates of unskilled workers is skill-biased technological change: if the relative demand for skilled workers grew more than the relative supply, this might explain the results. In order to control for this, we introduce the interaction of skill dummies with a linear trend (similarly to Katz and Murphy, 1992, and Card and Lemieux, 2001).

Column (1) of Table 1 reports the marginal effects of the probit estimates using yearly data from 1980 to 1989. Standard errors are clustered by year and skill. The main prediction of the model is

[17] Since there were changes in the minimum wage legislation in 1989, we concentrate on the period 1980-1989 for our analysis.

confirmed: for all groups, the 1984 reform implied a higher effect on unemployment for less skilled than for more skilled workers. Moreover, this effect monotonically decreases with the skill level. This model includes skill dummies with a linear trend, suggesting that skill-biased technological change is unlikely to explain the results.

Next we perform some robustness checks. First, we estimate the same model allowing for regional dummies, since differences in unemployment rates by skill groups might differ in different regions. As column (2) shows, the magnitude of the coefficients remains unchanged. Second, we also allow for several individual characteristics.[18] As column (3) shows, the magnitude of the coefficients is somehow reduced, but the main pattern of the coefficients remains unchanged and is consistent with the predictions of the model.

(2) Another important implication of the model is the relationship between the renewal rate of TCs into PCs and firing costs. The optimal renewal rate of TCs is lower the higher the firing costs are. In our theoretical model, firing costs F implicitly include severance payments as well as the effect of dismissal conflicts.[19] Table 2 provides evidence of this result for some European countries. In that table, countries are ordered according to firing cost F and, as can be seen in column (4), the renewal rate R decreases with F, confirming the prediction of the model.

7 Conclusion

In this paper, we have analyzed the effect of the introduction of temporary contracts on unemployment in an efficiency wage model. We have provided a novel explanation for why temporary contracts might *increase* unemployment based on their effect on incentives. We do this in a context in which a reduction in firing costs would have *reduced* unemployment.

Using an efficiency wage model, it is natural to incorporate the renewal rate of fixed-term contracts as a meaningful economic variable. Temporary contracts must be renewed into permanent contracts with a high enough probability in order to provide incentives. In turn, temporary wages have no incentive role insofar as the contract length is fixed. The renewal rate is lower the higher the effect of firing costs is. This result is supported by the empirical evidence reported for some

[18] See Table 1 for details.

[19] Recall that F is paid to workers *whenever* fired (including when the worker shirks). By law, shirking workers can only get compensation if they win the case in court (since by default they get no indemnity).

European countries. As in standard efficiency wage models, permanent workers are motivated by the fear of losing their jobs. Additionally, in our model, they are also motivated in order to avoid restarting with a temporary contract, since all firms only offer temporary contracts to the unemployed.

It is often stated that the argument for introducing fixed-term contracts is that this is "the price to pay in order to get full employment."But higher employment at the expense of segmentation of the labor market only arises if the wages of temporary contracts are very flexible. This is why the minimum wage is a critical part of our story. By "minimum wage," we mean the minimum wage that can be paid due to *social* or legal conventions. It may be that it is not feasible to charge a fee in exchange for a temporary job.

In the absence of a minimum wage the market restores full employment. The intuition is simple: being a temporary worker is not an ideal situation, and thus no unemployment is necessary in order to induce incentives as temporary contracts take this role. If the minimum wage is high, this is no longer true. Being a temporary worker is not as bad, and unemployment is required in order to provide the right incentives.

For a high enough minimum wage, equilibrium unemployment is higher in the world with temporary contracts than it is in the world with only permanent contracts. The reason is that it makes the provision of incentives of permanent workers more costly in a manner similar to that of higher unemployment insurance: the unemployed are better off with high minimum wage temporary contracts than in the one-tier system, which unfortunately translates into more expensive permanent contracts in the two-tier system. Our findings might give some hints of why unions in some countries currently oppose the abolition of temporary contracts, despite their effects on the unemployment rate.

The introduction of fixed-term contracts leaving the existing labor market regulations unchanged leads to a substitution of these contracts for permanent ones, and it can also imply lower equilibrium employment if the minimum wage is high enough. This implies that, for a given level of the minimum wage in the economy, such distortion will be higher for low-skilled workers than for high-skilled workers. This result is supported by the empirical evidence provided for Spain, the country with the highest incidence of temporary contracts in Europe.

Table 1. Introduction of temporary contracts and unemployment differentials by skills, 1980-1989

	(1)	(2)	(3)
*unskilled*1 X post-reform	0.033	0.032	0.019
	(0.009)	(0.008)	(0.006)
*unskilled*2 X post-reform	0.031	0.030	0.026
	(0.006)	(0.005)	(0.005)
*unskilled*3 X post-reform	0.073	0.070	0.066
	(0.014)	(0.014)	(0.013)
Skill Dummies	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes
Skill Dummies X Linear Trend	Yes	Yes	Yes
Regional Dummies	No	Yes	Yes
Individual Controls	No	No	Yes
N. of observations	704,440	704,440	704,440

Notes: (1) Marginal effects of a probit model of unemployment (0,1) on a measure of the introduction of TCs in Spain. (2) Regional dummies include 50 provinces. (3) Individual controls include a dummy for female, a dummy for married, dummies for age groups, the number of working adults, and the number of children in the household. (4) Standard errors in parentheses are clustered by year and skill. (5) Source: EPA.

Table 2. Renewal rate of temporary contracts and firing costs

	(1)	(2)	(3)	(4)	
	C	d	F	R	years
Spain	35	0.72	25.2	0.11	1987-96
Italy	32.5	0.55	17.8	(0.21,0.36)[1]	1999
France	15	0.74	11.1	0.33	1988-92
UK	8	0.45	3.6	(0.36,0.38)[2]	1991-97

Notes: C denotes the unfair severance payment; d denotes the probability that a dismissal is declared unfair in court and $F = dC$; R denotes the renewal rate.

[1]The first (second) number refers to renewal after 3 (5) years of a TC.

[2]The first (second) number refers to males (females) in Britain.

Sources: OECD (1999), Galdón-Sánchez and Güell (2000), Güell and Petrongolo (2007), Cipollone and Guelfi (2002), Goux *et al.* (2001), and Booth *et al.* (2002).

References

[1] Aguirregabiria, V. and Alonso-Borrego, C. (1999), "Labor contracts and flexibility: evidence from a labor market reform in Spain", Universidad Carlos *III* Working Paper No 99-27.

[2] Akerlof, G. A. and Katz, L. F. (1989), "Workers' trust funds and the logic of wage profiles", *Quarterly Journal of Economics*, 104 (3), 525-536.

[3] Alonso-Borrego, C., Fernández-Villaverde, J. and Galdón-Sánchez, J. E. (2004), "Evaluating labor market reforms: a general equilibrium approach", IZA Working Paper N. 1129.

[4] Bentolila, S. and Bertola, G. (1990), "Firing costs and labour demand: how bad is Eurosclerosis?", *Review of Economic Studies*, 57 (3), 381-402.

[5] Bentolila, S., P. Cahuc, Dolado, J. J., Le Barbanchon, T. (2012): "Two-tier labor markets in the Great Recession: France *versus* Spain", The Economic Journal, 122: F155–F187.

[6] Bentolila, S. and Dolado, J. J. (1994), "Labour flexibility and wages: lessons from Spain", *Economic Policy*, 9 (18), 53-99.

[7] Bentolila, S. and Saint-Paul, G. (1992), "The macroeconomic impact of flexible labor contracts, with an application to Spain", *European Economic Review*, 36 (5), 1013-1047.

[8] Bertola, G. and Rogerson, R. (1997), "Institutions and labor reallocation", *European Economic Review*, 41 (6), 1147-1171.

[9] Berson, C. and Ferrari, N. (2015), "Financial incentives and labor market duality", *Labour Economics*, 37, 77-92.

[10] Berton, F. and Garibaldi, P. (2012), "Workers and Firms Sorting into Temporary Jobs", *Economic Journal*, 122 (562), F125-F154.

[11] Blanchard, O. and Landier, A. (2002), "The perverse Eefects of partial labor market reforms: fixed duration contracts in France", *Economic Journal, Features: Symposium on Temporary Work*, F214-F244.

[12] Booth, A. L., Francesconi, M. and Frank, J. (2002), "Temporary jobs: stepping stones or dead ends?", *Economic Journal*, *Features: Symposium on Temporary Work*, F181-F188.

[13] Cabrales, A. and Hopenhayn, H. A. (1997), "Labor-market flexibility and aggregate employment volatility", *Carnegie-Rochester Conference Series on Public Policy* 46, 189-228.

[14] Cahuc, P. and Postel-Vinay, F. (2002), "Temporary jobs, employment protection and labor market performance", *Labour Economics*, 9 (1), 63-91.

[15] Cahuc, P., O. Charlot and F. Malherbet (2016), "Explaining the Spread of Temporary Jobs and its Impact on Labor Turnover", *International Economic Review*, 57 (2), 553-572.

[16] Card, D. and Lemieux, T. (2001), "Can falling supply explain the rising return to college for younger men? A cohort-based analysis", *Quarterly Journal of Economics*, 116 (2), 705-746.

[17] Carmichael, L. (1985), "Can unemployment be involuntary?: Comment", *American Economic Review,* 75(5), 1213-1214.

[18] Cao, S., Shao, E. and P. Silos (2013), "Match Quality, Labor Market Protection, and Temporary Employment ", Working Paper.

[19] Cipollone, P. and Guelfi, A. (2002), "Rational responses to poorly designed policies: The case of subsidies to Open End Contracts in Italy", mimeo.

[20] Costain, J., Jimeno, J. F. and Thomas, C. (2010): "Employment fluctuations in a dual labor market", mimeo.

[21] Dolado, J. J. and Felgueroso, F. (1997), "Los efectos del salario minimo: evidencia empirica para el caso espanol", *Moneda y Crédito*, 204, 213-263.

[22] Dolado, J. J., García-Serrano, C. and Jimeno, J.F. (2002), "Drawing lessons from the boom of temporary jobs in Spain", *Economic Journal, Features: Symposium on Temporary Work*, F270-F295.

[23] Galdón-Sánchez, J. E. and Güell, M. (2000), "Let's go to court! Firing costs and dismissal conflicts", Industrial Relations Section, Princeton University, Working Paper No. 444.

[24] Galdón-Sánchez, J. E. and Güell, M. (2003), "Dismissal conflicts and unemployment", *European Economic Review*, 47 (2), 323-335.

[25] Goux, D., Maurin, E. and Pauchet, M. (2001), "Fixed-term contracts and the dynamics of labour demand", *European Economic Review,* 45 (3), 533-552.

[26] Grubb, D. and Wells, W. (1993), "Employment regulation and patterns of work in EC countries", *OECD Economic Studies*, No. 21, 7-58.

[27] Güell, M. and Petrongolo, B. (2007), "How binding are legal limits? Transitions from temporary to permanent work in Spain", *Labour Economics*, 14 (2), 153-183.

[28] Kahn, L. M. (2010), "Employment protection reforms, employment and the incidence of temporary jobs in Europe: 1996-2001", *Labour Economics*, 17 (1), 1-15.

[29] Katz, L. F. and Murphy, K.M. (1992), "Changes in relative wages, 1963-1987: supply and demand factors", *Quarterly Journal of Economics*, 107 (1), 35-78.

[30] Lazear, E. P. (1990), "Job security provisions and employment", *Quarterly Journal of Economics*, 105 (3), 699-726.

[31] OECD (1993), *Employment Outlook*, Paris.

[32] OECD (1994), *Employment Outlook*, Paris.

[33] OECD (1999), *Employment Outlook*, Paris.

[34] OECD (2002), *Employment Outlook,* Paris.

[35] Saint-Paul, G. (1996), *Dual labor markets: A Macroeconomic Perspective*, Cambridge, MA: MIT Press.

[36] Shapiro, C. and Stiglitz, J. E. (1984), "Equilibrium unemployment as a worker discipline device", *American Economic Review*, 74 (3), 433-444.

[37] Wasmer, E. (1999), "Competition for jobs in a growing economy and the emergence of dualism in employment", *Economic Journal*, 109 (457), 349-371.

A Appendix: Proofs of the Model

A.1 Proof of Remark 1

Proof.

- The values of shirking and not shirking for a worker with a PC are, respectively,

$$rV_P^s = \tilde{w}_P + (b+q)(V_U + F - V_P^s)$$

$$rV_P^n = \tilde{w}_P - e + b(V_U + F - V_P^n).$$

- It follows that

$$V_P^n - V_P^s \geq 0 \iff (V_P^n - V_U) \geq \left(\frac{e}{q} + F\right) = \Delta \iff \tilde{w}_P - e + bF \geq (r+b)\,\Delta + rV_U.$$

■

A.2 Proof of Remark 2

Proof.

- We first consider the case of paying less than the efficiency wage. That is, if for some reason $w_P < \widehat{w}_P(V_U)$. In this case, there would be no production, and J_P would be: $rJ_P = -(\tilde{w}_P + bF) < 0$. Obviously, in this case firms would not be created.
- Thus, if there is production, the wage is at least $\widehat{w}_P(V_U)$. Given that the value of the firm decreases with the wage, it is clear that

$$w_P = max\{w_{\min} + bF, \widehat{w}_P(V_U)\}.$$

- If the minimum wage is not binding, we have $w_{\min} + bF \leq \widehat{w}_P(V_U) = w_P$. In this case, we can rewrite J_P as follows:

$$rJ_P = y - w_P = y - (r+b)\,\Delta - rV_U.$$

- If the minimum wage is binding, we have $\widehat{w}_P(V_U) \leq w_{\min} + bF = w_P$. In this case, we can rewrite J_P as follows:

$$rJ_P = y - w_{\min} - bF.$$

■

A.3 Proof of Remark 3

Proof.

- If the minimum wage is not binding, given that $V_P - V_U = \Delta$, it follows that $rV_U = a\Delta$.
- If the minimum wage is binding, the value of being employed is given by $(r+b)(V_P - V_U) = w_{\min} + bF - rV_U$, and therefore it follows that $rV_U = \frac{a}{(r+b+a)}(w_{\min} + bF)$.

■

A.4 Proof of Result 1

Proof.

- If the minimum wage is not binding, $w_{\min} + bF \leq \widehat{w}_P(V_U) = (r+b)\Delta + rV_U$. Putting together equations (3) and (4), we have that $r(J_P - C) = (y - rC) - (r+b)\Delta - a\Delta$. The value of the firm needs to equal its creation cost: $J_P = C$. Thus, a has to be such that

$$0 = \{y - rC - (r+b)\Delta\} - a\Delta.$$

  Notice that

  - If $\{y - rC - (r+b)\Delta\} < 0$ there is no non-negative a that can allow for $J_P = C$. The productivity is so low that it is not worth producing.
  - If $\{y - rC - (r+b)\Delta\} \geq 0$ then:

$$a_1 = \frac{\{y - rC - (r+b)\Delta\}}{\Delta}$$

$$rV_{U1} = y - rC - (r+b)\Delta$$

$$rV_P = y - rC - b\Delta$$

$$w_P = \hat{w}_P(V_U) = y - rC$$

$$J_P = C.$$

    Thus, the efficiency wage is fixed at $w_P = \hat{w}_P(V_U) = y - rC$. So, it cannot be the case that $y - rC < w_{\min} + bF = \tilde{w}_{\min} + bF < \hat{w}_P(V_U)$: if the minimum wage is very large, there is no production.

- If the minimum wage were binding: $\widehat{w}_P(V_U) = (r+b)\Delta + rV_U \leq w_{\min} + bF$. Putting together equations (3) and (4), we have that $r(J_P - C) = (y - rC) - \{w_{\min} + bF\}$. The only solution

for which $J_P = C$ is when $w_{\min} + bF = y - rC$. But given the above, in this case the minimum wage would stop being binding. Thus, the minimum wage is never binding.

■

A.5 Proof of Remark 5

Proof.

- If the NSCP holds, the value of holding a PC is $(r+b)(V_P - V_U) = w_P - rV_U$.
- If the NSCT holds, the value of holding a TC is $(r+\lambda)(V_T - V_U) = w_T + \lambda R(V_P - V_U) - rV_U$.
- Given that $rV_{U2} = a_2 (V_T - V_U)$, it follows directly from the value functions of a worker of holding a PC and a TC.

■

A.6 Proof of Result 7

Proof. We consider only values of $w_{\min}$ where there can be production in the world without temporary contracts and unemployment in the world with them:

$$y - rC - \lambda\rho\Delta \leq w_{\min} \leq y - rC - bF.$$

Given the employment rates in the world with and without temporary contracts (see results 1 and 5), the ratio of the employment rate in both is

$$\Xi = \frac{E_1}{E_2} == \frac{\lambda}{(b+\lambda\rho)} \frac{\{y - rC - (r+b)\Delta\}}{(r+\lambda)\Delta} \frac{\{(w_{\min} + \lambda\rho\Delta) - (y - rC)\}}{\{(y - rC) - \gamma (w_{\min} + \lambda\rho\Delta)\}}.$$

Unemployment is larger in the world with temporary contracts iff $\Xi > 1$. Notice that Ξ is increasing in the minimum wage (and is zero in its lowest possible value $w_{\min} + \lambda\rho\Delta = y - rC$).

When we evaluate it at $b = 0$, we have

$$\Xi|_{b=0} = \frac{1}{\rho} \frac{\{y - rC - r\Delta\}}{(r+\lambda)\Delta} \frac{\{(w_{\min} + \lambda\rho\Delta) - (y - rC)\}}{\{(y - rC) - \gamma (w_{\min} + \lambda\rho\Delta)\}}.$$

We then evaluate Ξ at the highest possible value of the minimum wage compatible with production in the world without temporary contracts (i.e., evaluated at $w_{\min} = y - rC - bF$) :

$$\Xi|_{b=0} (w_{\min} = y - rC - bF) = \frac{1}{\rho} \frac{r + \lambda\rho}{(r+\lambda)} > 1.$$

Given that Ξ is monotonously increasing in $w_{\min}$ and continuous in b, it follows that

1. There exists a wage $w^*(b=0)$ such that $\Xi|_{b=0}(w) > 1 \; \forall w \in (w^*, y - rC + \lambda\rho\Delta - bF]$.
2. There exist a set of values of b with positive mass for which $w^*(b) \in (y - rC - \lambda\rho\Delta, y - rC - bF)$.

■

A.7 Proof that in equilibrium NSCT and NSCP are both binding

Result 8. *It is not possible that neither the NSCT nor the NSCP do not hold.*

Proof. Output would be zero, thus no firm would be created. ■

Result 9. *When confronted with the equilibrium environments described in results 4 and 5, no firm would offer a contract where the NSCP holds but the NSCT does not.*

Proof. Presumably, the firm could obtain profits by delaying the arrival to the permanent state. Workers could be paying to the firm while in the temporary state and start producing in the permanent one, the extra profits being obtained by the fees paid (by workers) in the temporary phase. The value of a firm in the permanent state is the same as in the equilibrium (since it pays the efficiency wage and the worker works).

This cannot be an equilibrium because in the temporary stage workers are already being paid the minimum possible wage ($\tilde{w}_{\min}$). Thus, the stream of profits in the temporary phase has to be smaller than in the equilibrium. A smaller stream of profits in the temporary phase, and equal in the permanent phase, must mean that the value of the firm is smaller than its value if offering the equilibrium contract. ■

Result 10. *When confronted with the equilibrium environments described in results 4 and 5, no firm would offer a contract where the NSCT holds but the NSCP does not.*

Proof. Presumably, the firm could obtain profits by reducing the payments in the permanent phase, even at the cost of stopping production.

Effectively, this would amount to (1) either closing the firm at the permanent stage or (2) ensuring the worker a utility V_U in the permanent stage (so that he is willing not to break the match at that point).

If the firm is closed at the permanent stage, there would be no renewal rate that would be compatible with NSCT, since remember that the incentive condition at the temporary phase is $\lambda RQ(V_P - V_U) \geq e$, and in this case $V_P = V_U$. Thus, there would be no production and the value of the firm would be zero instead of C, so it would not be offered.

If the worker is kept in the firm (albeit unproductive) but ensuring him a value V_U, we have the same case, since no renewal rate could induce the worker to produce in the first stage. ■

Result 11. *If NSCT and NSCP both hold, then they are both binding.*

Proof. If NSCP is holding, then it is binding, since from equations (8) and (7), is clear that J_T is increasing in $(J_{P2} - J_T)$, and $(J_{P2} - J_T)$ is decreasing in w_P, so the firm chooses the smallest w_P and the NSCP binds.

Remember from result 5 that whenever in steady state there is unemployment, $J_{P2} < C = J_T$. Thus, J_T is decreasing in R, and the minimum value of R compatible with NSCT is $R = \rho$, so NSCT binds. ■