Temporary Contracts, Incentives and Unemployment

DISCUSSION PAPER SERIES

No. 8116

TEMPORARY CONTRACTS, INCENTIVES AND UNEMPLOYMENT

Maia Güell and José Vicente Rodríguez Mora

INTERNATIONAL MACROECONOMICS and LABOUR ECONOMICS

Centre for Economic Policy Research

www.cepr.org

Available online at: **www.cepr.org/pubs/dps/DP8116.asp**

ISSN 0265-8003

TEMPORARY CONTRACTS, INCENTIVES AND UNEMPLOYMENT

Maia Güell, University of Edinburgh
José Vicente Rodríguez Mora, University of Edinburgh and Universitat Pompeu Fabra

Discussion Paper No. 8116
November 2010

Centre for Economic Policy Research
53–56 Gt Sutton St, London EC1V 0DG, UK
Tel: (44 20) 7183 8801, Fax: (44 20) 7183 8820
Email: cepr@cepr.org, Website: www.cepr.org

CEPR Discussion Paper No. 8116

November 2010

ABSTRACT

Temporary Contracts, Incentives and Unemployment*

Firing-cost-free temporary contracts were introduced in many European countries during the eigthies in order to fight high unemployment rates. Their rational was to increase job creation in a context of high firing costs that were politically hard to decrease. Temporary contracts have become a prevalent labor market institution in many countries, and with hindsight it seems uncontroversial that they have failed at decreasing unemployment. Evidence indicates that temporary contracts not only increases unemployment fluctuations, but also unemployment levels. In this paper we argue that the rational for the introduction of temporary contracts is flawed at its root. We provide a novel explanation of why temporary contracts can increase unemployment even in a context where a reduction of firing costs would actually reduce unemployment. We argue that, if minimum wages are kept at high levels, temporary contracts have an effect not unlike the increase of unemployment benefits. By increasing the flows in and out of unemployment into relatively highly paid temporary jobs (minimum wage), they increase the value of being unemployed. This has a negative effect on incentives, increases wages and reduces the willingness of firms to create employment. We present empirical evidence supportive of some of the implications of the model.

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

Maia Güell
School of Economics
University of Edinburgh
31 Buccleuch Place
Edinburgh EH8 9JT
UK

Email: maia.guell@gmail.com

For further Discussion Papers by this author see:
www.cepr.org/pubs/new-dps/dplist.asp?authorid=138442

José Vicente Rodríguez Mora
University of Edinburgh
Old College
South Bridge
Edinburgh
EH8 9YL

Email: sevimora@gmail.com

For further Discussion Papers by this author see:
www.cepr.org/pubs/new-dps/dplist.asp?authorid=131483

* We are grateful to participants of the Third World Conference EALE-SOLE 2010 for very helpful comments and suggestions. The authors acknowledge financial support from the Spanish Ministry of Education and Science under grants SEJ2006-09993 (Güell) and grant SEJ2007-64340 (Rodríguez Mora).

Submitted 03 November 2010

1 Introduction

Since the mid-1970s, Europe has had much higher unemployment levels and duration than the US. At the same time, European labor markets have typically been characterized by a wide use of permanent contracts with high regulated firing costs.

In the mid-1980s, many European governments attributed the under performance of the labor market to the existence of high firing costs which were politically difficult to reduce. As a response, a common way to reform labor markets was to introduce, or extend, in the legislation the figure of fixed-term (temporary) contracts with negligible firing costs even for non-seasonal jobs.[1] Since their introduction, temporary contracts play an important role in the labor market as they account for most new hirings[2] and are used in all sectors and occupations (OECD, 2002). In addition, the transition 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, these reforms have not been successful at bringing unemployment down. With hindsight, it seems clear that not only they have negative effects on the volatility of employment, but also that their effects on average employment has been negative (see Khan, 2010). Today, while many OECD countries are facing historical high unemployment rates, firing costs and temporary contracts are back into the center of the policy debate.

In this paper, we argue that temporary contracts do not need to reduce unemployment *even in a context where a reduction of firing cost would actually reduce it.* Thus, the logic for their introduction was faulty at its root. While our point is very simple, it is a novel explanation on the effects of temporary contracts whose intuition is as follows. Temporary contracts increase the flows in the labor market. Thus, unemployed workers know that their probability of accessing a temporary job is relatively large. In the presence of high minimum wage this translates into an improvement in their condition, implying that wages increase and the willingness of firms to create jobs decreases. The effects of temporary contracts are in this context not unlike the effects of increasing unemployment benefits.

We show that, in a context of efficiency wages, temporary contracts could reduce unemployment only if minimum wages were very low. In such a case they may improve the structure of incentives, as being a temporary worker with a very low wage is punishment enough, and the threat of dismissal is an effective deterrent. If, on the other hand, the minimum wage is high, the opposite happens. The unemployed know that they will access a decent wage fast, and this worsens the effectivity of dismissal as a deterrent of shirking. Higher wages are the only option that firms face, but this

[1] See Grubb and Wells (1993) and OECD (1993, 1994, 1999 and 2002) for a detailed description of temporary contracts 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; from 5% to 10% in Italy.

decreases the number of jobs that the market can sustain.

There is large and growing literature on the effects of temporary contracts on different aspects of the labor market.[5] The traditional answer of 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), as they reduce both hirings and firings, so is the impact of introducing of temporary contracts. Few papers go somehow beyond this point and do not consider temporary contracts as being similar to lower firing costs, yet the explanations provided in the end are nevertheless not that different from the well-known effects of firing costs.[6] We think that this is unsatisfactory as we lack understanding of why introducing cheaper contracts might fail to boost employment beyond the fact that these contracts increase both job creation and job destruction. In this paper, we show that introducing temporary contracts is not equivalent to reducing firing costs and their impact depends on the interaction with other existing labor market institutions such as the minimum wage. We provide a new explanation of why temporary contracts might be perverse based on their impact on cost of providing incentives to workers and the consequences for equilibrium unemployment. We contribute to the rather scarce theoretical literature on the effects of temporary contracts on the level of unemployment by providing a new mechanism beyond the effects of these contracts on labor market flows.

Efficiency wage models are best suited to examine the two main differences between temporary and permanent contracts, namely, firing costs and contract duration. These models allow to consider in a simple way a very general specification of employment protection legislation and not just severance payments.[7] 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. In the existing literature, the link between temporary and permanent contracts has typically been ignored or assumed exogenous. In most countries, temporary contracts cannot be used continuously and forever as firms have to convert them into a permanent contract or to fire the worker at their 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 constraints their potential to increase employment. In particular, the minimum wage regulation affecting temporary workers decreases the willingness of firms to create jobs via an endogenous general equilibrium

[5] See, for example, Aguirregabiria and Alonso-Borrego (1999), Alonso-Borrego, Fernández-Villaverde and Galdón-Sánchez (2004), Bentolila, Cahuc, Dolado and Le Barbanchon (2010), Bentolila and Dolado (1994), Cabrales and Hopenhayn (1997), Costain, Jimeno, and Thomas (2010), Saint-Paul (1996) and Wasmer (1999).

[6] See, for instance, Blanchard and Landier (2002), 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).

[7] See Galdón-Sánchez and Güell (2003). In fact, firms seem to complain precisely about the complexity introduced by such regulation (see Blanchard and Tirole, 2008).

effect: the increase in value for the unemployed.

In our framework, firing costs imply higher efficiency wages for permanent workers and thus higher unemployment. This makes the problem interesting as lower firing costs would reduce unemployment yet temporary contracts may fail to improve employment outcomes. In the absence of a minimum wage, the effects of firing costs could be undone through lower wages of temporary contracts. Actually, the first best can be restored with low enough temporary wages. Workers would have to buy their right to a temporary contract by accepting a wage substantially lower than their productivity. In this case, the value of having a temporary contract would be very low. So low, that the contract structure would solve the incentive problem effectively and unemployment would disappear.

However, the presence of a minimum wage distorts this mechanism. Temporary contracts combined with a high enough minimum wage make the value of being unemployed higher than in a world with only permanent contracts. In this case, the introduction of temporary contracts acts in a similar manner as unemployment insurance. This is why. Temporary contracts arrive fast while permanent contracts imply a longer wait. Taking the level of unemployment as given, a high minimum wage implies that a large percentage of total income generated is transferred to temporary workers in the immediate future. The high turnover between temporary contracts and unemployment implies that it is the unemployed who enjoy such income. Thus, to the extent that workers discount the future, being unemployed in the presence of temporary contracts is not as bad. But a higher value of being unemployed makes the incentive problem of the economy worse. This requires a higher equilibrium unemployment rate in order to discipline workers. The same would happen with an increase of unemployment benefits. We believe that this is a very useful finding, as we have a better and more intuitive understanding of the effects of unemployment insurance. Relating temporary contracts to unemployment benefits can help us understand why temporary contacts have failed to boost employment as well as to understand the current resistance to remove them by allowing us to review the political economy of employment protection.

In short, temporary contracts can increase unemployment, albeit the unemployed are happier and the employed with permanent contracts are also happier than without temporary contracts. However, society is worse off as less output is being produced, and many workers are receiving minimum wages in a temporary contract, earning less than what they would earn if temporary contracts were not allowed.

The rest of the paper is organized as follows. In section 2, we introduce the model in a context where only permanent contracts are available. In section 3 both permanent and temporary contracts are available. Then equilibrium employment in the two systems are compared in section 4. In section 5, some evidence is provided for the main empirical implications of the model. Section 6 concludes.

2 One-tier system: only permanent contracts legal

The model is a modified version of the shirking model of Shapiro and Stiglitz (1984) with two additions: firing costs and a minimum wage. Also, there are two types of contracts: temporary contracts and permanent contracts, which differ in length and firing costs. 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). The general assumptions of the model are as follows:

1. We focus on the incentives effects (good and bad) of temporary contracts and the consequences for labor market outcomes. For ease of exposition, we assume that there are no search frictions. Instead, there exists queuing.

2. The model is set in continuous time.

3. The number of vacancies in the economy is endogenous. To create 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 non-arbitrage condition determining the number of positions filled in the economy, as the value of a position must be equal to the creation cost C.

4. All workers are identical and have a constant productivity $\widetilde{y}$.[8]

5. 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 (either a permanent or a temporary, i.e. $c = \{P, T\}$) and e is the cost of providing an effort level e. Worker's 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 expend zero effort and production is zero.

6. There is a minimum wage, $\tilde{w}_{\text{min}}$, that all contracts must satisfy. 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, as we will see that with temporary contracts the market might desire to do so.

7. To simplify, we assume that unemployment benefits are zero.

[8] 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 mostly firms are using temporary contracts because they provide a cheaper option than permanent contracts rather than for screening purposes (see Güell and Petrongolo, 2007).

The goal of this section is to study the situation in which it is only legal to hire workers under a permanent contract.

2.1 Environment description

In the one-tier system, the only possible contract is a permanent one (ψ_P), which is defined by its wage: $\psi_P = \tilde{w}_P$. Contract structure becomes more complicated when we allow for temporary contracts.

There are two reasons for the termination of the relationship between workers and firms. First, workers face a rate b of being separated from their job because the match becomes exogenously 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.[9] 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.

2.2 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.

2.2.1 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:* $w_{\min} = \tilde{w}_{\min} - e$

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

Definition 4. *Let $\hat{w}_P(V_U)$ be the lowest wage (net of effort and the present discounted value of firing cost) that induces the worker in a permanent contract not to shirk:*

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

Remark 1. *The non-shirking condition for permanent workers (NSCP) can be written as:*

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

For a detailed derivation, see appendix (7.1).

This is as in Shapiro and Stiglitz (1984), except for the part related to firing costs. Since workers that are caught shirking are fired and compensated with F, effectively, this is like if 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.

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

2.3.1 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 $w_P \geq \hat{w}_P(V_U)$, this is given by:

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

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:*

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

And the value of the firm depends on whether it is paying the efficiency wage or the minimum wage. This is:

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

For a detailed derivation, see appendix (7.2).

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 (as 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 $w_{\min}$.

2.3.2 Value of being unemployed

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

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 (7.3).

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.

2.4 Labor unemployment dynamics

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: $\dot{U}_1 = bL - a_1\left(1 - L\right)$ and $\dot{L} = a_1\left(1 - L\right) - bL$. The measure of unemployment that we will use is the employment to unemployment ratio, that in steady state is given by:

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

2.5 Equilibrium

In equilibrium, the hiring rate a has to be such that: **(1)** The wage is given by equation (2), **(2)** the value of unemployment is determined by equation (4), and finally **(3)** 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* $w_{\min} \geq y - rC - bF$*, then:*

$$\begin{aligned} w_P &= y - rC; \\ a_1 &= \frac{\{y - rC - (r+b)\,\Delta\}}{\Delta} \\ U_1 &= \frac{b\Delta}{\{y - rC - (r+b)\,\Delta\} + b\Delta}; \quad E_1 = \frac{\{y - rC - (r+b)\,\Delta\}}{b\Delta} \\ rV_{U1} &= y - rC - (r+b)\,\Delta \end{aligned}$$

Proof. *See appendix (7.4).* ■

In order to have production, worker productivity has to be large enough. In particular, it has to be larger than the minimum wage. Remarkably, when the minimum wage would be binding, it would be so large that there would be no production, thus it is never binding. Moreover, productivity has to be large enough to make up of the summation 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. *In order to ensure that production takes place in the one-tier system, productivity net of the creation cost has to be large enough compared both to the minimum wage (i.e.,* $w_{\min} + bF < y - rC$*) and to the efficiency cost generated by the incentive problem (i.e.,* $(r+b)\,\Delta < y - rC$*). That is:*

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

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 a first sight, this policy may seem as one that could lead to a reduction of unemployment. This is, at least 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 (minimum wage) are left in place.

3 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.[10] In particular, mandated firing costs of permanent contracts and the legal minimum

[10] We consider that, when a temporary contract expires, indemnities are zero. This is the case in most countries. Also, as temporary contracts can be made sufficiently short, it can be realistically assumed that they do not involve firing costs, because the firm always waits for the end of the contract whenever it wants to adjust employment.

wage are not modified by the introduction of temporary contracts.

3.1 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 as follows.

- TC expire at an exogenous rate λ. Agents can not bargain upon it, as it is an institutional restriction. TC do not terminate by any other event. This is, b (the expiry rate of PC) does not affect λ. Thus TC can not 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. This is, λ is independent on whether the worker is shirking or not, but if he is shirking he can be detected once the date arrives.[11]

- 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).[12] A worker can only be hired once by the same firm under a TC. When this expires, the firm has to decide whether to renew the worker into a PC or to fire him. This happens with endogenous probability R.[13] 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 (3.7), 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 phase of such contract.

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

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

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

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

3.2 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, there are three restrictions to be taken into account:

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

$$\left[\begin{array}{c} \tilde{w}_{\min} \leq \tilde{w}_T \\ \tilde{w}_{\min} \leq \tilde{w}_P \end{array}\right] \Longleftrightarrow \left[\begin{array}{c} w_{\min} \leq w_T \\ w_{\min} + bF \leq w_P \end{array}\right]$$

Also, in each phase of the contract must be incentive compatible:

2. **Incentive constraint for the permanent-phase.** In order to induce the worker to exercise 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 exercise 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.

3.2.1 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, it allows entering into the renewal lottery.

Result 2. *The non-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,*

$$\left(V_T^n - V_T^s\right) \geq 0 \Longleftrightarrow R\left(V_P - V_U\right) \geq \frac{e}{\lambda Q} \qquad \text{(NSCT)}$$

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

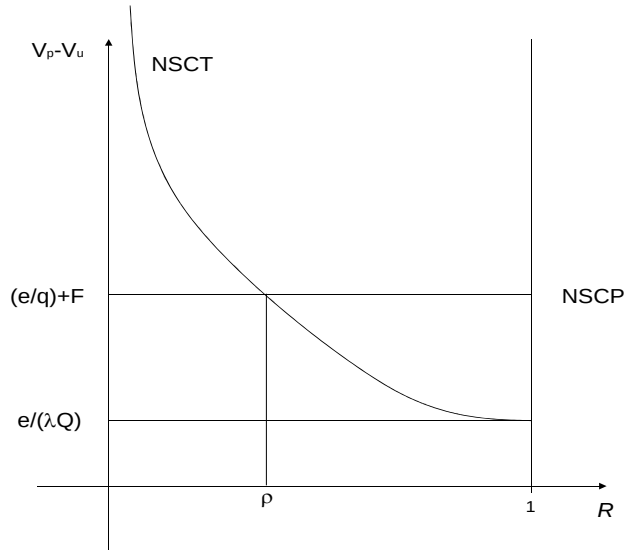

Figure 1: Incentive restrictions in a temporary contract.

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.

3.2.2 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 (3.6), 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.

3.2.3 All incentive restrictions together

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

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

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:*

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

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

3.3 Choice of contracts

It follows from result (2) that temporary wages have no incentive role and thus will not be not 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 contact (i.e., $\psi_T = \{\widetilde{w}_T, R, \widetilde{w}_P\}$) 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 (as the only way to exit unemployment is through a temporary contract).

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

3.4.1 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); 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_P, respectively.

- The value of having a permanent worker is analogous to the one-tier system. If $w_P \geq \hat{w}_P(V_U)$ (there is production):

$$rJ_P = \widetilde{y} - \widetilde{w}_P + b(J_P - F - J_P) \tag{7}$$

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

$$rJ_T = y - w_T + \lambda\left[R\left(J_P - J_T\right) + \left(1 - R\right)\left(J_T - J_T\right)\right] \tag{8}$$

In what follows, we assume that both incentive constraints are binding and later we show that in equilibrium that is the case (see appendix (7.7)).

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

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

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

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

3.4.2 Value of being unemployed

The difference in value of being unemployed in the two systems is going to 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 $rV_{U2} = a_2\left(V_T - V_{U2}\right)$.

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 (7.5).

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.

3.5 Labor unemployment dynamics

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 $U_2 = \left(1 - L_T - L_P\right)$. The dynamics of the labor market are determined from the following equations:

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

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 dynamics are once temporary contracts have been introduced.

3.6 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 $\hat{w}_P\left(V_U\right)$.

(3) The value of the 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:*

$$r(J_T - C) = y - rC - \frac{(r + \lambda)\gamma + a_2}{r + \lambda + a_2}\left(w_T + \lambda\rho\Delta\right) - (1 - \gamma)b\Delta \tag{12}$$

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; while 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, as 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 case and a case with "high" minimum wage will become relevant.

3.6.1 Low minimum wage. No unemployment

Result 4. *If $w_{\min} \leq y - rC - \lambda\rho\Delta - (1 - \gamma)b\Delta$, then: the minimum wage does not bind neither in the temporary-phase nor in the permanent-phase; there is no unemployment. Both NSCP and NSCT bind and in equilibrium we have:*

$$\psi_T = \{w_T, R, w_P\} = \{y - rC - \lambda\rho\Delta - (1 - \gamma)b\Delta, \;\; \rho, \;\; y - rC + \Delta(r + \gamma b)\}$$

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

$$rV_{U_2} = rV_T = y - rC - (1 - \gamma)b\Delta, \;\; rV_P = y - rC - (1 - \gamma)b\Delta + r\Delta$$

$$J_T = C; \;\; J_P = C - \frac{\Delta(r + \gamma b)}{r};$$

Proof. *For $w_{\min} = y - rC - \lambda\rho\Delta - (1-\gamma)\Delta b$, the equilibrium condition (12) can only hold with $a_2 \to \infty$, thus establishing the inexistence of unemployed workers.*

For $w_{\min} < y - rC - \lambda\rho\Delta - (1-\gamma)\Delta b$, the equilibrim condition (12) is incompatible with $a_2 \geq 0$ unless the wage is bid up to $w_{\min} = y - rC - \lambda\rho\Delta - (1-\gamma)\Delta b$. 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 that there would be no more unemployed in order to avoid queing (and having unsued capital). Thus, $\forall w_{\min}$ such that $w_{\min} \leq y - rC - \lambda\rho\Delta - (1-\gamma)\Delta b$, full employment is reached.

We prove that NSCT and NSCP bind in appendix (7.7). ■

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 of unemployment: to loose 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 re-start their career (in some other firm) with a temporary contract (perhaps paying again a fee).

In our model (and differently than other models with bonding, like Akerlof and Katz (1989)) the implicit bonding that temporary wages represent *is* a perfect substitute for a first-best contract. The reason lies 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", as it loses all incentive role.

3.6.2 High minimum wage. Unemployment.

Result 5. *If $y - rC - \lambda\rho\Delta - (1-\gamma)b\Delta \leq w_{\min} \leq y - rC - bF$ 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:*

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

$$a_2 = (r+\lambda)\,\frac{(y-rC) - \gamma\,(w_{\min} + \lambda\rho\Delta) - (1-\gamma)b\Delta}{(w_{\min} + \lambda\rho\Delta) - (y-rC) + (1-\gamma)b\Delta};$$

$$U_2 = \frac{\lambda b[(w_{\min}+\lambda\rho\Delta) - (y-rC) + (1-\gamma)b\Delta]}{\lambda b[(w_{\min}+\lambda\rho\Delta) - (y-rC) + (1-\gamma)b\Delta] + (b+\lambda\rho)(r+\lambda)[(y-rC) - \gamma(w_{\min}+\lambda\rho\Delta) - (1-\gamma)b\Delta]};$$

$$E_2 = \frac{(b+\lambda\rho)}{\lambda}\frac{(r+\lambda)}{b}\frac{(y-rC) - \gamma\,(w_{\min} + \lambda\rho\Delta) - (1-\gamma)b\Delta}{(w_{\min} + \lambda\rho\Delta) - (y-rC) + (1-\gamma)b\Delta};$$

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

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

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

$$J_T = C; \;\; J_P = C - \frac{\left(y - rC - w_{\min}\right)}{\lambda\rho}$$

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, while firms find them instantanously. Every thing else follows. We prove that NSCT and NSCP bind in appendix (7.7).*

The efficiency wage of the permanent-phase is decreasing in the minimum wage but always larger than the minimum wage (in all 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:*

$$\Delta(1-\gamma)[r + \lambda\rho + b] - bF > 0$$

The larger the minimum wage is, the less interesting is to create firms, ceteris paribus, as less profits can be extracted in the temporary-phase. Thus, there is less firm creation. From the workers point of view, the higher minimum wage the less bad is 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, like in all efficiency wages models of the Shapiro-Stiglitz tradition. Unemployment becomes the threat that solves the incentive problem of the firm.

Remark 7. *If $y - rC - \lambda\rho\Delta - (1-\gamma)b\Delta \leq w_{\min} \leq y - rC - bF$, the value of all agents is decreasing in $w_{\min}$.*

The larger the minimum wage, the larger the unemployment is, and the lower the value of *all* workers is. Unemployed workers are worse off as they have more waiting time to get a job. Permanent workers are worse off as 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) worsens the value in the temporary-phase, by implying more time spent on unemployment over the lifetime of the individual which does not compensate the 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 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 wage 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, as their wages are "large". Being a temporary worker would not seem such a bad thing anymore and thus the prospects of becoming one are not bad enough to be 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 $y - rC - \lambda\rho\Delta - (1-\gamma)b\Delta$ induce unemployment in the two-tier system. And the larger the minimum wage, the larger the unemployment level. Not only that, 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.

3.7 Commitment

There are two commitment related issues. First, irrespectively of the minimum wage, the value of a firm with a permanent worker is lower than C. It could be thought that this would induce firms to close at this stage. Notice, nevertheless that the value of the firm with a permanent worker is positive if C is large enough. Thus, for C large enough firms have no incentive to declare bankruptcy once workers access the permanent phase. And this irrespectively 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 of having the 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 a permanent worker is always lower than the one of 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 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 $\frac{\Delta(r+\gamma b)}{r}$, 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* $C > \frac{\Delta(r+\gamma b)}{r}$. *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 firm's value to zero. It is then clear that insofar 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, thus it demands (like any other non-Markov equilibrium in any repeated game) of commitment to the strategy on the part of the workers, which we simply assume. In this context, this is not completely unreasonable, as no firm offers a permanent contract directly and it is quite easy to get a temporary contract (the hiring rate is higher than without temporary contracts).

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

4 Comparative statics of the introduction of temporary contracts

The point of this paper is to compare the level of steady state unemployment in an 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, as they ease the incentive constraints of the economy. On the other hand, we have also seen that the larger the minimum wage, the larger the unemployment is in the universe with temporary contracts. It remains to be seen if 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. $\exists w^* : \; y - rC - \lambda\rho\Delta - (1-\gamma)b\Delta < w^* < y - rC - bF$ *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 (7.6).* ■

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 insure that there exist a certain wage threshold, such that if mandatory minimum wage is above it, unemployment is higher in the universe where temporary contracts are available.

This result may seem surprising, as 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 figure of temporary contracts. Our point is that this reasoning is incorrect. Moreover, it is incorrect even if it is right 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 TC are allowed. Furthermore, the probability that the contract is renewed into a permanent one is independent of the minimum wage, as it is used an the 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 access soon a *relatively* highly paid job. Thus, to be unemployed is not so bad. This has a negative effect on the structure of incentives, as 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 an unemployed worker in the universe with temporary contracts is always larger than in the universe without them.*

If the minimum wage is low, the results of the introduction of temporary contracts are not unlike an increase of the provision of unemployment insurance: by increasing the value of the unemployed it complicates the structure of incentives 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 TC). Total unemployment being the same, GDP and average consumption would also be the same in both worlds, as 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 get some 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),[14] the unemployed have rapid access to income thanks to 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 TC to have similar effects than unemployment insurance.

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

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

5 Empirical implications

We provide evidence that gives support to 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-80s, 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 TCs, and 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 constitutes the main labor market reform in Spain in the 1980s.[15]

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 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[16]. We exclude

[15] 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 percent among workers aged 16-19 and from 2 to 9 percent 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. While 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.

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

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: *unskilled*1 is a dummy for completed secondary school and no tertiary education; *unskilled*2 is a dummy for completed primary school and uncompleted secondary school; and *unskilled*3 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, *unskilled*1 and *unskilled*3).

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 skilled 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 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 skilled 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.[17] As column (3) shows, the magnitude of the coefficients is somehow reduced but the main pattern of the coefficients remains unchanged and 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

[17] See Table 1 for details.

effect of dismissal conflicts.[18] 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.

6 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 of why temporary contracts might *increase* unemployment based on their effect on incentives. And we do this in a context where a reduction of 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 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 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, as 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 to in order get full employment". But higher employment at the expense of segmentation of the labor market only arises if 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 could just be that it is not feasible to charge a fee in exchange of 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 such a great deal 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 not true anymore. Being a temporary worker is not as bad, and unemployment is required in order to provide the right incentives.

For high enough minimum wage, the equilibrium unemployment is higher in the world with temporary contracts than in the world with only permanent contracts. The reason is that it makes the provision of incentives more costly in a similar manner as higher unemployment insurance would do: 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. Relating the effect of temporary contracts (when the minimum wage is high) to those of unemployment insurance is a very useful finding. The effects of temporary contracts are complex yet we have a better understanding of the effects of unemployment benefits. Our findings

[18] 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 (as by default they get no indemnity).

might give some hints of why there is currently opposition in some countries on the abolition of temporary contacts in order to fight high unemployment rates.

The introduction of fixed-term contracts leaving the existing labor market regulations unchanged (that is, leaving the non–neutral effects of firing costs 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. The 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 parenthesis 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 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., Fernandez-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, 381-402.

[5] Bentolila, S., P. Cahuc, Dolado, J. J., Le Barbanchon, T. (2010): "Two-Tier Labor Markets in the Great Recession: France vs. Spain", mimeo.

[6] Bentolila, S. and Dolado, J. J. (1994), "Labour flexibility and wages: lessons from Spain", *Economic Policy*, 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, 1013-1053.

[8] Blanchard, O. and Landier, A. (2002), "The Perverse Effects of Partial Labor Market Reforms: Fixed Duration Contracts in France", *Economic Journal, Features: Symposium on Temporary Work*, F214-F244.

[9] Blanchard, O. and Tirole, J. (2008), "The optimal design of unemployment insurance and unemployment protection. A first pass", *Journal of the European Economic Association*, 6(1), 45-77.

[10] 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.

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

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

[13] 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, 705-46.

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

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

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

[17] 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.

[18] Galdón-Sánchez, J. E. and Güell, M. (2003), "Dismissal Conflicts and Unemployment", *European Economic Review*, 47 (2), 127-139.

[19] 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.

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

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

[22] 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.

[23] Katz, L. F. and Murphy, K.M. (1992), "Changes in Relative Wages, 1963-1987: Supply and Demand Factors", *Quarterly Journal of Economics*, 107, 35-78.

[24] Kahn, L. M. (2010), "Employment Protection Reforms, Employment and the Incidence of Temporary Jobs in Europe: 1995-2001", *Labour Economics*, 14 (1), 1-15.

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

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

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

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

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

[30] Saint-Paul, G. (1996), "Dual labor markets, a macroeconomic perspective", Cambridge, MA: MIT Press.

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

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

7 Appendix

7.1 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:

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

■

7.2 Proof of Remark 2

Proof.

- We first consider the case of paying less than the efficiency wage. This 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:

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

■

7.3 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 $rV_U = \frac{a}{(r+b+a)}(w_{\min} + bF)$.

■

7.4 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 can not 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.

■

7.5 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.

■

7.6 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:

$$y - rC - \lambda\rho\Delta - (1-\gamma)b\Delta \leq w_{\min} \leq y - rC - bF$$

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:

$$\Xi = \frac{E_1}{E_2} == \frac{\lambda}{(b+\lambda\rho)} \frac{\{y - rC - (r+b)\Delta\}}{(r+\lambda)\Delta} \frac{\{(w_{\min} + \lambda\rho\Delta) - (y - rC) + (1-\gamma)b\Delta\}}{\{(y - rC) - \gamma(w_{\min} + \lambda\rho\Delta) - (1-\gamma)b\Delta)\}}$$

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 $w_{\min} + \lambda\rho\Delta = y - rC - (1-\gamma)b\Delta$).

When we evaluate it at $b = 0$:

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

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:
   $w^*(b) \in (y - rC - \lambda\rho\Delta - (1-\gamma)b\Delta, y - rC - bF)$.

■

7.7 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. Presumibly 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 (as it pays the efficiency wage and the worker works).

This can not be an equilibrium as in the temporary stage workers are already be 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. An 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 close the firm at the permanent stage or (2) ensure the worker an 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, as remember that the incentive condition at the temporary-phase is $\lambda RQ\left(V_P - V_U\right) \geq e$, 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 are in the same case, as 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, as from equations (8) and (7), is clear that J_T is increasing in $(J_P - J_T)$, and $(J_P - J_T)$ 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, $J_P < C = J_T$. Thus, J_T is decreasing in R, and the minimum value of R compatible with NSCT is $R = \rho$, so NSCT binds. ■

7.8 Proof that in the two-tier system to offer directly a permanent contract is not an equilibrium strategy.

Result 12. *When confronted with the equilibrium environments described in Results 4 and 5, no firm would offer directly a permanent contract to an unemployed.*

Proof. If they did, they would need to pay at least the efficiency wage, thus the value of the firm would not be smaller than C (J_P is already smaller than C), so it is strictly better to offer the equilibrium contract. ■