Abstract

During the 1980s, many European countries introduced fixed-term contracts to fight high and persistent levels of unemployment. Although these contracts have been widely used, unemployment has remained about the same after fifteen years. This paper builds a theoretical model to reconcile these facts. We analyse the labour market effect of the introduction of fixed-term contracts and the firm's choice of contracts are studied. Permanent contracts are the standard way to offer incentives, but fixed-term contracts are cheaper. This generates an externality, which can make employment higher in the system with only permanent contracts. As a consequence, from a social point of view, the share of fixed-term contracts is too large. Increases in the renewal rate of fixed-term contracts into permanent contracts lead to higher employment levels. Finally, the model highlights the interactions between different rigidities in the labour market. Aggregate employment and the share of temporary contracts are affected in the same way by the firing costs and the flexibility of wages.

This paper was produced as part of the Centre's
Labour Markets Programme

Fixed-Term Contracts and Unemployment: An Efficiency Wage Analysis

Maia Ghell

July 2000

Series Editor: Graham Ingham

Published by
Centre for Economic Performance
London School of Economics and Political Science
Houghton Street
London WC2A 2AE

ISBN 0 7530 1387 8

Individual copy price: £5

Fixed-Term Contracts and Unemployment: An Efficiency Wage Analysis

Maia Ghell

The Centre for Economic Performance is financed by the Economic and Social Research Council

Acknowledgements

I am especially grateful to Alan Manning and Gilles Saint-Paul for their valuable comments throughout this project. Also Charlie Bean, Samuel Bentolila, Alberto Bennardo, Antonio Cabrales, Patrizia Canziani, Giulio Fella, Leonardo Felli, JosJ E Galdon, Nobu Kiyotaki, Ricardo Lagos, Javier Ortega and Bernard SalaniJ for very helpful discussions and suggestions at different stages of the paper.

Maia Ghell is a member of the Centre for Economic Performance and the Industrial Relations Department, Princeton University.

Fixed-term Contracts and Unemployment: an Efficiency Wage analysis

Maia Güell

1 Introduction

Most European countries are considered economies with highly regulated labor markets, particularly when compared to the U.S. At the same time, it is also a well known fact that, since the mid-1970s, Europe has had much higher unemployment levels than the U.S. It has often been suggested that the different degrees of flexibility of their labor markets could be responsible for the differences in their labor market performances. Despite the ongoing debate on the possible causes of European unemployment and, in particular, on the possible effect of labor market flexibility,[1] many European countries have already started to implement reforms in their labor markets: more flexible regulations have been introduced to fight high and persistent levels of unemployment.

Typically, European labor markets have been characterized by a wide use of permanent contracts with, what appear to be, high firing costs. A common way to increase flexibility has been to allow employers the option of hiring workers using fixed-term contracts with negligible firing costs. For most countries, these fixed-term contracts cannot be used continuously and forever. They require a conversion into permanent contracts after a specific amount of time. In addition, for most countries, the job for which the worker is hired with a fixed-term contract is not required to be a seasonal one.[2]

Since their introduction, fixed-term contracts have been widely used. These account for most new jobs.[3] More surprisingly, they have been used for all types of jobs and occupations.[4] However, unemployment has remained as high as before the reforms. At the same time, this type of reform has created a two-tier system and the labor market has become highly segmented.[5] This

[1] For instance, see Bean (1994) and Layard et al. (1991) for a survey on unemployment and Jackman et al. (1996), Nickell and Layard (1998) and Piore (1986) for the debate on labor market flexibility.

[2] See Grubb and Wells (1993) and OECD (1993, 1994 and 1999) for a detailed description of fixed-term contracts regulations in Europe.

[3] For instance, in Spain 98% of newly registered contracts between 1986 and 1992 were fixed-term contracts (see Bentolila and Saint-Paul, 1992). In France, in 1992, 80% of all entries were hirings on fixed-term contracts (see Goux et al., 2000).

[4] See OECD (1993).

[5] The share of fixed-term contracts in Spain has gone from 11% to 35% between 1983 and 1995. In France, it has gone from 3.3% to 12% during this period. See OECD (1993).

is mainly due to the low transition of …xed-term contracts into permanent ones.[6]

This paper builds a theoretical model to reconcile these facts: unchanged unemployment levels despite the wide use of more ‡exible labor contracts. The introduction of …xed-term contracts is analyzed in the framework of an e¢ ciency wage model. As will be discussed, this kind of model is best suited to examine the two main di¤erences between …xed-term and permanent contracts, namely, …ring costs and contract duration. High wages are the standard way to provide incentives with permanent contracts, but …xed-term contracts are cheaper. The …rm's choice of hiring with one contract or the other is analyzed. Firing will be given exogenously. So, in the terminology of labor demand models, …rms will be operating in the hiring regime. Fixed-term incentive-compatible contracts are then characterized. I willshow that the instrument that allows the provision of incentives with …xed-term contracts is not their wage, but the renewal rate of these contracts into permanent ones. Fixed-term contracts are chosen by …rms when they are cheap enough. But this implies an externality which can make aggregate employment higher in a system with only permanent contracts. Firms do not take into account, in the two-tier system, that the increase in out‡ows from unemployment result in higher wages for permanent contracts. In this case, the optimal renewal rate of …xed-term contracts from the social point of view is one. That is, employment can be increased by reducing the in‡ows back to unemployment.

There is a growing literature on the impact of …xed-term contracts on several aspects of the labor market.[7] In relation to the e¤ects on aggregate employment, the literature has been dominated by partial equilibrium models of labor demand.[8] These models have the same characteristics as those of labor demand with …ring costs.[9] These are very useful to understand the e¤ects of these …ring restrictions on the dynamic functioning of the labor market. But the e¤ects on aggregate employment are ambiguous and remain in partial equilibrium.

Here, I choose an e¢ ciency wage model to study the impact of …xed-

[6] In Spain, between 1987 and 1996, only 11% of …xed-term contracts are converted into permanent ones (see Güell and Petrongolo, 2000).

[7] See, for example, Aguirregabiria and Alonso-Borrego (1999), Alba (1994, 1996 and 1998), Bentolila and Dolado (1994), Goux et al. (2000), Jimeno and Toharia (1993 and 1996) and Saint-Paul (1996).

[8] Exceptions of this are Cabrales and Hopenhayn (1997) and Alonso-Borrego et al. (1999).

[9] See, for example, Bentolila and Bertola (1990), Bentolila and Saint-Paul (1994), Bertola (1992) and Nickell (1978).

term contracts on employment through their effect on wages.[10] This type of model not only allows for effects of firing costs on wages but it is also possible to consider a broad view of employment protection legislation and not just severance payments. In particular, dismissal conflicts which have been blamed for being costly can be modeled in a simple way.

One additional characteristic of fixed-term contracts is that they differ in duration with respect to permanent contracts. The existing literature has not explicitly taken this into account. In a competitive labor market, the duration of contracts does not matter. In an efficiency wage model, duration of contracts is an important source of incentives. Studying fixed-term contracts in an efficiency wage model allows to explicitly address the question of how incentives may be provided in short duration contracts. This, in turn, would answer the previously mentioned striking fact that fixed-term contracts are used even for jobs where duration matters. So, in the model, the share of fixed-term contracts is endogenous.

This paper highlights the links between different rigidities in the labor market. Employment and the share of fixed-term contracts are affected in the same way by the firing costs associated with permanent contracts and the flexibility of wages in fixed-term contracts. The mechanism by which the creation of employment and, more precisely, permanent employment are discouraged is the combination of these last two. The introduction of fixed-term contracts does not completely remove the effect of firing costs unless the wages in fixed-term contracts are perfectly flexible. For this reason, two extreme situations could generate higher employment than a two-tier system with unchanged firing costs and less than perfectly flexible wages in fixed-term contracts. One would be a situation in which the wages of fixed-term contracts are very high. In this system, permanent contracts alone would generate higher employment than the two-tier system. The other situation would be the case with perfectly flexible wages in fixed-term contracts. In this case, full employment would arise.[11]

The paper is organized as follows. In section 2 the model is introduced. First, I consider an economy where only permanent contracts are available and firing costs reduce employment (section 2.1). Then, the introduction of contracts with no firing costs (fixed-term contracts) in such economy is ana-

[10] In Saint-Paul (1996), chapter 7, this is also studied although it is assumed that fixed-term workers are already different ex-ante from permanent workers and are paid at the competitive wage. This "dual labor market" approach does not allow to analyze why in Europe most of the outflows from unemployment are fixed-term contracts nor the renewals of fixed-term contracts into permanent contracts.

[11] As it will be shown, full employment is possible in a two-tier system despite the presence of the incentive problem.

lyzed (section 2.2). The optimal incentive-compatible contract is described, the firm's choice of contracts is analyzed, and then the market outcome is derived and compared to the situation where only permanent contracts are available (section 2.3). Section 2.4 presents a welfare analysis of the two-tier system. Finally, section 3 concludes.

2 The model

The model is a version of the shirking model of Shapiro and Stiglitz (1984) with two types of contracts. Firms can choose to hire new workers with a permanent (PC) or with a fixed-term contract (temporary contract, TC).[12] Contracts differ in length and firing costs. To make the model as simple as possible, assume that TCs last one period and that PCs can last an infinite number of periods. A worker can only be hired once on a TC by the same firm. Thus, after the one period TC, the firm has to decide whether to renew the worker into a PC or to fire him.[13] A TC is going to be renewed into a PC with an (endogenous) probability R.

The model is set in discrete time and workers decide in each period whether or not to shirk. As in Shapiro and Stiglitz, a worker's effort is not perfectly observable and there is a detection technology that catches shirking workers (never erroneously) with some probability q (where $q < 1$). When a worker is found shirking, he is fired and becomes unemployed. To simplify, suppose that unemployment benefits are zero. In this model, all workers are identical.[14] In addition, workers are risk neutral and their instantaneous utility function is: $U(w;e) = w - e$; where w is the wage and e is the effort. Workers' effort choices are discrete. If they shirk, they expend zero effort and production is zero. The effort required to perform in the job is $e > 0$. The effort is the same in any contract because there is only one type of job.

Every period, workers choose the level of effort that maximizes their utility actualized at rate r. Let V^i_{jt}, $i = \{s;n\}$; $j = \{P;T\}$ be the present

[12] The terms fixed-term and temporary contract (TC) will be used interchangeably throughout the paper.

[13] This is only a simplifying assumption. Assuming that fixed-term contracts can be renewed into further fixed-term contracts does not change the results because, as it will be shown, it will be necessary that at some point fixed-term contracts get renewed into permanent ones.

[14] Therefore, I am not considering the possible use of TC to observe worker's characteristics. I implicitly assume that the "trial" period of the contract has already elapsed and has been useful for this matter. As a consequence, there is no adverse selection problem but only a moral hazard one. In most countries, TC include a "trial" period with no costs of separation on either part, as in PC.

discounted utility of an employed worker with contract j (P for permanent contracts and T for temporary contracts) at period t when shirking ($i = s$) or non shirking ($i = n$).

2.1 Only permanent contracts available

2.1.1 Firing costs

Assume that the legislation fixes a severance payment for permanent contracts, but no severance payment for TCs.[15] Modelling mandated severance payments in a shirking efficiency wage model allows to distinguish cases in which workers are fired without right of firing indemnities (when they are caught shirking, that is a disciplinary dismissal) from other ones in which the firm has to compensate fired workers (in case of redundancies or shocks).[16] Since I focus on hiring decisions of firms, the modelling of the second case is kept simple: workers have an exogenous probability b of being separated from their job, in that case they are protected by the legislation.

Another important aspect of employment protection legislation systems is the workers' right to sue employers in case of disagreement and what is considered an "unfair" case (see OECD, 1999). Permanent workers have the right to sue employers in every case of dismissal, but workers with a TC cannot do it when they are not renewed.[17] The efficiency wage model allows to consider dismissal conflicts explicitly. In such a context, conflicts between employers and employees can arise in relation to the (unobservable) effort. A double moral hazard can arise, where firms use disciplinary cases when facing redundancies to try to avoid paying firing costs and workers deny any disciplinary case to try to get compensation. This implies that court resolutions will be imperfect, given the information problem. Consequently, disciplinary cases are not costless, they cost dC, where C is the severance payment and d is the probability that the court declares it "unfair". Given this information problem, $d > 0$.[18]

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

[16] The terms redundancies and shocks are used interchangeably in this paper.

[17] As mentioned before, being TC sufficiently short, temporary workers are actually not renewed rather than being fired for other reasons. This implies that, in practice, temporary workers can never sue employers in court.

[18] This is a simple version of Güell (2000). There, redundancies cost zC, where $z \neq d$ because firms can have greater chances to proof a truly disciplinary case than a hidden redundancy. As shown, this cost is neutral on employment. Therefore, for simplicity, in

2.1.2 Non-shirking condition

In this section, I analyze the wage workers must be paid in order to provide the optimal effort on the job. Since PCs are assumed to have a stationary form,[19] it is possible to omit time indices. When a worker does not shirk in a PC, he gets a utility equal to

$$V_P^n = w_P - e + \frac{1}{1+r}[(1-b)V_P^n + b(V_U + C)]; \qquad (1)$$

where w_P is the wage of a PC and V_U is the present value of utility of an unemployed worker. If the worker decides to shirk in a PC, his utility is

$$V_P^s = w_P + \frac{1}{1+r}[(1-b-q)V_P^s + b(V_U + C) + q(V_U + dC)]: \qquad (2)$$

As in Shapiro and Stiglitz (1984), shirking saves the current disutility of effort but it implies a higher risk of becoming unemployed. This risk is proportional to the probability of being caught shirking (q). Firing costs also influence the effort decision here because of the imperfect court decisions. With probability d; shirking workers may be compensated with a severance payment. This reduces the cost of shirking.

The worker will choose to provide an effort e if and only if $V_p^n \geq V_p^s$. Using equations (1) and (2), the NSC$_P$ in form of utilities can be written as

$$V_P^n - V_U \geq \frac{e(1+r)}{q} + dC \equiv K: \qquad (3)$$

This condition states that in order to provide incentives, the punishment of losing a job must be at least equal to the opportunity cost of shirking, denoted by K. Substituting this condition into equation (1), the incentive-compatible wage in a PC can be written as

$$w_P \geq e - \frac{bC}{1+r} + \frac{rV_u}{1+r} + K\frac{(r+b)}{(1+r)} \equiv w\mathbf{b}_P: \qquad (4)$$

In this wage equation, it is possible to distinguish between the reservation wage (first three terms) and the rent linked to the incentive problem (last term). For C = 0, this condition is the same as in the original Shapiro and Stiglitz (1984). In order to provide incentives, wages need to exceed the reservation wage by a rent, K: This rent is proportional to the opportunity cost of not shirking weighted by the term (r + b). The higher the discount

this paper I assume that z = 1.

[19] For discussions of possible forms of bonding see Katz (1986).

rate, the more a worker values the saving of effort today. The higher the probability of being fired for other reasons than (truly) shirking cases (i.e. shocks), the more costly it is to expend effort today.

For $C > 0$, it is possible to distinguish two types of effects of firing costs: those directly related with the incentive problem and those that are not. Firing costs affect the incentive problem because to the extent that (truly) disciplinary dismissals are declared "unfair" (i.e., $d > 0$), legal severance payments reduce the punishment associated with being fired when caught shirking. This implies that firms have to pay higher rents in order to prevent shirking, as can be seen in the above non-shirking condition (see equation 3).

At the same time, independently of the incentive problem, the introduction of mandated severance payments allows the employer to reduce the wage exactly by the same proportion that the present discounted utility of an employee is increased, without affecting incentives. This can be seen in the firing cost element of the reservation wage (see equation 4). The idea is that lower wages today, together with compensation when being fired for shocks, leave the present discounted utility of being employed unchanged.[20]

If the PC satisfies the NSC_P, that is, if the worker is paid at least w_P, or if being unemployed a is sufficiently large punishment ($V_P^n > V_U$), the worker will choose to expend the effort e. Let V_P be the expected utility of holding a PC in equilibrium. The firm chooses the minimum wage at which the worker will not shirk, so that in equilibrium the NSC_P is binding and $V_P = V_P^n = V_P^s$.

Many countries have legal minimum wage constraints. Implicitly, I am assuming here that the legislated minimum wage would be a slack constraint. This will become more relevant in the next section where temporary contracts, which will be paid at the minimum wage level, are considered.

2.1.3 Hiring decisions

In this model, all firms are identical and infinitely lived. They chose employment to maximize the present discounted value of profits

$$\underset{L_{Pt}}{Max} \sum_{t=0}^{\infty} \left[f(L_{Pt}) - w_P L_{Pt} - bC L_{P(t-1)} \right] \frac{1}{(1+r)^t},$$

where L_P is employment in the system with only PCs and $f(L_P)$ is a CRS production function with $f'(L_P) = m$. In steady state,[21] labor demand is

[20] This effect of firing costs is the same as that proposed by Lazear (1990).

[21] The steady state is reached after one period. For $t = 0$, employment is simply given by $m = w_P$ since there are no workers to be fired.

given by

$$m = w_P + \frac{bC}{1+r}. \tag{5}$$

This equation shows that, for given wages, firing costs reduce labor demand proportionally to their expected present value.

2.1.4 Market equilibrium

Equilibrium occurs when each firm, taking as given all other firms' wages and employment, finds it optimal to offer the going wage rather than a different wage. The key market variable that determines firm individual behavior is the present value utility of an unemployed worker, V_U. Let a be the rate of exit from unemployment. Therefore

$$V_U = \frac{1}{1+r}[aV_P + (1-a)V_U].$$

Given that the NSC$_P$ is satisfied, in equilibrium

$$rV_U = aK. \tag{6}$$

Substituting equation (6) into equation (4), the efficiency wage curve in equilibrium can be written as

$$w\mathbf{b}_P^{\alpha} = e - \frac{bC}{1+r} + K\frac{(r+b+a)}{(1+r)}. \tag{7}$$

In equilibrium, the incentive-compatible wage is higher the higher the exit rate from unemployment. This result is also found in Shapiro and Stiglitz (1984). The rent linked with the incentive problem is weighted by a because the higher a; the less becoming unemployed is a penalty.

Aggregate employment, L_P, is derived from the steady state flow condition. In steady state, inflows to unemployment are given by bL_P. Outflows are given by $a(N - L_P)$, where N is the total of workers in the economy. Thus

$$a(N - L_P) = bL_P. \tag{8}$$

Therefore,

$$L_P = \frac{aN}{a+b}. \tag{9}$$

Combining equations (5) and (7), the equilibrium outflow rate from unemployment, a^{α}, can be written as

$$m = e + K\frac{(r+b+a^{\alpha})}{(1+r)}. \tag{10}$$

In equation (10), it can be seen that the second type of effect of severance payments mentioned before can be fully undone. The idea is that if markets are complete and perfect, and firing costs are fully transferred to workers, then they are neutral on employment because the wage is reduced by the same proportion as the increased shadow cost of labor (see Lazear 1990).

However, in this model, even if firing costs are fully received by workers, they are not neutral because they affect the rent, K. The effects of severance payments on the efficiency wage setting have no counteracting effects through the non-wage component of the shadow cost of labor. Therefore, the wage schedule is shifted to the left and it has a negative impact effect on employment. Firing costs have a real effect because they reduce the cost of shirking.

The aggregate NSC_P can also be written in terms of the unemployment rate, u. Replacing equation (8) into equation (7), this condition can be written as

$$w \geq b + \frac{bC}{1+r} + K\frac{(r + \frac{bN}{N - L_P})}{(1+r)} = e - \frac{bC}{1+r} + K\frac{(r + b/u)}{(1+r)}; \qquad (11)$$

where $u = (N - L_p)/N$.

As in Shapiro and Stiglitz (1984), this expression shows the incompatibility of full employment with incentives.[22] This expression can be represented in the (w_P, L_P) space. Figure 1 shows the labor market equilibrium in the presence of (non-neutral) firing costs and compares it with the no firing cost situation.

2.2 Temporary and permanent contracts available

For a given vacancy, firms can now choose among temporary and permanent contracts. PCs look exactly the same as in the previous section. TCs are analyzed in the following section.

2.2.1 Non-shirking condition in a temporary contract

Since TCs have a non stationary form and this is precisely what will drive the results, it is convenient to use time indices to start analyzing them. The incentive problem to examine is that of a worker holding a TC at period t which can be renewed into a PC at period $(t+1)$ with probability R: If the contract is not renewed, the worker becomes unemployed. Thus, the

[22] As it will be shown, this is not necessarily the case when fixed-term contracts are introduced.

incentive problem at $(t+1)$ is exactly the same as in a PC. So, the non-shirking constraint of a TC at $(t+1)$, $NSC_{T(t+1)}$, is just the non-shirking constraint of a PC, i.e. $NSC_{T(t+1)} = NSC_P$.

Provided that the $NSC_{T(t+1)}$ is satisfied, then expected present discounted utility of being employed with a TC at period t of not shirking and of shirking is given respectively by

$$V^n_{Tt} = w_{Tt} - e + \frac{1}{1+r}\left[R(1-b)V_{P(t+1)} + [b+(1-R)(1-b)]V_{U(t+1)}\right] \quad (12)$$

and

$$V^s_{Tt} = w_{Tt} + \frac{1}{1+r}\left[R(1-b-q)V_{P(t+1)} + [b+(1-R)(1-b-q)+q]V_{U(t+1)}\right]; \quad (13)$$

where w_T is the wage of the TC and R is the probability in which temporary contracts get renewed into permanent ones.

Again, shirking implies saving the disutility of effort today but implies a higher risk of becoming unemployed tomorrow. Moreover, in a TC, not being caught shirking is a necessary condition in order to be renewed into a PC. It has been assumed that all workers are identical and that there is a "hidden action" problem but not a "hidden information" one. Thus, in TCs, expenditure of effort does not give any additional information about the worker's characteristics that could influence renewal. But, expenditure of effort in a TC makes renewal more likely than when shirking. Not shirking reduces the probability to become unemployed directly.

A first important remark is that if there is no renewal of TC into PC at the end of period t, then shirking is always strictly preferred (if $R = 0$, then $V^n_{Tt} - V^s_{Tt} = -e < 0$). The idea behind this is very simple: if a worker always becomes unemployed independently of the effort expended, there is no way to give incentives to the worker by paying him a higher wage. The only way to induce workers not to shirk in a TC is that the firm commits to a sufficiently high renewal rate. In other words, that firing is not automatic after the end of a TC.

I am considering an extreme case where TCs last only one period and thus the wage paid does not affect incentives. But still, in a more general case, even if the TC was longer, when unemployment is certain at the end of the contract, wages have no incentive role. Instead, the prospects of renewal do. When it is uncertain for a worker that he will keep the job tomorrow, his preoccupation is more about his renewal than his wage. Once there is no uncertainty about ending one's contract (except for exogenous reasons), then workers are motivated by the wage they get paid.

The condition that guarantees incentives to expend the effort in a TC at period t, that is, the non-shirking condition of a temporary contract at t, i.e. NSC_{Tt} can be written as

$$V^n_{Tt} - V^s_{Tt} \geq 0 \text{ if and only if } R(V_{P(t+1)} - V_{U(t+1)}) \geq \frac{e(1+r)}{q}. \qquad (14)$$

This condition states that incentives in a TC can be given by the renewal rate of TC into PC and/or by the rent associated with holding a PC. Incentives given with future wages is the standard idea of efficiency wages. The renewal rate is also related to the incentive problem in a similar way: for given $(V_{P(t+1)} - V_{U(t+1)})$, R needs to be higher, the higher the required effort (e); the more inefficient the control technology (q); the higher the interest rate (r); and the higher the probability of exogenous redundancies(b).

The two mechanisms that can provide incentives in a TC are substitutes: the higher the renewal rate, the lower the wage can be in a PC given the incentive problem. And vice versa. However, for given permanent wages, the renewal rate cannot be zero, as thought intuitively. Also, for given R, workers in a PC must enjoy some rent, as in the standard efficiency wage models. Figure 2 represents the NSC_{Tt} in the space $(R; V_P - V_U)$.

An incentive-compatible TC must satisfy the NSC_{Tt} and the NSC_P. As seen in the previous section, workers in PCs are paid the minimum rent compatible with incentives, that is, the NSC_P is binding. This reduces the possible values of R to

$$R \geq \frac{e(1+r)}{e(1+r)+q(1-d)} = R^{\alpha}. \qquad (15)$$

Figure 3 represents the two non-shirking constraints of a TC. The thicker line in the graph represents the combinations of $(R; V_P - V_U)$ where the two NSC are satisfied. And R^{α} is the renewal rate for which both NSC are binding. Note that for the case where $d > 0$, $R^{\alpha} < 1$. That is, if firing costs are non-neutral on permanent employment, the minimum incentive-compatible renewal rate is less than one.

To conclude this section, it has been found that incentives in a TC are provided with a combination of a non-zero renewal rate into a PC and a non-zero rent paid in a PC. The rent is the minimal rent compatible with incentives given by the NSC_P, and the renewal rate R can take any value within the NSC_{Tt} compatible with such rent, that is $R \geq R^{\alpha}$. Let this condition be NSC_T: Let V_T be the expected utility in equilibrium of a TC. Since V_T satisfies the NSC_T; then $V_T = V^n_T$: In the next section the firm's objective function is introduced and its choice of contracts as well as the determination of R is analyzed.

2.2.2 Choice of contracts in a two-tier system

I first analyze the choice of contracts for a given vacancy and then calculate in the next section the firm's labor demand for the given (optimal) contract chosen.

When the firm hires a new worker, it can choose between a PC (as the one described in section 2.1) or a TC (as the one described in the previous section). The firm compares the present discounted value of marginal profits with the two different types of contracts taking into account their respective incentive constraints. Let Π_{it} be the present discounted value of marginal profits with type i contract ($i = T, P$). That is

$$\Pi_{it} = f'(L_i) - w_{it} + \frac{1}{1+r}\left[\Pi_{i(t+1)}\right] \quad \text{s.t. NSC}_{it} \text{ and NSC}_{i(t+1)}$$

$$\text{where } \Pi_{i(t+1)} = \begin{cases} (1-b)(1-R)\Pi_{T(t+1)} + (1-b)R\Pi_{P(t+1)} & \text{for } i = T \\ -bC + (1-b)\Pi_{P(t+1)} & \text{for } i = P \end{cases}$$

Firms always get the net product instantaneously with any type of contract. Then, with a PC, the firm incurs the firing cost if there is a redundancy, otherwise the contract continues. TCs end after one period. If there is a shock, the contract does not continue and this is not costly for the firm. Otherwise, the contract continues, becoming a permanent one (with probability R) or restarting with a new worker with another TC (with probability $1-R$).

Lemma 1. The optimal contract in a two-tier system is a fixed-term contract that is renewed into a permanent contract with probability R.

Proof: It is easy to note that the permanent contract problem ($i = P$) is just the subproblem at $(t+1)$ of the temporary contract problem ($i = T$) at t. Since the wage in a TC, w_T, has no incentive role (implying that it will not be higher than the efficiency wage in a PC) and there are no firing costs, the firm cannot be made worse off by starting with a fixed-term contract.[23] ■

Therefore, the optimal strategy for the firm is to start with a TC and after one period renew it into a PC with some probability R. The renewal rate is chosen to maximize the present discounted value of marginal profits of a TC (Π_T) subject to the NSC_T. The firm also chooses the wage to be paid during the TC. For reasons that will become apparent, I consider two cases:

[23] If the wage in a TC is higher than in a PC then the two-tier system would not be an equilibrium (see Proposition 2).

(1) where w_T is flexible and the firm only has to consider a participation constraint and (2) where there is some legislation that sets the wage at least at a minimum level, say w_{min}. In this case, the participation constraint is slack.[24]

The complete characterization of the incentive-compatible TC is given by

$$\begin{aligned} &\underset{R,w_T}{Max}\ \Pi_T(R, w_T) \\ &\text{s.t.:} \begin{cases} R^{\alpha} \leq R \leq 1 \\ \text{case (1): } V_T \geq V_U \\ \text{case (2): } w_T \geq w_{min} \end{cases} \end{aligned}$$

The resolution of this problem leads to the following proposition:

Proposition 1 *If wages in fixed-term contracts are perfectly flexible, then the firm is indifferent among any incentive-compatible renewal rate of fixed-term contracts into permanent contracts, that is $R \in (R^{\alpha}; 1)$. But if there are minimum wage restrictions, then the firm chooses the minimum renewal rate, that is, R^{α}.*

Proof: see appendix.

The idea behind this result is simple. If wages in TCs are perfectly flexible, all the effects of firing costs on the wage setting of the PC can be undone with the wage of the first period while the worker is in a TC. Thus the firm is indifferent among any renewal rate because profits can always be kept constant. In this case, the economy would be at full employment.[25] Instead, if wages are not perfectly flexible, the optimal rate of renewal is the minimum compatible with incentives, that is R^{α}, where $R^{\alpha} < 1$. The mechanism that is preventing higher renewal rates is the non-neutral effect of firing costs on the efficiency wage. Figure 4 represents the iso-profits curves for the two cases in the space $(R, V_P - V_U)$.

Back to the initial question, note that this result provides an interesting and paradoxical explanation of the use of TCs: when temporary contracts are very "cheap", the firm is actually indifferent among TCs or PCs. While when temporary contracts are more "expensive", the firm actually chooses the minimum share of PC given the incentive constraints.

[24] As mentioned, the legislated minimum wage would be a slack constraint in the world with only permanent contracts. A further discussion on this is done in section (2.3) when the two systems are compared.

[25] To see how full employment can be reached in an efficiency wage model see Remark 1 in section 2.2.4 where employment in a two-tier system is derived.

2.2.3 Hiring decisions

In this section I derive the labor demand for the optimal type of contract described in Proposition 1 (case 2).[26] Firms maximize employment given the wage of TC (w_{min}) and renewal rate (R^a) of this contract. Such a contract implies that the total workforce will be the sum of those workers with a TC (those who are in the first period of their contract) and those with a PC. Workers with a PC are either those who have just been renewed from a TC or those who already had a PC and were not fired. To distinguish from the system in which only PCs were available, I denote with "e" the value of variables that were also present in that system (i.e. $L_P; w_p; a; V_U$). Thus

$$\tilde{L}_{Pt} = (1 - b)\tilde{L}_{P(t-1)} + R^a(1 - b)L_{T(t-1)} \qquad \forall t, t = 1, ..., +1 \tag{16}$$

and

$$\tilde{L}_{P0} = 0.$$

Firms maximize the present discounted value of profits

$$\underset{L_T, L_P}{Max} \sum_{t=0}^{t=+1} \left[f(\tilde{L}_t) - w_{min} L_{Tt} - w_P \tilde{L}_{Pt} - bC \tilde{L}_{p(t-1)} \right] \frac{1}{(1+r)^t}$$

subject to (16).

The steady state labor demand is given by

$$m = \bar{w}_{min} + (1 - \bar{}) \left[w_P + \frac{bC}{1+r} \right]; \tag{17}$$

$$\text{where} \qquad \bar{} = \frac{r + b}{r + b + R^a(1 - b)}.$$

In a two-tier system, the marginal product of labor is equalized to a weighted sum of the marginal cost of a TC and the marginal cost of a PC. The weights correspond to the actualized share of TC, ($\bar{}$); and PC, ($1 - \bar{}$); respectively. A more detailed discussion on $\bar{}$ is done in the next section.

2.2.4 Market equilibrium

As before, the key market variable is $\tilde{V}_U$. In a two-tier system, all contracts start with a TC. Therefore,

$$\tilde{V}_U = \frac{a}{r + a} V_T. \tag{18}$$

[26] As mentioned, there is full employment in case 1.

Replacing equation (18) into equation (12), V_U^e in equilibrium can be written as

$$\frac{rV_U^e}{1+r} = \frac{a}{1+r+a}\left[(w_{min} - e) + \frac{(1-b)}{(1+r)}\frac{e(1+r)}{q}\right]; \qquad (19)$$

where the term $e(1+r)/q$ denotes the importance of the shirking problem in a TC, that is, $R^{\alpha}(V_P - V_U)$; given by (14).

Now, going back to equation (4), the efficiency wage of a PC in a two-tier system is given by

$$w_P^{\alpha} = e - \frac{bC}{1+r} + K\frac{(r+b)}{1+r} + \frac{a}{(1+r+a)}\left[(w_{min} - e) + \frac{e(1-b)}{q}\right]: \qquad (20)$$

As before, L^e is derived from the steady state flows conditions[27]. Let L^e be total employment in the two-tier system, which equals temporary employment, L_T plus permanent employment, L_P^e. In flows and out flows into employment have basically the same structure as in the system only with PCs. There are also the flows from the renewal and non-renewals of TC. Figure 5 represents all these flows.

In the steady state, the out flow from unemployment is given by $a(N - L^e)$ workers. The in flow to unemployment comes from those whose TC is not renewed, $(1-b)(1-R^{\alpha})L_T$, and from all those who lost their jobs for exogenous reasons, bL^e. Thus

$$a(N - L_T - L_P^e) = (1-R^{\alpha})(1-b)L_T + b(L_T + L_P^e): \qquad (21)$$

At any time, a proportion R^{α} of those TCs that are not finished for exogenous reasons, are renewed into PCs, while a proportion b of those already in PCs become unemployed. So

$$(1-b)R^{\alpha}L_T = bL_P^e: \qquad (22)$$

Combining these last two conditions, temporary and permanent employment can be written as

$$L_T = \frac{aN\,b}{b + a[b + (1-b)R^{\alpha}]}; \qquad L_P^e = \frac{aN\,(1-b)R^{\alpha}}{b + a[b + (1-b)R^{\alpha}]}:$$

The proportion of TCs is given by

$$\beta = \frac{b}{b + (1-b)R^{\alpha}} \qquad (23)$$

[27] The optimal contract described above implies that the steady state equilibrium can be reached in two periods.

and $(1 - \alpha)$ is the proportion of permanent contracts.

Combining (17) and (20), the equilibrium outflow rate of unemployment in a two-tier system, a^*, can be written as

$$m = \bar{w}_{min} + (1 - \bar{\alpha}) \left[e + K \left(\frac{r + b}{1 + r} + \frac{a^*}{(1 + r + a^*)} \right) \left(w_{min} - e + \frac{e(1 - b)}{q} \right) \right]. \tag{24}$$

Going back to the efficiency wage in the two-tier system, it is possible to express (20) in terms of the unemployment rate. This allows to do the following remark. Replacing (22) into (21), the outflow rate from unemployment can be written as

$$a = \frac{\alpha(1 - e_u)}{e_u},$$

where $e_u = (N - L_T - L_P)/N$ is the unemployment rate in the two-tier system. So, the efficiency wage curve in equilibrium is given by

$$w_P^* = e - \frac{bC}{1 + r} + K \left(\frac{(r + b)}{(1 + r)} + \frac{\alpha(1 - e_u)}{\alpha(1 - e_u) + e_u(1 + r)} \right) \left(w_{min} - e + \frac{e(1 - b)}{q} \right). \tag{25}$$

Remark 1 Full employment is not incompatible with the incentive problem in a two-tier system as it is in the system with only one type of contract (as in Shapiro and Stiglitz, 1984). But it would always be a "mixed" full employment, i.e. full employment in which TC and PC coexist.

This can be seen directly from expression (25): the incentive-compatible wage for zero unemployment rate is finite.[28] This is in sharp contrast from the situation with only PCs (see equation 11). However, this full employment would be 'mixed', in other words, with both types of contracts coexisting. In this case, full employment is compatible with incentives. The reason is that each type of employment gives incentives to the other: temporary workers are motivated by the possibility of getting a better contract, that is, a permanent contract. And permanent workers are motivated to work in order to avoid restarting with a fixed-term contract.[29]

[28] From Proposition 1, we have that in case 1, for any combination of (w_T, R), $a \to 1$.

[29] Although temporary wages are lower than those in a PC, temporary workers get incentives from the renewal prospects into higher utility contracts. Firing costs make TC

2.3 Comparing two systems: two-tier vs. only permanent contracts

In this section I compare employment levels and the effects of firing costs in each system. I start with the equilibrium conditions for each system.

For a system to be an equilibrium, it has to be the case that firms cannot make higher profits by offering the other type of contract within that system.

Lemma 2. The equilibrium conditions for each system depend on the level of the minimum wage.

Proof: see appendix.

Proposition 2 For $w_{min} > m$, the system with only permanent contracts is the only equilibrium. For $w_{min} < m$, the two-tier system is the only equilibrium. For $w_{min} = m$, any of the two systems can be an equilibrium.

Proof: see appendix

The idea behind this result is that given that in the system with only PCs workers are paid their marginal product, when the minimum wage is above m, TCs are more costly than PCs so firms would offer PCs only. On the contrary, when the minimum wage is below m, TCs are "cheap" and firms end up in a two-tier system. For the case where the minimum wage is exactly m, any contract has the same cost and both systems generate the same profits so either of the two systems could be an equilibrium.

2.3.1 Employment levels

It is important to know if the introduction of TC generates higher employment or not despite the fact that, in general, it creates a higher segmentation of the labor market. Comparing (24) with (10), it is possible to distinguish two effects at play. On the one hand, for given wages, employment is higher in a two-tier system due to a composition effect. The weight $\bar{\theta}$ corresponds to an actualized share of TC given by θ (equation 23).[30] On the other hand,

worse not only because fired workers are not paid an indemnity, but also because they make $R^{\alpha} < 1$. If there were no firing costs, then $R^{\alpha} = 1$ and the only potential difference between contracts would be their wage. In this case, an upward sloping wage profile would not generally be a perfect substitute for a first-best contract with an upfront fee, as argued by Akerlof and Katz (1989).

[30] If $r = 0$; then $f'(\bar{e}) = \theta w_{min} + (1 - \theta)\left(wp + \frac{bC}{1+r}\right)$. Also, if $r = +1$; then $f'(\bar{e}) = w_{min}$. That is, if firms are patient, they equalize the marginal product of labor to the average cost of labor. In the opposite extreme case, firms only perceive the cost of the present labor force which is always holding a TC.

w^{*}_{P} is not necessarily equal to w^{*}_{P}. This also has an effect on employment. If wages of PC are higher in a two-tier system than in a system with only PCs, ceteris paribus, employment would be lower in a two-tier system.

Lemma 3. The difference in employment levels in the two systems depends on the level of the minimum wage.

Proof: see appendix

Intuitively, the composition effect is lower the higher the minimum wage is. From Proposition 1, the share of TC in the economy is constant for any (positive) w_{min} and, therefore, increases of the minimum wage are not compensated by a reduction of TCs. At the same time, the difference in permanent contract wages in the two systems also depends on the level of minimum wages. The higher the minimum wage, the higher the permanent wage in the two-tier system.[31] This, in turn, also reduces employment in the two-tier system.

So, the effect of TC on employment depends crucially on the level of minimum wages. Therefore, a two-tier system does not guarantee higher levels of employment. More precisely, the following proposition can be formulated:

Proposition 3 There exists a value w^{*}_{min} such that: for $w_{min} > w^{*}_{min}$, employment is higher in the system with only permanent contracts. Moreover, there is a range of values of w_{min}, namely $w_{min} \in [w^{*}_{min}; m]$, for which the minimum wage constraint corresponding to w_{min} is slack in the system with only PC.

Proof: see appendix.

The idea is that for high enough minimum wages, the fact that a two-tier system has less permanent workers is not compensated by their higher labor cost. The interest of the result is that there is a range of values for which the w_{min} is high enough to make employment in the two-tier system lower, but it is not so high to as to make directly labor costs higher in the two-tier system. Indeed, it is possible to have higher employment in the system with only PCs even though PCs are still paid above the minimum wage constraint. That is, the composition effect is not eliminated.

Now, the question is: Is it always the case that a system is an equilibrium when employment is higher in that system? The study of this question gives the following proposition:

Proposition 4 When the system with only PC is an equilibrium, employment is always higher in such a system. But in the range of minimum wages,

[31] This comes from the fact that in the two-tier system all contracts start being TC which are paid at the minimum wage.

$w_{min} \in (w^{\natural}_{min}, m)$; employment is higher in a system with only PC even though a two-tier system is the resulting equilibrium.

Proof: see appendix.

When firms chose PCs it is because TCs are too expensive. By the same token, the two-tier system would generate lower employment and the system with only PCs (which generates higher employment) is the only equilibrium. The mechanism behind is that when the minimum wage is low enough, firms do not take into account that by using TCs (and not PCs directly) they hire more, increasing a, and therefore increasing w_p so much that total employment turns out to be lower than it would have been with only PCs.

2.3.2 Effects of firing costs in a two-tier system

In the system with only PCs, the effect of firing costs was clear-cut: their non-neutral effect on the wage setting reduced employment. Given the results on employment in a two-tier system found in the last section, it is interesting to analyze the effects of firing costs in the two-tier system. That is, are firing costs neutral in a two-tier system despite the fact that the sign of employment is ambiguous?

In the two-tier system, firing costs also reduce employment, but it is important to distinguish two effects. First, they reduce employment just like in the system with only PCs because of their positive effect on permanent contract wages. Note that this effect is lower than in the other system since the proportion of permanent employment is in general lower. Second, firing costs also play a role in the determination of the renewal rate. The higher the rent in a PC (due to the effect of firing costs), the lower incentive-compatible renewal rate, $R^{\natural}$, needs to be.[32] This reduces the above effect. That is, employment is less reduced. The question then is: does it eliminate it completely?

Proposition 5 *The neutrality of firing costs cannot be restored with the introduction of fixed-term contracts for any imperfectly flexible temporary wage.*

Proof: see appendix.

The intuition is that the incentive problem imposes a minimum proportion of permanent employment and that its costs can only be compensated at the expense of lower wages for temporary workers. But, as it is shown, there is no positive temporary wage that can undo the effect of firing costs.

[32] This effect could make insiders holding a PC push for higher firing costs and firms accept it since it would allow them to offer lower renewal rates to new entrants with TC.

This means that the introduction of TC may imply higher employment despite the fact that it does not remove the inefficiency of firing costs completely. What happens then when the non-neutrality effect of firing costs is reduced? That is, what happens if δ is reduced? In the system with only PCs, employment increases. In the two-tier system, employment also increases as well as the renewal rate of TCs. So, the labor market is less segmented. This explains why the introduction of TCs keeping PCs unchanged (that is, leaving the non–neutral effects of firing costs unchanged) leads to a substitution of TCs for PCs without a necessary increase of total employment. Therefore, the removal of the non-neutrality effects of firing costs is an efficient policy. Whether it would have more impact effect in one system or the other depends again in the level of minimum wages that determine the difference in employment in both systems.

2.4 Welfare Analysis

Finally, it is important to know if the equilibrium allocation is constrained Pareto efficient or not. The social planner maximizes aggregate welfare

$$W = L_P(V_P + \psi_P) + L_T(V_T + \psi_T) + (N - L)V_U:$$

In steady state, the inflows and outflows from each group are such that maximizing aggregate welfare across agents is equivalent as maximizing the expected utility of a representative individual that gets all the resources in the economy, that is

$$L_P(w_P - e) + L_T(w_T - e) + L_P(m - w_P) + L_T(m - w_T);$$

which in turn equals

$$L_P(m - e) + L_T(m - e) = L(m - e):$$

that is, total output minus the social cost of production (the effort, e).

Thus, the central planner is only concerned with total employment. Therefore, from Proposition 4, the market outcome is not always efficient. More precisely, the two-tier system is not always socially optimal. So, what is the socially optimal renewal rate of TCs?

The social planner maximizes employment in a two-tier system subject to the NSCs and the minimum wage constraint. Moreover, the social allocation must be profitable from the private point of view, that is aggregate profits must be non-negative. So, the social planner solves

$$\max_{R;a;w_T;w_p} (m - e)L_{(a;R)}$$

$$\text{s.t.} \begin{cases} R \geq R^{\alpha} & (\lambda_1) \\ R \leq 1 & (\lambda_2) \\ w_P - e + \dfrac{bC}{1+r} - K\dfrac{(r+b)}{(1-R)(1+r)} - \dfrac{a}{1+r+a}\left[w_T - e + \dfrac{R(1-b)K}{1+r}\right] \geq 0 & (\lambda_3) \\ mL_{(a;R)} - w_T L_{T(a;R)} - \left(w_P + \dfrac{bC}{1+r}\right)L_{P(a;R)} \geq 0 & (\lambda_4) \\ w_T \geq w_{min} & (\lambda_5) \end{cases}$$

The resolution of this problem leads to the following proposition:

Proposition 6 There exists a value $w_{min}^{\alpha\alpha}$ such that: for $w_{min} > w_{min}^{\alpha\alpha}$, the socially optimal renewal rate of fixed-term contracts is $R = 1$, where $w_{min}^{\alpha\alpha} > w_{min}^{\alpha}$.

Proof: see appendix.

Thus from the social point of view, there are gains from reducing the segmentation of the labor market because this increases total employment. In particular, the two-tier system does not generate higher employment compared to the system with only PCs, the socially optimal renewal rate is larger than the private one. The intuition is the following. Firms do not take into account that when they increase the rate of renewal, permanent wages will fall. Thus, they chose the minimum incentive-compatible renewal rate because they take as given permanent wages.

3 Conclusion

In this paper, I have analyzed the introduction of fixed-term contracts in an economy where firing costs reduce employment. The model has shown that the choice of fixed-term contracts is understandable even in a context of efficiency wages. The idea is that the renewal rate into permanent contracts has an incentive role. In addition, renewal rates are lower the higher the (negative) effect of firing costs on employment.

It is often stated that the argument for introducing fixed-term contracts is that this is "the price to pay to get full employment". But higher employment at the expense of segmentation of the labor market only arises if wages are very flexible. Otherwise, employment is not necessarily higher than in a system with only permanent contracts while the labor market becomes segmented. The idea is that perfect wage flexibility would be required in order for fixed-term contracts to eliminate the non-neutrality effect of firing costs.

This can explain why the introduction of fixed-term contracts keeping permanent contracts unchanged (that is, leaving the non–neutral effects of firing costs unchanged) leads to a substitution of fixed-term for permanent contracts without a necessary increase of total employment as it is seen in some European countries.

Moreover, from the social point of view, market segmentation is too large. Higher renewal rates of fixed-term contracts into permanent contracts lead to higher employment levels. This analysis suggests that, policies on the employment protection legislation tackling the core labor contracts can be more efficient in motivating the creation of employment and, more precisely, the creation of permanent employment.

4 Appendix

4.1 Proof of proposition 1

Proof. I first analyze case 1 and then case 2.

² In case 1, the firm chooses to pay the lowest wage that satisfies the participation constraint, that is w_T such that $V_T = V_U$: Using equation (12), in equilibrium, this wage is given by

$$w_T = e - \frac{(1-b)}{1+r} R (V_P - V_U) + \frac{rV_U}{1+r}:$$

So, $w_T = w_T(R; V_U; V_P)$:

Therefore, $\frac{d\Pi_T(R; w_T(R;.);.)}{dR} = \frac{\partial \Pi_T}{\partial R} + \frac{\partial \Pi_T}{\partial w_T}\frac{\partial w_T}{\partial R}$:

And, sign $\frac{d\Pi_T(R; w_T(R;.);.)}{\partial R}$ = sign $((\Pi_P - \Pi_T) + (V_P - V_U))$:

The first element $(\Pi_P - \Pi_T)$ shows the direct effect of the renewal rate on temporary profits: every contract renewed gives Π_P instead of Π_T. The second element shows the indirect effect of the renewal rate through the wage setting in TCs: an increase in the renewal rate implies an increase of the utility of holding a TC proportional to the rent in permanent contracts, $(V_P - V_U)$; which allows to reach the participation constraint with a reduction of the wage in TCs (and therefore increase profits) by the same amount.

It is possible to rewrite the above expression in terms of total surplus, S_i, of a match with the current worker on a PC or on a TC, that is, $S_i = \Pi_i + V_i$ for $i = \{P; T\}$:

sign $((\Pi_P - \Pi_T) + (V_P - V_U))$ = sign $(S_P - S_T + V_T - V_U)$; where

$S_P = m - e + \frac{1}{1+r}[bV_U + (1-b)S_P]$ and

$S_T = m - e + \frac{1}{1+r}[bV_U + (1-b)R S_P + (1-b)(1-R)(V_U + \Pi_T)]$:

The difference in surplus among the different contracts depends crucially on the renewal rate and on the fact that TC can only be used once on the same worker. If the renewal rate is 1, then TCs and PCs generate the same total surplus. Their difference is just in the distribution of this surplus among current worker and employer. Secondly, the fact that TCs can only be used once on the same worker implies a change of utility (from holding a TC to becoming unemployed) for current workers holding a TC whenever they are not renewed. Therefore

sign $(S_P - S_T)$ = sign $[(1-b)(1-R)(V_T - V_U)]$ and

$$\text{sign}((\pi_P - \pi_T) + (V_P - V_U)) = \text{sign}[(1-b)(1-R)(V_T - V_U)].$$

The fact that firm chooses the wage such that $V_T = V_U$, implies that

$$\text{sign}\frac{d\pi_T(R; w_T(R))}{dR} = 0$$

Therefore, the firm is indifferent among any incentive-compatible R.

Note that from the whole economy point of view the two types of contracts also generate the same surplus because when a TC is not renewed, the firm starts a new one with another worker. The intuition for this is simple: there is only one type of job in the economy and workers are all homogeneous. Globally, the different contracts just determine a different distribution of surplus among workers and employers.

In case 2, the wage for TCs is fixed exogenously and there is only a direct effect of the renewal rate on temporary profits. That is

$$\text{sign}\frac{\partial\pi_T(R; w_T)}{\partial R} = \text{sign}(\pi_P - \pi_T):$$

$$\text{sign}(\pi_P - \pi_T) = \text{sign}(w_T - w_P - \frac{bC}{1+r}) < 0; \text{since } w_T \cdot w_P:$$

So, the firm chooses the minimal renewal rate incentive-compatible. ■

4.2 Proof of lemma 2

Proof. : A system with only PCs is an equilibrium if:

$$\pi_P(\hat{w}_P) \geq \pi_T(w_{min}; R^*; \pi_P(\hat{w}_P)): \tag{26}$$

A two-tier system is an equilibrium if:

$$\pi_T(w_{min}; R^*; \pi_P(\tilde{w}_P)) \geq \pi_P(\tilde{w}_P): \tag{27}$$

Condition (26) is satisfied if $w_{min} \geq \hat{w}_p^*$ ( ) $w_{min} \geq m$:

Condition (27) is satisfied if $w_{min} \cdot \tilde{w}_p^*$ ( ) $w_{min} \cdot \frac{m - \bar{w}_{min}}{1 - \bar{}}$ ( ) $w_{min} \cdot m$. ■

4.3 Proof of proposition 2

Proof. : From lemma 2: for every value of w_{min} the equilibrium is defined as follows:

- if $w_{min} < m$; the two-tier system is an equilibrium.
- if $w_{min} = m$; any of the two systems can be an equilibrium.
- if $w_{min} > m$; the system with only PCs is an equilibrium. ■

4.4 Proof of lemma 3

Proof.: Employment in each system is given, respectively:

$$L_P = \frac{aN}{b+a} \text{ and } L^e = \frac{aN[b+(1-b)R^*]}{b+a[b+(1-b)R^*]}.$$

From equation (10), $a^* = \frac{(m-e)(1+r) - K(r+b)}{K} \equiv \frac{J}{K}$.

From equation (24), $a^e = \frac{X(1+r)}{1-X}$; where

$X \equiv \frac{J - \bar{\beta}J'}{[(w_{min}-e)(1+r)+(1-b)R^*K](1-\bar{\beta})}$ and $J' \equiv J-(m-w_{min})(1+r)$.

The difference in employment in the two systems is given by:

$sign(L_P - L^e) = sign(a^* - a^e[b+(1-b)R^*])$; where $a^e = a^e(w_{min})$.

If $w_{min} = w^*_{min} \Rightarrow L_P - L^e(w^*_{min}) = 0$, where

$$w^*_{min} = \frac{KM[Jr+r\bar{\beta}JK(1-b)(1-R^*)+KM[m(1+r)^2\bar{\beta}+J(J+e(1+r)+Kb)]}{(1+r)[J+\bar{\beta}MK(1+r)]};$$

where $M = b+(1-b)R^*$.

So,

- if $w_{min} > w^*_{min}$, $L_P > L^e$.
- if $w_{min} < w^*_{min}$, $L_P < L^e$. ■

4.5 Proof of Proposition 3

Proof.:

- From Lemma 3, if $w_{min} > w^*_{min} \Rightarrow L_P > L^e$.
- To check if the minimum wage constraint is binding in the system with only permanent contracts, $wb^*_P - w^*_{min}$ needs to be calculated.

$sign(wb^*_P - w^*_{min}) = sign(m - w^*_{min}) =$

$$sign\begin{bmatrix} m(1+r)J - m(1+r)^2KM\bar{\beta} - KMJ(1-\bar{\beta})r \\ -KMm(1+r)^2 - JKr\bar{\beta} - J(J+e(1+r)+Kb) \end{bmatrix} =$$

$sign[J(J+Kr-J) - JKr(M(1-\bar{\beta})+\bar{\beta})] =$

$sign[JKr(1-\bar{\beta})(1-M)] =$

$sign[JKr(1-\bar{\beta})(1-b)(1-R^*)] > 0$.

Since $wb^*_P - w^*_{min} > 0$; then for $w_{min} \in (w^*_{min}, m)$, $L_P > L^e$ and w_{min} not binding in the system with only PCs. ■

4.6 Proof of Proposition 4

² From proposition 2, the system with PCs only is an equilibrium if $w_{min} > m$: From lemma 3, employment in is this system is higher if $w_{min} > w^{¤}_{min}$: From proposition 3, $m > w^{¤}_{min}$. This implies that whenever the system with PCs only is an equilibrium, employment is always higher in that system.

² From proposition 2, the two-tier system is an equilibrium if $w_{min} < m$: From lemma 3, if $w_{min} \in (w^{¤}_{min}; m)$ employment is lower in this system. Therefore it is this same range of w_{min} for which the two-tier system is an equilibrium despite the fact that employment in the two-tier system is lower and the minimum wage constraint is not binding in the system with only PCs. ■

4.7 Proof of Proposition 5

Proof.: The effects of F (the non-neutral …ring cost, $F = dC$) on employment in the two-tier system are given by

$$\text{²} \operatorname{sign}\left(\frac{@L^{e}}{@F}\right) = \operatorname{sign}\left[a(1 ¡ b)\frac{@R^{¤}}{@F} + (b + (1 ¡ b)R^{¤})\frac{@a^{e}}{@F}\right]; \text{where}$$

$$\frac{@R^{¤}}{@F} < 0 \text{ and}$$

$$\operatorname{sign}\left(\frac{@a^{e}}{@F}\right) = \operatorname{sign}\left[¡(m ¡ w_{min})(w_{min} ¡ e + (1 ¡ b)e=q)\right]:$$

For all the cases where the two-tier system is an equilibrium, $m ¡ w_{min} > 0$: From Proposition 1 it is possible to write: $w_{min} = e ¡ (1 ¡ b)e=q + A$; where $A > 0$ in case 2 (and $A \cdot 0$ in case 1). Therefore, $\frac{@a^{e}}{@F} < 0$ in case 2. Thus, $\frac{@L^{e}}{@F} < 0$; in case 2. That is, for all w_{min} in case 2, …ring costs reduce employment. ■

4.8 Proof of Proposition 6

The …rst order conditions of the social planner problem are:

$$(1)\ R: \quad \underbrace{(m ¡ e)\frac{@L^{e}}{@R} + ¸_1 ¡ ¸_2 ¡ ¸_3\frac{a}{1+r+a}\frac{(1 ¡ b)K}{1+r}}_{A} + ¸_4\left[\frac{@L^{e}}{@R}m ¡ \frac{@L_T}{@R}w_T ¡ \frac{@L_P}{@R}\left(w_p + \frac{bC}{1+r}\right)\right] = 0$$

$$(2)\ a: \quad (m - e)\frac{\partial L^e}{\partial a} - \lambda_3 \left[w_T - e + \frac{(1-b)RK}{1+r} \left(\frac{(1+r)}{(1+r+a)^2} + \right. \right.$$
$$\left. \left. + \lambda_4 \left[\frac{\partial L^e}{\partial a} m - \frac{\partial L_T}{\partial a} w_T - \frac{\partial L_P}{\partial a} \left(w_p + \frac{bC}{1+r} \right) \right] = 0 \right)$$

$$(3)\ w_P: \lambda_3 - \lambda_4 L_P = 0$$

$$(4)\ w_T: \lambda_5 - \lambda_3 \frac{a}{1+r+a} - \lambda_4 L_T = 0$$

² Conditions (3) and (4) imply that either $\lambda_3 = \lambda_4 = \lambda_5 = 0$ or $\lambda_3 > 0$; $\lambda_4 > 0$; and $\lambda_5 > 0$: The…rst case implies a contradiction (from (2), R would be negative). Therefore these multipliers are positive implying that the three constraints associated are binding.

² Employment is then given by: $L^e = a^S; R; w^{\alpha}_{min} = \frac{a^S N [b + (1-b)R]}{b + a^S [b + (1-b)R]}$;

where

$$a^S(R; w^{\alpha}_{min}) = \frac{J - \beta J^b}{J - J^b + K^b (r + M)(1 - \beta)}:$$

If $w_{min} < w^{\alpha\alpha}_{min} \Rightarrow L^e = a^S; 1; w^{\alpha\alpha}_{min} < L^e = a^S; R^{\alpha}; w^{\alpha\alpha}_{min} < 0$, where this minimum wage constraint is not binding in the system with only permanent contracts, that is

$$m < w^{\alpha\alpha}_{min} = \frac{JKr(1-\bar{})(1-M) + JK - Mrb(1-\beta) + \frac{r^2 R^{\alpha}(1-b)}{r+M}(1 - R^{\alpha}(1-b))}{(1+r)(1-M)[J + Kb(1+\beta r)]};$$

where

$$M = b + (1-b)R^{\alpha}:$$

So, when $w_{min} \in [w^{\alpha\alpha}_{min}; m]$, the socially e¢ cient renewal rate of …xed-term contracts is 1:

² From Proposition 3:

$$m - w^{\alpha}_{min} = \frac{JKr(1-\bar{})(1-M)}{(1+r)[J + K\bar{}M(1+r)]}:$$

Therefore,

$w^{\alpha\alpha}_{min} < w^{\alpha}_{min} < m$.

So, when the market solution is not optimal, the socially e¢ cient renewal rate of …xed-term contracts is 1:■

References

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

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

[3] Alba, Alfonso (1994): "Formal training, temporary contracts, productivity and wages in Spain", Oxford Bulletin of Economics and Statistics, 56 (2), 151-170.

[4] Alba, Alfonso (1996): "Labor market effects of fixed-term employment contracts in Spain", Universidad Carlos III de Madrid Working Paper No. 96-60.

[5] Alba, Alfonso (1998), "How temporary is temporary employment in Spain?", Journal of Labor Research, 19 (4), 695-710.

[6] Alonso-Borrego, César, Jesús Fernandez-Villaverde and José E. Galdón-Sánchez (1999): "A general dynamic equilibrium model of temporary contracts", University of Minnesota mimeo.

[7] Bean, Charles R. (1994): "European unemployment: a survey", Journal of Economic Literature, 32, 573-619.

[8] Bentolila, Samuel and Guiseppe Bertola (1990): "Firing costs and labour demand: how bad is Eurosclerosis?", Review of Economic Studies, 57, 381-402.

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

[10] Bentolila, Samuel and Gilles Saint-Paul (1992): "The macroeconomic impact of flexible labor contracts, with an application to Spain", European Economic Review, 36, 1013-1053.

[11] Bentolila, Samuel and Gilles Saint-Paul (1994): "A model of labor demand with linear adjustment costs", Labor Economics, 1, 303-326.

[12] Bertola, Guiseppe (1992): "Labor turnover costs and average labor demand", Journal of Labor Economics, 10 (4), 389-411.

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

[14] Goux, Dominique, Eric Maurin and Marianne Pauchet (2000): "Fixed-term contracts and the dynamics of labour demand", forthcoming European Economic Review.

[15] Grubb, David and William Wells (1993): "Employment regulation and patterns of work in EC countries", OECD Economic Studies, No. 21, 7-58.

[16] Güell, Maia (2000): "Employment Protection and Unemployment in an Efficiency Wage Model", Industrial Relations Section Working Paper No. 432.

[17] Güell, Maia and Barbara Petrongolo (2000): "Workers' transitions from temporary to permanent employment: the Spanish case", Centre for Economic Performance Discussion Paper No. 438.

[18] Jackman, Richard, Richard Layard and Stephen J. Nickell (1996): "Combatting unemployment: is flexibility enough?", Centre for Economic Performance Discussion Paper No. 293.

[19] Jimeno, Juan F. and Luis Toharia (1993): "The effects of fixed-term employment on wages: theory and evidence from Spain", Investigaciones Economicas, XVII (3), 475-494.

[20] Jimeno, Juan F. and Luis Toharia (1996): "Effort, absenteeism, and fixed term employment contracts", Revista Española de Economia, 13 (1), 105-119.

[21] Katz, Lawrence F. (1986): "Efficiency wage theories: a partial evaluation", NBER Macroeconomics Annual, 235-276.

[22] Layard, Richard, Stephen J. Nickell and Richard Jackman (1991), Unemployment: Macroeconomic Performance and the Labour Market, Oxford University Press.

[23] Lazear, Edward P. (1990): "Job security provisions and employment", Quarterly Journal of Economics, 105, 699-726.

[24] Nickell, Stephen J. (1978): "Fixed-costs, employment and labour demand over the cycle", Economica, 45, 329-345.

[25] Nickell, Stephen J. and Richard Layard (1998): "Labour market institutions and economic performance" in Orley Ashenfelter and David Card (eds.), Handbook of Labor Economics, Amsterdam: North-Holland.

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

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

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

[29] Piore, Michael J. (1986): "Perspectives on labor market flexibility", Industrial Relations, 25 (2), 146-166.

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

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

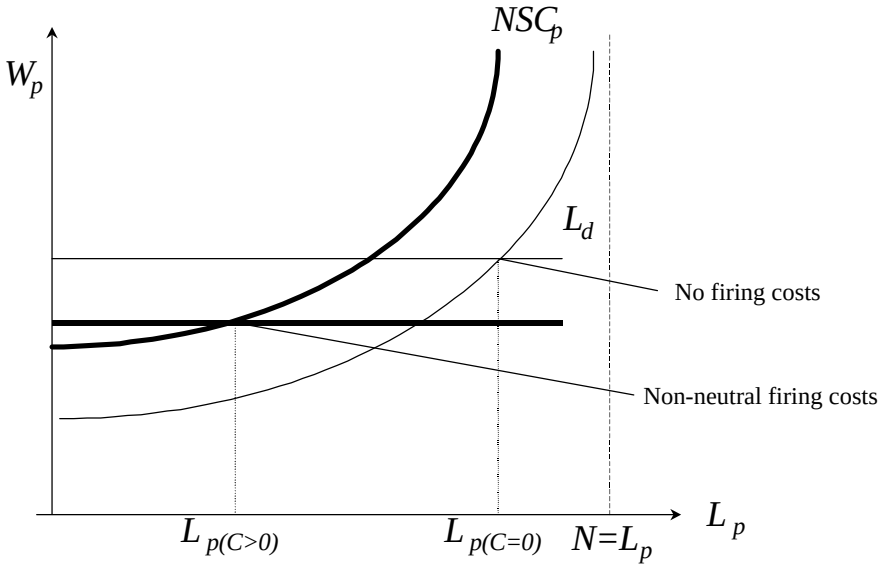

Figure 1: Market equilibrium with non-neutral firing costs

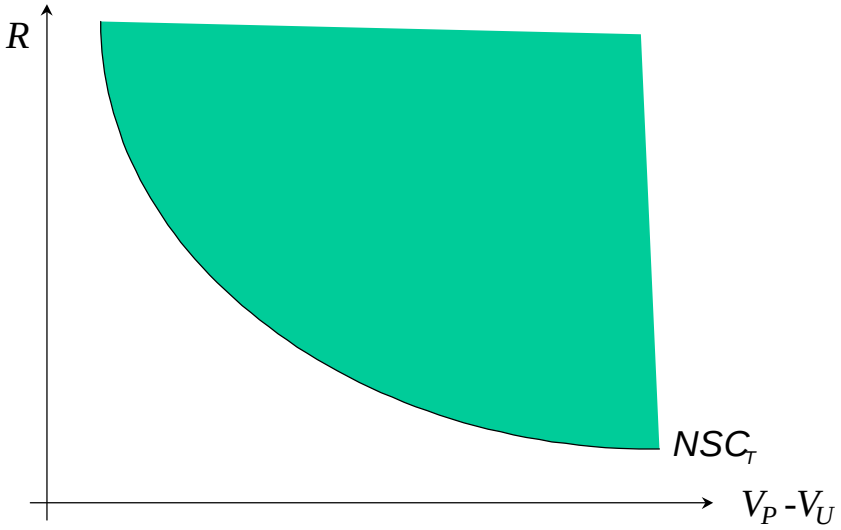

Figure 2: Non-shirking condition of a temporary contract

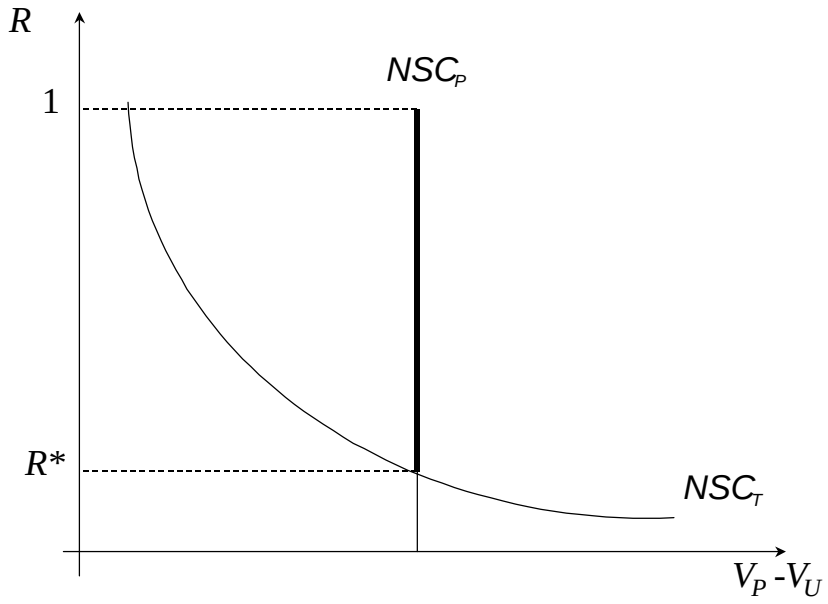

Figure 3: Non-shirking conditions of a temporary contract

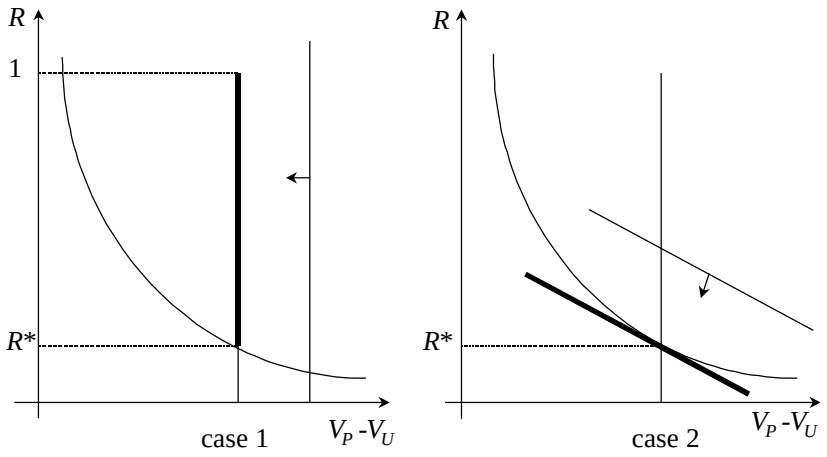

Figure 4: Optimal renewal rate with flexible and non flexible wages

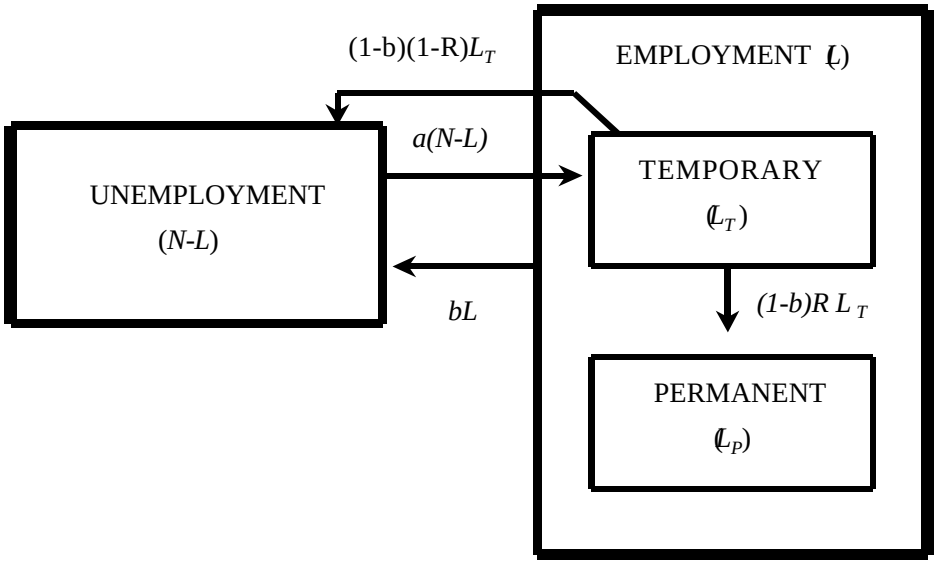

Figure 5: Flows of the labor market in a two-tier system

CENTRE FOR ECONOMIC PERFORMANCE
Recent Discussion Papers

460	P. Ramezzana	Per Capita Income, Demand for Variety, and International Trade: Linder Reconsidered
459	H. Lehmann J. Wadsworth	Tenures that Shook the World: Worker Turnover in Russia, Poland and Britain
458	R. Griffith S. Redding J. Van Reenen	Mapping the Two Faces of R&D: Productivity Growth in a Panel of OECD Industries
457	J. Swaffield	Gender, Motivation, Experience and Wages
456	C. Dougherty	Impact of Work Experience and Training in the Current and Previous Occupations on Earnings: Micro Evidence from the National Longitudinal Survey of Youth
455	S. Machin	Union Decline in Britain
454	D. Marsden	Teachers Before the ›Threshold‹
453	H. Gospel G. Lockwood P. Willman	The Right to Know: Disclosure of Information for Collective Bargaining and Joint Consultation
452	D. Metcalf K. Hansen A. Charlwood	Unions and the Sword of Justice: Unions and Pay Systems, Pay Inequality, Pay Discrimination and Low Pay
451	P. Martin H. Rey	Financial Integration and Asset Returns
450	P. Martin H. Rey	Financial Super-Markets: Size Matters for Asset Trade
449	A. Manning	Labour Supply, Search and Taxes
448	S. Nickell L. Nunziata	Employment Patterns in OECD Countries
447	W. Buiter	The Fallacy of the Fiscal Theory of the Price Level
446	R. Portes H. Rey	The Determinants of Cross-Border Equity Flows
445	G. Duranton D. Puga	Nursery Cities: Urban Diversity, Process Innovation and the Life-Cycle of Products
444	D. Quah	UK Phillips Curves and Monetary Policy
443	L. Feinstein	The Relative Economic Importance of Academic, Psychological and Behavioural Attributes Developed in Childhood

442	D. Quah	Cross-Country Growth Comparison: Theory to Empirics
441	D. Quah	Internet Cluster Emergence
440	E. Mellander	The Multi-Dimensional Nature of Labour Demand and Skill-Biased Technical Change
439	F. Green A. Felstead D. Gallie	Computers are Even More Important than You Thought: An Analysis of the Changing Skill-Intensity of Jobs
438	M. Güell-Rotllan	Workers= Transitions from Temporary to Permanent Employment: The Spanish Case
437	S. Redding	The Dynamics of International Specialisation
436	M. West M. Patterson J. Dawson S. Nickell	The Effectiveness of Top Management Groups in Manufacturing Organisations
435	F. Green S. McIntosh A. Vignoles	›Overeducation= and Skills - Clarifying the Concepts
434	H. Overman D. Puga	Unemployment Clusters Across European Regions and Countries
433	D. Puga	Diversity and Specialisation in Cities: Why, Where and When Does it Matter?
432	S. McIntosh	A Cross-Country Comparison of the Determinants of Vocational Training
431	H. Steedman	Looking into the Qualifications ›Black Box=: What can International Surveys Tell us About Basic Competence?
430	F. Trionfetti	On the Home Market Effect: Theory and Empirical Evidence
429	A. Scott	Does Tax Smoothing Imply Smooth Taxes?
428	A. Cameron J. Proudman S. Redding	Productivity Growth, Convergence and Trade in a Panel of Manufacturing Industries
427	E. Falcetti A. Missale	The Currency Denomination of Public Debt and the Choice of the Monetary Regime

To order a discussion paper, please contact the Publications Unit
Tel 020 7955 7673 Fax 020 7955 7671 Email info@cep.lse.ac.uk
Web site http://cep.lse.ac.uk