

Hart, Robert A.; Ma, Yue

**Working Paper**

## Why Do Firms Pay an Overtime Premium?

IZA Discussion paper series, No. 163

**Provided in Cooperation with:**  
Institute of Labor Economics (IZA)

Suggested Citation: Hart, Robert A.; Ma, Yue (2000) : Why Do Firms Pay an Overtime Premium?, IZA Discussion paper series, No. 163

This Version is available at:  
<http://hdl.handle.net/10419/21005>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

IZA DP No. 163

# Why Do Firms Pay an Overtime Premium?

Robert A. Hart  
Yue Ma

June 2000

# Why Do Firms Pay an Overtime Premium?

**Robert A. Hart**

*Department of Economics, University of Stirling and IZA, Bonn*

**Yue Ma**

*Department of Economics, University of Stirling*

Discussion Paper No. 163

June 2000

IZA

P.O. Box 7240  
D-53072 Bonn  
Germany

Tel.: +49-228-3894-0  
Fax: +49-228-3894-210  
Email: [iza@iza.org](mailto:iza@iza.org)

This Discussion Paper is issued within the framework of IZA's research area *The Future of Work*. Any opinions expressed here are those of the author(s) and not those of the institute. Research disseminated by IZA may include views on policy, but the institute itself takes no institutional policy positions.

The Institute for the Study of Labor (IZA) in Bonn is a local and virtual international research center and a place of communication between science, politics and business. IZA is an independent, nonprofit limited liability company (Gesellschaft mit beschränkter Haftung) supported by the Deutsche Post AG. The center is associated with the University of Bonn and offers a stimulating research environment through its research networks, research support, and visitors and doctoral programs. IZA engages in (i) original and internationally competitive research in all fields of labor economics, (ii) development of policy concepts, and (iii) dissemination of research results and concepts to the interested public. The current research program deals with (1) mobility and flexibility of labor markets, (2) internationalization of labor markets and European integration, (3) the welfare state and labor markets, (4) labor markets in transition, (5) the future of work, (6) project evaluation and (7) general labor economics.

IZA Discussion Papers often represent preliminary work and are circulated to encourage discussion. Citation of such a paper should account for its provisional character.

## **ABSTRACT**

### **Why Do Firms Pay an Overtime Premium?\***

We develop a rationale for the payment by firms of a wage premium on marginal, or overtime, weekly hours. We examine wage-hours contracts within the framework of a two-period specific human capital model with asymmetric information. The wage premium serves to achieve contract efficiency. For those weekly hours for which a premium is paid, worker compensation exceeds the value of marginal product. There is an optimal automatic compensatory differential rule between straight-time wages and the premium, and this provides new theoretical insights into recent empirical work in this area. Implications of imposing mandatory rules for premium pay and hours of work are also assessed.

JEL Classification: J41, J33

Keywords: Overtime premium, human capital, asymmetric information, mandatory overtime rules

Robert A. Hart  
Department of Economics  
University of Stirling  
Stirling FK9 4LA  
Scotland, UK  
Tel.: + 44 1786 467471  
Fax: + 44 1786 467279  
Email: r.a.hart@stir.ac.uk

---

\* We thank Dan Hamermesh and Yoram Weiss as well as seminar participants at the Universities of Hamburg and Mainz as well as the U.K. Education and Employment Economics Group for helpful comments.

## 1. Introduction

Models based on agency (Lazear, 1981) and firm-specific human capital (Kahn and Lang, 1992) recognise that efficient long-term contracts must set hours as well as wages. Empirically, it is well recognised that unions bargain over both hourly wage rates and the length of working hours (Pencavel, 1991). The contract literature has stopped short, however, of providing explanations of why firms often pay for marginal daily or weekly hours at premium overtime rates. In any given week, roughly 25 percent of U.S. and 40 percent of U.K. male workers undertake paid overtime. Internationally, overtime hours are remunerated at a premium hourly rate, representing the straight time hourly rate plus an added percentage.<sup>1</sup> Why do firms pay this premium? This is clearly an important consideration in a country like the U.K. where the premium is set by collective agreement. But even in the US, where the government mandates a 50 percent premium for weekly hours in excess of 40, significant numbers of firms pay the premium for hours *less than* 40 (Trejo, 1993).

We develop a contract model that underpins the payment of a premium. It belongs to the class of contract models in which the parties have access to private information (Hashimoto, 1979; Carmichael, 1983; Malcomson, 1999). We show that a contract based solely on a straight-time wage does not achieve efficiency but that full efficiency can be achieved with the additional payment of an overtime premium. The intuition behind our key result is quite simple. In human capital models that concentrate only on the extensive margin, the parties set a higher wage-rate in the post-investment period in order to minimise sub-optimal (extensive margin)

---

<sup>1</sup> See OECD Employment Outlook (1998) for international comparisons of average premium rates.

separations. With both extensive and intensive margins, the wage rate alone cannot be set to achieve *both* optimal separation and optimal worker utilisation. Providing that the value of an extra hour of leisure does not exceed the sum of the second period wage and expected job satisfaction, we demonstrate that the overtime premium provides an extra-required instrument that permits contract efficiency.

A rationale for exploring the overtime dimension in the wage-hours contract is provided by the U.S. study of Kahn and Lang (1992). They test the prediction from the agency approach that high tenured workers will want to work more hours than contracted. This arises because the firm and workers agree a second period optimal wage rate which is set above marginal product and designed to minimise worker malfeasance. Their PSID data reject this outcome. In the standard specific human capital model, by contrast, the optimal second period wage is set below marginal product. The firm would like the worker to supply more hours and it will restrict second period workers from working fewer-than-contracted hours. But their data also reject the prediction that second period workers will want to work fewer than contracted hours. Our model predicts that the straight-time wage is set below and the premium wage above marginal product. In effect, the premium acts optimally in the short-term to stimulate longer second period working hours within the human capital framework. Where overtime is worked, the marginal wage outcome runs parallel to the agency model of Lazear (1981) and the human capital model of Carmichael (1983) that establish a wage-in-excess-of-marginal-product for senior workers. However, our study provides both a long- and a short-run rationale for this phenomenon.

As a second area of interest, we consider the consequences for the model if the payment of a premium on marginal hours is subject to statutory rules. Typically, such legislation is intended to promote work sharing. The introduction of a high mandated overtime premium is directed towards increasing marginal cost on the intensive relative to the extensive margin and thereby encouraging a worker-hours substitution effect. The wage-hours contract developed here provides theoretical support for the view, tested by Trejo (1991), that firms will mitigate rises in mandatory premium payments by reducing straight-time hours.

## **2. Underlying framework**

Our wage-hours model differentiates between an initial period in which both work and specific training are undertaken and a post-investment period where the investment affects productivity. The analysis is conducted in terms of the marginal worker who initially receives spot market wage earnings in a perfectly competitive labour market. Thus, prior to specific training in the initial period, the particular wage-hours combination available to the worker is determined by the market. The training endows the worker with job-specific skills and so in the second period he is differentiated from other workers in the spot market. The generation of a surplus in the training period allows the parties to set a wage-hours combination in the second period that differs from the market-equivalents.

The worker's pre-entry endowment of general human capital is worth  $w_a$  in the spot market and this is not augmented within the firm. The firm provides specific training at a fixed (i.e. hours-independent) weekly cost,  $C$ . In period 1, the worker has hourly productivity  $MPL_1 = w_a - C/h$ , where  $h$  is first-period weekly hours. The expected

value per unit of specific human capital is  $M$  so that specific training is expected to raise hourly productivity to  $w_a + M$ .

The parties negotiate the contract at the beginning of period 1 and there is no subsequent renegotiation. The contract contains an agreed value of investment return  $M$ : it may be simple to verify some of the elements that signal the level of productivity – such as the state of current and future orders for the firm’s product. However, transaction costs of communicating and verifying information between the parties prevent agreement over the way in which random elements cause deviations from  $M$ . Such costs are represented by a random variable  $\eta$  which has density function  $f(\eta)$  and  $E(\eta) = 0$ . That is, the realised hourly productivity in period 2 is  $w_a + M + \eta$ . Due to lack of agreement over  $\eta$ , the firm responds unilaterally to the realised value of  $\eta$  at the end of period 1. The worker assesses the degree of job satisfaction  $\theta$  in the firm, relative to potential outside opportunities, at the end of period 1. Again, transaction costs prevent a mutually agreed value of  $\theta$  and only the worker responds to its realised value. The density function of  $\theta$  is  $q(\theta)$  with  $E(\theta) = 0$ . It is assumed that  $\text{Cov}(\eta, \theta) = 0$ . *Ex post*, information is private and cannot be exchanged and so separation decisions are made independently.

The probability of a worker deciding to quit is

$$Q = Q(\theta^*) = \int_{-\infty}^{\theta^*} q(\theta) d\theta \quad (1)$$

while the probability of the firm wanting to fire a worker is

$$F = F(\eta^*) = \int_{-\infty}^{\eta^*} f(\eta) d\eta \quad (2)$$

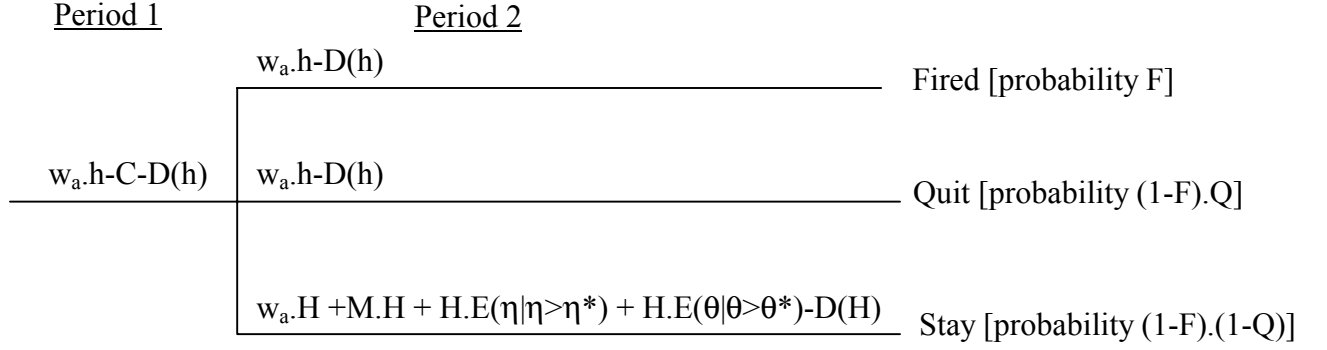


where  $\theta^*$  is the level of job satisfaction that leaves the worker indifferent about leaving and  $\eta^*$  is the level of productivity that leaves the firm indifferent over employing the worker. Without loss of generality, the discount rate is set to zero.

The worker works  $h$  and  $H$  weekly hours in periods 1 and 2 respectively, with the corresponding disutilities represented by  $D(h)$  and  $D(H)$ . If  $H > h$  then the question arises as to how the marginal increase in hours is to be compensated. We examine the consequences of introducing an overtime premium payment  $k \geq 1$  with respect to these hours.

### **3. The wage-hours model**

The parties' joint wealth consists of the returns arising from three mutually exclusive and exhaustive events, weighted by the probability of their occurrence. A two-period time line of worker and producer surplus is illustrated in Figure 1. The worker may be fired or not-fired at the end of the first period. In the event of the worker not being fired, separation may occur due to a quit decision or the employment relationship may continue. In all three outcomes the first period surplus consists of wage earnings net of training cost and work disutility ( $w_a \cdot h - C - D(h)$ ). If the worker is fired or voluntarily quits, the second period surplus to the worker is given by the market value  $w_a \cdot h - D(h)$ ; in these instances, the firm itself cannot obtain second period surplus. If the worker remains with the firm, second period surplus differs from the first period due to enhanced productivity and job satisfaction as well as to the fact that second-period hours may differ from those in the first period.

**Figure 1: Time line of worker and producer surplus**

Formally, the expected joint wealth  $W$  is expressed:

$$\begin{aligned}
W = & F \cdot [w_a \cdot h - C - D(h) + w_a \cdot h - D(h)] \quad (\text{the worker is fired}) \\
& + (1-F) \cdot Q \cdot [w_a \cdot h - C - D(h) + w_a \cdot h - D(h)] \quad (\text{the worker quits}) \\
& + (1-F) \cdot (1-Q) \cdot \{w_a \cdot h - C - D(h) + w_a \cdot H + M \cdot H + H \cdot E(\eta | \eta > \eta^*) + H \cdot E(\theta | \theta > \theta^*) - D(H)\} \\
& \quad (\text{the worker stays}). \quad (3)
\end{aligned}$$

Information concerning job satisfaction and productivity cannot be exchanged *ex post*.

To maximise (3), we follow the two-step approach of Carmichael (1983). First, we solve for the optimal  $\eta, \theta$  pair to maximise our objective function. Second, we assign second-period wages and hours to the first-order condition from step 1 to obtain the optimal wage-hour contract. From the Results Appendix (a) (see (A7) and (A8)), we establish a necessary condition for achieving a constrained optimal contract under the assumption that both parties are risk neutral. The contract is offered to ensure that workers will quit whenever job satisfaction is too low; i.e.

$$\theta < \theta^* = -\{M + E(\eta | \eta > \eta^*) - w_a h / H + w_a + [D(h) - D(H)] / H\} . \quad (4)$$

Equivalently, the firm will fire the workers whenever productivity is too low; i.e.

$$\eta < \eta^* = -\{M + E(\theta | \theta > \theta^*) - w_a h/H + w_a + [D(h) - D(H)]/H\} . \quad (5)$$

These conditions imply that the party wishing to separate must be made to internalise the entire expected losses from the separation.<sup>2</sup>

#### 4. Marginal hours compensated at the straight-time wage rate

Assume the earnings structure in period 2 is given as follows:

$$\text{Earnings (period 2)} = w_2 \cdot h + k \cdot w_2 \cdot (H - h) \quad (6)$$

where  $w_2$  is the straight-time wage in period 2 and  $k (\geq 1)$  is the overtime premium.

In this section, we consider the case of  $k = 1$ , or overtime hours do not incur a wage premium. In establishing an optimal wage-hours contract, the objective of the parties is two-fold. First, they seek to protect positive worker/producer surplus on the extensive margin by minimising sub-optimal separations. Second, since the size of the surplus is in part dependent on hours worked per-period, they wish to attain optimal second-period working time. These two objectives are not independent. Both the wage rate and hours affect productivity and so the process of minimising separations is dependent on is predicated on achieving optimal values of *both*  $w_2$  and  $H$ . It seems to be intuitively clear that  $w_2$  cannot be used as a single instrument to achieve optimality with respect to both labour margins.<sup>3</sup> In fact, this is demonstrated

---

<sup>2</sup> In this Section, our wage-hours results run parallel to those obtained by Carmichael (1983) for the wage-rate alone. This can be checked by noting that the wage outcomes converge with Carmichael's for  $h = H$ .

<sup>3</sup> In similar fashion in the efficiency wage literature, the wage rate cannot achieve market clearing and optimal per-period worker effort.

formally below. Nonetheless, there are gains in carrying out the steps involving  $k = 1$  because several key intermediate results from this simpler case are relevant to the case  $k > 1$  which is discussed in the next section.

From the first-order conditions for maximising joint wealth in (3), derived in Results Appendix (a) (see (A12) and (A14)), we obtain

$$-\{E(\theta|\theta > \theta^*) - w_a h/H + [D(h) - D(H)/H]\} = w_2 \quad (7)$$

and

$$w_2 = w_a + M + E(\eta|\eta > \eta^*) > w_a. \quad (8)$$

As illustrated in Figure 2 (a), equation (8) produces the result familiar to earlier comparable models that the contractual wage rate rises with tenure.

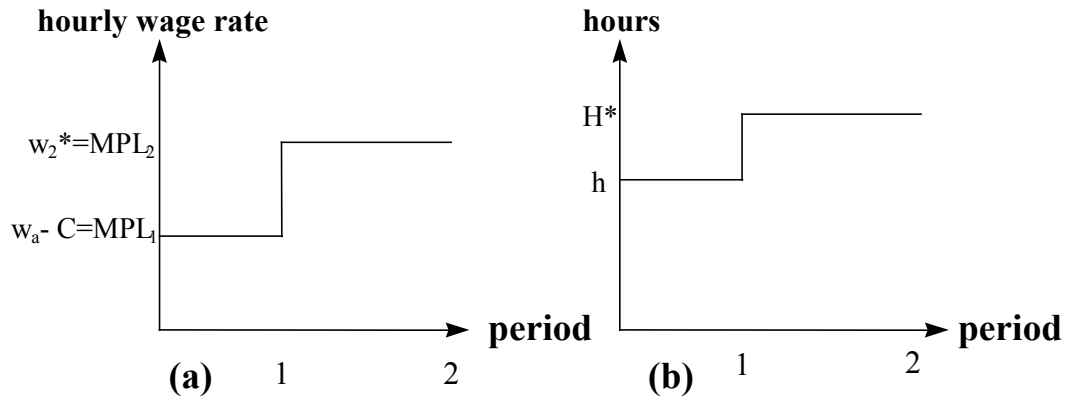
From the Results Appendix (a) (see (A17) and (A19)) we find, providing the marginal disutility of working  $D'(H)$  is less than the sum of the second period wage rate and the expected job satisfaction, that

$$\partial\theta^*/\partial H < 0. \quad (9)$$

and

$$\partial\eta^*/\partial H < 0. \quad (10)$$

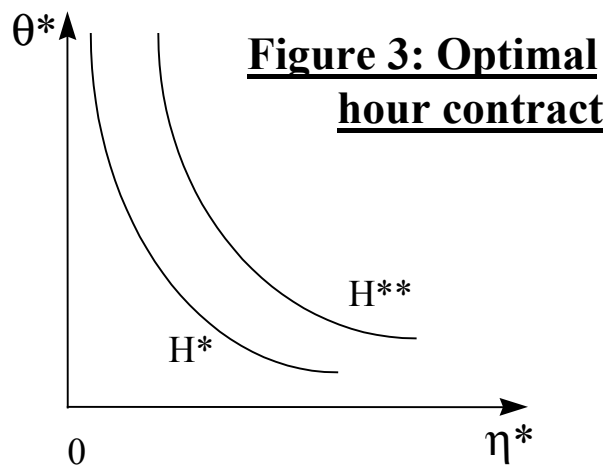
Within the marginal disutility constraints, equations (9) and (10) state that an increase in hours in the post-investment period will reduce the probability of separation. For a given wage rate, a rise in  $H$  increases the size of the surplus that in turn is distributed in higher profits and wage earnings.

**Figure 2: Wage and hours profiles**

From Results Appendix (b), we know that there are two solutions to (7) - i.e.  $H^*$  and  $H^{**}$  - which satisfy  $H^{**} < h < H^*$ . However, (9) and (10) imply that  $H^{**}$  is not the preferred option in period 2, in which case we have

$$H^* > h. \quad (11)$$

Such a result is illustrated in Figure 3 by the move  $H = H^{**}$  to  $H = H^*$ . Thus, we have the hours profile illustrated in Figure 2(b), showing that hours also rise with tenure.



As it stands, however, this particular wage-hours contract does not produce efficiency on either of the labour margins. Through (8),  $w_2 = w_a + M + E(\eta|\eta > \eta^*)$ ; that is the worker is paid his expected productivity. The worker is fired by the firm if the wage is greater than actual productivity, that is  $w_2 > w_a + M + \eta$ . Thus, the critical value of  $\eta$  at which the worker is fired is  $\eta^* = w_2 - M - w_a$ . But substituting for  $w_2$  from (8) implies that  $\eta^* = E(\eta|\eta > \eta^*)$  which only occurs when  $\eta^*$  is the upper bound of  $\eta$  or when almost all workers are fired. On the other hand, using (4) and (8), the critical value of  $\theta$  at which the worker quits is  $\theta^* = w_a h/H - w_2 - [D(h) - D(H)]/H$ . Combining this quit rule with (7) gives  $\theta^* = E(\theta|\theta > \theta^*)$  which occurs when almost all workers quit. In essence, the contract with  $k = 1$  is roughly equivalent to a spot market solution since almost all workers will quit/be fired before the second period, effectively resulting in no training taking place.

### 5. Marginal hours compensated at a premium wage rate

We now consider the payment of a wage premium which renders pay on marginal hours to be greater than hourly straight-time pay; that is  $k > 1$  in (6). We begin by establishing that this serves to counter the contract inefficiency outlined above.

With  $k > 1$ , the solutions which maximise joint wealth in (3) - equivalent to (7) and (8) for the case where  $k = 1$  - are given by (A20) of Results Appendix (a):

$$-\{M + E(\theta|\theta > \theta^*) + w_a - w_a \cdot h/H + [D(h) - D(H)]/H\} = -[w_a + M - k \cdot w_2] \quad (12)$$

and, using (A22) from Results Appendix (a),

$$-[M + E(\eta|\eta > \eta^*)] = -[w_2 \cdot (\gamma + 1) - w_a] \quad (13)$$

where  $\gamma = (k-1) \cdot (1 - h/H) > 0$ .

If the firm solves (12) and (13) simultaneously, it will attain an optimal wage-hours  $(w_2^*, H^*)$  contract, conditional on the level of premium,  $k$ . In order to see how the inefficient quit rule of the previous section (i.e. for  $k = 1$ ) has been overcome, we combine (12) with the quit rule  $\theta^* = w_a h/H - w_2 - [D(h) - D(H)]/H$  to obtain  $\theta^* = E(\theta|\theta > \theta^*) - w_2 \cdot (k-1) \cdot h/H$ . Note that in the previous model formulation (i.e. with  $k = 1$ ) the critical value of  $\theta$  at which the worker quits is given by  $\theta^* = E(\theta|\theta > \theta^*)$  which occurs when almost all workers quit. In the new equivalent result, the overtime premium provides a wedge that serves to satisfy the necessary condition for *ex ante* joint wealth maximisation. The introduction of the premium allows the attainment of a similar optimal solution with respect to firing: combining (13) with the fire rule  $\eta^* = w_2 - M - w_a$  we obtain  $\eta^* = E(\eta|\eta > \eta^*) - \gamma \cdot w_2$ .

Before we look more closely at the implications of (13), we need to tackle the question of whether there exists a  $k$  that maintains (i)  $w_2^* > w_a$  and (ii)  $H^* > h$ . We find that the answer is yes. From (8), we know that if  $k=1$  then

$$w_2^* > w_a. \tag{14}$$

By assuming continuity, there exists a  $k_{\max_1} > 1$  such that if  $k \in [1, k_{\max_1}]$  then  $w_2^* > w_a$  from (13). So the well-known result that the contractual wage rate increases with tenure is retained. Similarly, we also know that if  $k=1$  then  $\partial\theta^*/\partial H < 0$  and  $\partial\eta^*/\partial H < 0$  from (9) and (10). By the continuity assumption, there exists a  $k_{\max_2} > 1$  such that if  $k \in [1, k_{\max_2}]$  then  $\partial\theta^*/\partial H \leq 0$  and  $\partial\eta^*/\partial H \leq 0$ . That is, the working hours allocated to the trained workers can induce efficient turnover. The implied premium profile is shown in Figure 3. Parallel to the developments in the previous section, it can be shown that

$$H^* > h \tag{15}$$

for any  $k$  if  $1 < k \leq \min [k_{\max_1}, k_{\max_2}]$ .

From (13), it can be shown that

$$k \cdot w_2 > \text{MPL}_2 = w_a + M + E(\eta | \eta > \eta^*) > w_2 \quad (16)$$

or premium pay is higher than the expected marginal product of labour in period 2 ( $\text{MPL}_2$ ), while the straight-time wage is lower than  $\text{MPL}_2$ .

The payment of a wage premium  $k > 1$  for hours  $(H - h)$  allows the parties to achieve an optimal wage-hours contract that consists of second-period wages and hours that are higher than their first-period equivalent values. By contrast, there are inefficient quits and layoffs if the premium is set to unity, that is if a single wage is paid in the second period. This would seem to imply that an increase in  $k$  is associated with reductions in separations. This is confirmed formally in Results Appendix (a) (see (A24) and (A25)). It is shown that there exists a  $k_{\max_3} > 1$  such that if  $k \in (1, k_{\max_3}]$  then

$$\partial \theta^* / \partial k < 0 \quad (17)$$

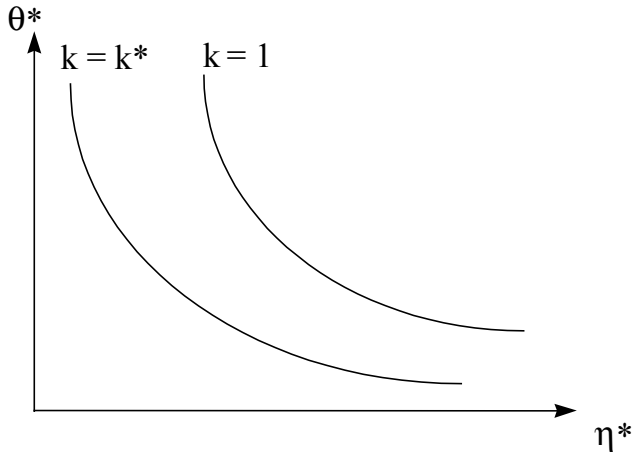
and

$$\partial \eta^* / \partial k < 0 . \quad (18)$$

Figure 4 illustrates the effect of an increased  $k$  on the quit/layoff decisions.



**Figure 4: Premium payments and efficient turnover**



On the worker's side, the results in (17) are quite straightforward. Since overtime is remunerated at a premium rate in excess of marginal product, it is unsurprising that a rise in  $k$  will lead to a higher  $H$  and a lower quit probability. But these outcomes appear to fall short of providing contract optimality from the firm's viewpoint (see (18)). While  $k > 1$  provides a desirable instrument towards achieving a contractual solution on the two margins, the firm would be reluctant to raise the proportion of premium payments within total labour costs in the absence of offsetting cost reductions. In other words, this would act merely to raise the worker's surplus. However, the optimal wage-hours contract contains an in-built compensating differential. We find from (13) that

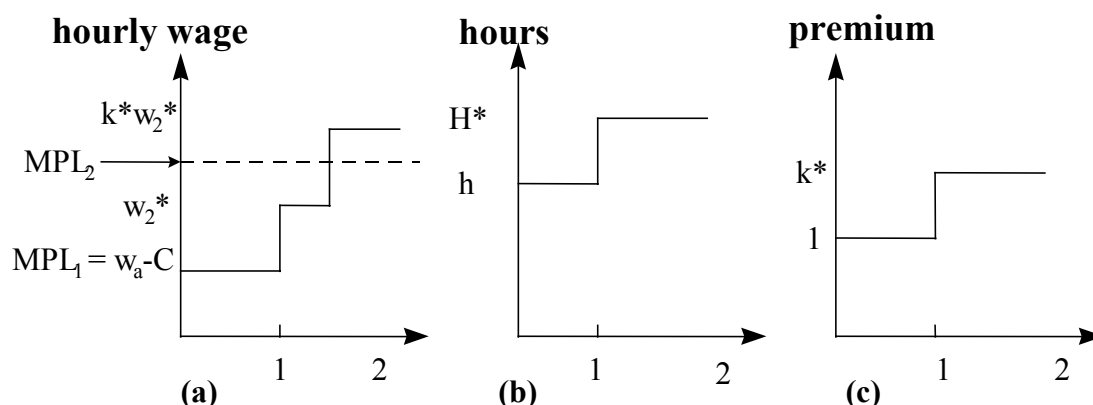
$$\frac{\partial w_2}{\partial k} < 0$$

or there is an inverse relationship between the contractual wage and the overtime premium. Therefore, there exists an "optimal automatic compensating differential rule". A compensating differential reaction in the straight-time wage to an increase in  $k$  is embedded in the contract solution and therefore (18) holds.

The full solution to the contract is as follows. Let  $k^* = \min\{k_{\max_1}, k_{\max_2}, k_{\max_3}\}$ . Then (9), (10), (14), (15), (17) and (18) will all hold. Given  $k^*$ , solving (12) and (13) simultaneously gives us  $w^*$  and  $H^*$ . And then  $(w_2^*, H^*, k^*)$  forms the efficient contract. The solutions are illustrated graphically in Figure 5.

To the extent that these overtime outcomes are feasible, the model predicts that, as with straight-time hourly wages, hours should rise with job tenure. Hart and Ma (2000) provide strong empirical support for this contention. We note that the life cycle models of Ghez and Becker (1975) predict that hours supplied to the market place would be positively related to the price of time over the life cycle. Consistent with this approach is the expectation that workers would contribute their highest average hours when they are most productive, that is in the middle years of their work experience.

As illustrated in Figure 5 (a), the payment of an hours premium in order to effect efficient turnover produces the result that the worker is paid more than marginal product in period 2. Suppose that weekly compensation is based on  $x$  number of straight time hours and  $y$  number of overtime hours. The optimal payments configuration is to pay the former hours at below and the latter hours above their respective marginal products.

**Figure 5: Wage, hours, and premium profiles**

In Lazear (1981), the wage mark-up is paid in later years of job tenure and is interpreted as a long-run incentive-compatible form of compensation. The equivalent long-term explanation in the present paper relates to wage premiums designed to encourage longer working time given specific human capital accumulation over the length of job experience. In Carmichael (1983), the central argument is also a long-term one; wages above marginal product result from seniority-based promotions. However, a comparative advantage of the wage-hours model is that it also encompasses a *short-term* rationale. For *given* levels of human capital, it may pay the firm to offer an incentive to work longer hours in order to protect reduce sub-optimal separations.

## 6. Effects of statutory overtime regulations

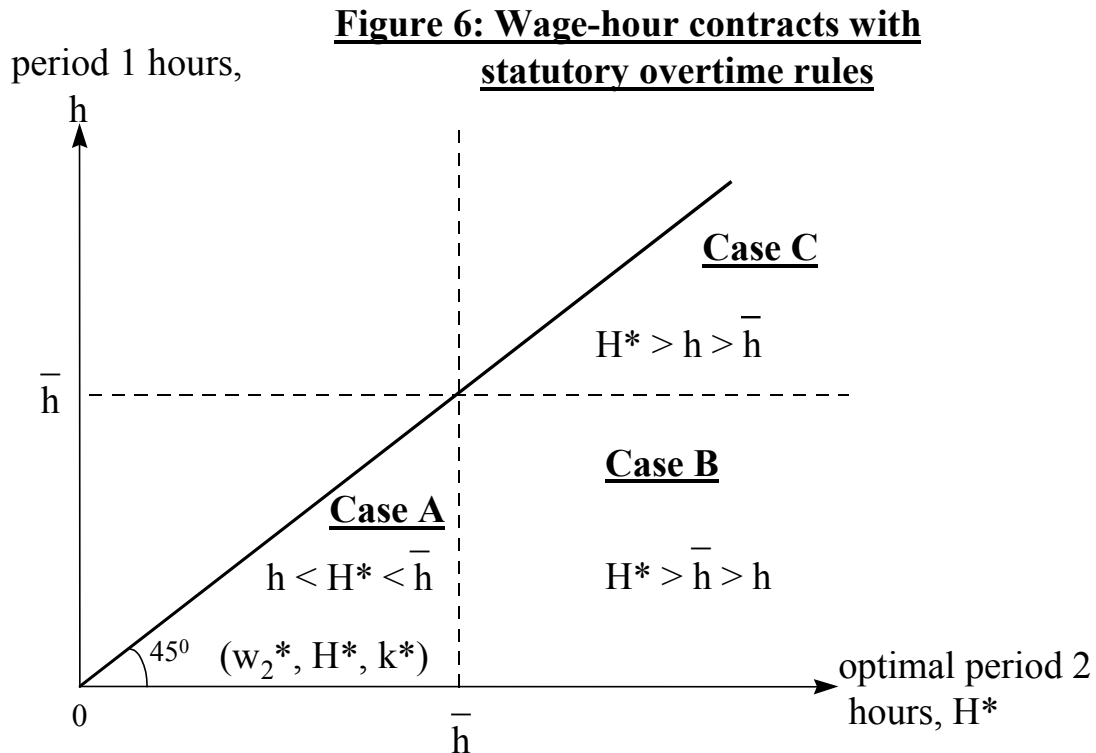
The wage-hours contract developed in the previous section involves the parties reaching agreement on optimal values of the straight-time wage, the overtime premium and the length of per-period hours. In several OECD economies, statutory overtime pay restrictions limit negotiated degrees of freedom as far as setting the premium is concerned (OECD Employment Outlook, 1998). As mentioned in the

introduction, the usual policy objective behind overtime legislation is to encourage employment expansion by raising marginal cost on the intensive relative to the extensive labour margin. Among the most stringent, comprehensively binding, and simplest sets of legislative measures is the US Fair Labor Standards Act (FLSA). Under FLSA rules, covered workers must be paid an overtime wage of at least one and one-half times the straight-time wage for weekly hours in excess of 40. Let these hours and premium constraints be denoted, respectively, by  $\bar{h}$  and  $\bar{k}$  (i.e.  $\bar{h} = 40$ ,  $\bar{k} = 1.5$ ). Here, we discuss several implications of our model in relation to this Act.

If we rule out short-time working, Figure 6 illustrates three cases between actual straight-time hours worked in period 1 ( $h$ ), maximum permitted straight-time hours before a premium must be paid ( $\bar{h}$ ), and optimal second period hours ( $H^*$ ). All period 2 contracts under the legislation - indicated as either Case A or Case B or Case C - occur at or below the 45° line given that period 2 hours are greater than period 1 hours. Here, we present a non-exhaustive discussion different possible contracts.

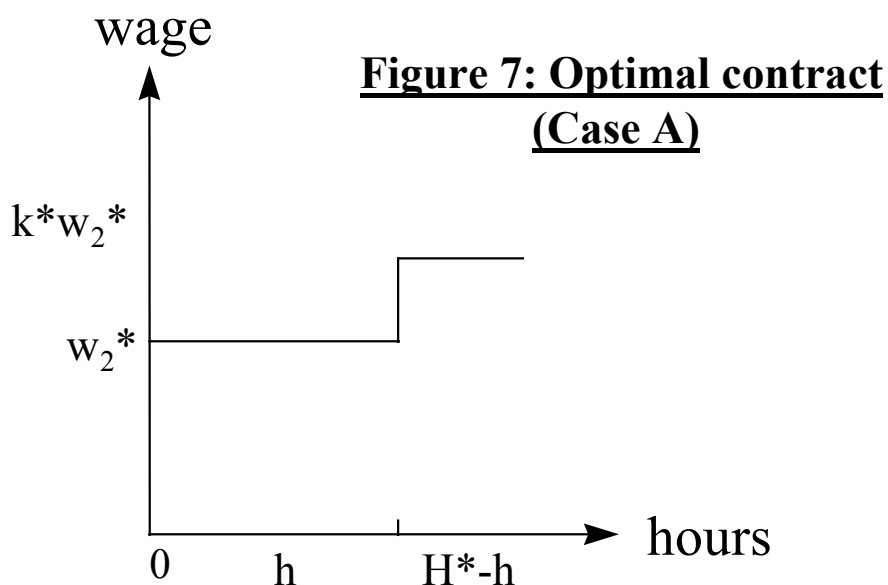
### **Case A**

The simplest case in terms of the previous analysis concerns the outcome  $h < H^* \leq \bar{h}$ . Period 2 hours are above those in period 1 but below the mandatory maximum that trigger overtime regulations. As illustrated in Figure 7, the optimal contract would be one whereby the internal premium  $k^*$  is paid on hours  $H^*-h$ . The implication is that it



would be optimal to pay a premium on marginal hours (i.e.  $H^*-h$ ) despite no compulsion so to do. This outcome is consistent with the interesting observation that a significant proportion of US firms pays an overtime premium even when weekly hours are *below* the statutory minimum set under FLSA rules. Trejo (1993) presents 1985 Current Population Survey data which reveal that over 20 per cent of workers sampled receive premium pay for hours less than the 40 hour limit; in fact, for 10 per cent of workers, the premium started at 34 hours or less.<sup>4</sup> Moreover, both union and non-union workers display similar percentages in these respects.

<sup>4</sup> Although due to (an under-recorded) anomaly resulting from the fact that some workers receive overtime pay according to a daily standard, Trejo reports that the figures may exaggerate the frequency with which workweek standards other than the 40-hour standard may occur.

**Case B**

A commonly occurring case is that of  $H^* > \bar{h} \geq h$  and  $\bar{k} > k^*$ .<sup>5</sup> These relative outcomes fit with the work-sharing policy-logic discussed above. Two related labour market issues arise.

**(i) Compensating differentials**

Trejo (1991) presents U.S. empirical evidence that firms mitigate rises in mandatory premium payments by reducing straight-time wages. This response accords with the so-called 'fixed-job' model whereby firms and workers adhere to agreed compensation packages by lowering straight-time wages in response to increases in overtime premium pay or overtime eligibility. Our model provides theoretical justification for such behaviour by the two parties. Equation (15) in the previous section shows that an automatic compensating differential rule is integral to the optimising behaviour suggested by the wage-hours model. A rise in  $k$  due to

---

<sup>5</sup> If  $k^* \geq \bar{k}$ , then the analysis is effectively the same as under Case A.

legislation will result in an agreed offsetting lowering of  $w_2$ . Worker compensation and the outside opportunity will be left unaffected with no incentive to expand employment.

### **(ii) Non-compliance**

Based on late-1970s data, Ehrenberg and Schumann (1982, Ch. 5) indicate that a 10 percentage rate of non-compliance with the FLSA regulations would constitute a conservative estimate (see also Trejo, 1993). If the parties seek this illegal strategy, what type of non-compliance might appear to be most mutually advantageous? The firm and its workers may reach an implicit agreement at the beginning of period 1 to work “unpaid” hours in period 2 to the extent that the value of  $k$ , averaged over paid and unpaid overtime hours, is equal to  $k^*$ .<sup>6</sup> One such agreement along these lines is illustrated in Figure 8 (a). Here, the parties agree to work paid and unpaid hours in period 2 that solves

$$k^*.w_2^*. (H^*-h) = (\bar{h} - h).k^*.w_2^* + \bar{k} H_p + 0.H_u$$

where, in period 2,  $H_p$  is paid-for and  $H_u$  is unpaid-for hours. Under this arrangement, the firm pays for hours in excess of period 1 straight-time hours and up to  $\bar{h}$  at the optimal premium rate and tackles the problem of  $\bar{k} > k^*$  by manipulation of the length of unpaid overtime. This latter exercise determines  $H_p$  and  $H_u$  as

---

<sup>6</sup> Unpaid overtime is quantitatively very significant in the U.K. While there are no national-level overtime regulations in this economy, premium pay and the maximum level of straight-time pay may be set at industry-level - such as in the engineering industry - and effectively act as mandatory rules for relevant firms. The mandatory overtime-related reason for working unpaid hours could be one of several explanations of this phenomenon, as discussed by Bell and Hart (1999).

$$H_p = \frac{k^*}{\bar{k}}(H^* - h)$$

and

$$H_u = \left| 1 - \frac{k^*}{\bar{k}} \right| (H^* - h).$$

As with Case A, the firm pays a premium before mandatory hours,  $\bar{h}$ , are reached. An alternative strategy to achieve  $k^*$  is to agree to commence paying the premium  $k = \bar{k}$  for hours above  $h$ .<sup>7</sup>

In the absence of a downward adjustment of  $w_2$ , or some form of non-compliance,  $\bar{k} > k^*$  implies that either  $\bar{h}$  or  $\bar{k}$  become binding. The former outcome is illustrated in Figure 8 (b) where no overtime would be undertaken.

### **Case C**

An analysis parallel to Case B applies here; for example, non-compliance incentives are again relevant.

## **7. Conclusions and future developments**

Overtime premium payments are an important variable in labour market economics and macroeconomics because, in many instances, they represent the marginal cost of labour input. Earlier explanations as to why firms operate overtime schedules include the need to provide extra compensation in order to cover rush orders, high seasonal

---

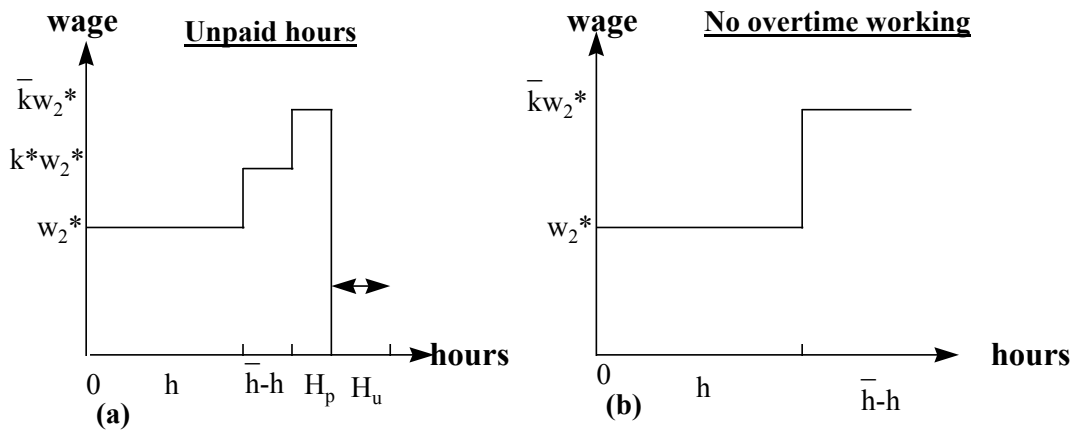
<sup>7</sup> Under this agreement,  $k^*.w_2^*. (H^* - h) = (\bar{h} - h). w_2^* + \bar{k}. H_p. w_2^* + 0.H_u$ , in which case  $H_p = [h - \bar{h} + k^*(H^* - h)] / \bar{k}$  and  $H_u = H^* - [h - \bar{h} + k^*(H^* - h)] / \bar{k}$ .



demand, and work scheduling involving irregular or abnormal hours requirements.

These reasons may be important but they tend to be derived *either* from purely

**Figure 8: Case B contracts**



supply-side arguments *or*, more usually, from *ad hoc* economic reasoning. Here, we offer a new approach to understanding the use of premium payments based on a more general wage contract formulation. Our model allows for changes in labour inputs on the extensive (workers) and intensive (working hours) margins. It also incorporates information asymmetries between workers and firms. We show that it is in the interest of the firm and its workforce to increase *both* wages and hours once investments have been sunk. However, the payment of a wage premium for additional hours is required in order to achieve an optimal wage-hours contract. Our results are consistent with a number of recent important empirical findings concerning the operation of overtime working.

This modelling framework could no doubt benefit from further modifications and refinements. One particular area is worthy of future research. Unlike the treatment of productivity and job satisfaction, we assume that the parties can agree with certainty over the length of job-task completion times. In other words, hours of work are not

subject to randomness and problems of asymmetric information. In important instances, however, the firm and its workers may be uncertain over the completion times of given tasks, especially in jobs requiring significant degrees of independent worker decision making and initiative. Management and professional occupations would be particularly relevant in this respect. Integrating this possibility could clearly lead to modifications of results and conclusions.

## References

- Bell, D N F and R A Hart. "Unpaid work." *Economica* 66, (1999), 271-90.
- Carmichael, L. "Firm-specific human capital and promotion ladders", *Bell Journal of Economics* 14, (1983), 251-58.
- Ehrenberg, R G. *Fringe benefits and overtime behavior*, (1971), Lexington, Mass.: Heath.
- Ehrenberg, R G and P L Schumann. *Longer hours or more jobs?* Cornell Studies in Industrial and Labor Relations, no. 22, (1982), Ithaca, NY: Cornell University.
- Hart, R A and Y Ma, "Asymmetric information, rent sharing and wage-hours contracts", Department of Economics, (1999), University of Stirling (mimeo).
- Hashimoto, M. "Bonus payments, on-the-job training and lifetime employment in Japan." *Journal of Political Economy* 87 (1979): 1086-1104.
- Hashimoto, M and B T Yu, "Specific capital, employment contracts and wage rigidity", *Bell Journal of Economics*, (1980), 11, 536-49.
- Kahn, S and K Lang, "Constraints on the choice of hours", *Journal of Human Resources* 27, (1992), 661 - 678.
- Lazear, E P. "Agency, earnings profiles, productivity, and hours restrictions", *American Economic Review* 71 (1981): 606-20.
- Malcomson, J M. "Individual employment contracts", Handbook of Labor Economics, volume 3/4 (eds. Orley Ashenfelter and David Card), (1999), Elsevier Science.
- OECD Employment Outlook, chapter "Working hours: latest trends and policy initiatives", (1998), Paris: OECD.
- Pencavel, J H, Labor markets under trade unionism, (1991), Oxford: Blackwell.
- Trejo, S J. "The effects of overtime pay regulation on worker compensation.", *American Economic Review*, 81, (1991), 719-40.
- Trejo, S J. "Overtime pay, overtime hours, and labor unions." *Journal of Labor Economics*, 11, (1993), 253-78.

## Results Appendix

### (a) Joint wealth maximisation

In order to illustrate the optimisation with respect to the joint wealth defined in (3) in the main text, we begin by presenting a number of useful lemmas.

#### Lemma 1

$$\frac{d}{du} \int_{a(u)}^{b(u)} g(x,u) dx = \int_{a(u)}^{b(u)} \frac{\partial g}{\partial u} dx + g(b,u)b' - g(a,u)a'$$

#### Lemma 2

$$dQ/d\theta^* = q(\theta^*) \quad \text{and} \quad dF/d\eta^* = f(\eta^*)$$

**Proof.** From (1), (2) and lemma 1.

**QED.**

#### Lemma 3

$$1 - Q = \int_{\theta^*}^{\infty} q(\theta) d\theta \quad \text{and} \quad 1 - F = \int_{\eta^*}^{\infty} f(\eta) d\eta$$

#### Lemma 4

$$E(\theta | \theta > \theta^*) = \frac{1}{1 - Q} \int_{\theta^*}^{\infty} \theta q(\theta) d\theta$$

$$E(\eta | \eta > \eta^*) = \frac{1}{1 - F} \int_{\eta^*}^{\infty} \eta f(\eta) d\eta$$

#### Lemma 5

$$\frac{dE(\theta | \theta > \theta^*)}{d\theta^*} > 0 \quad \text{and} \quad \frac{dE(\eta | \eta > \eta^*)}{d\eta^*} > 0$$

#### Proof

$$\frac{dE(\theta|\theta > \theta^*)}{d\theta^*} = -\frac{\theta^* q(\theta^*)}{1-Q} + \frac{q(\theta^*) \int_{\theta^*}^{\infty} \theta q(\theta) d\theta}{(1-Q)^2} = \frac{q(\theta^*)}{(1-Q)^2} \int_{\theta^*}^{\infty} (\theta - \theta^*) q(\theta) d\theta > 0$$

Similar proof applies to  $dE(\eta|\eta > \eta^*)/d\eta^*$ .

**QED.**

To maximise  $W$  defined in (3) in the main text, we first collect the item

$[wa.h - C - D(h)]$  in  $W$ :

$$\begin{aligned} W &= [wa.h - C - D(h)] && \text{(defined as X)} \\ &+ [F + (1-F)Q][wa.h - D(h)] && \text{(defined as Y)} \\ &+ (1-F)(1-Q)\{wa.H + H.M + H.E(\eta|\eta > \eta^*) + H.E(\theta|\theta > \theta^*) - D(H)\} && \text{(defined as Z)} \\ &= X + Y + Z && \text{(A1)} \end{aligned}$$

The first order conditions to max  $W$  in (A1) are:

$$\partial W / \partial \theta^* = 0 \quad \text{and} \quad \partial W / \partial \eta^* = 0$$

To derive  $\partial W / \partial \theta^* = 0$  firstly:

$$\partial X / \partial \theta^* = 0 \tag{A2}$$

$$\partial Y / \partial \theta^* = (1-F) \cdot [dQ/d\theta^*] \cdot [wa.h - D(h)] = (1-F) \cdot q(\theta^*) \cdot [wa.h - D(h)] \tag{A3}$$

(from lemma 2)

Rewrite  $Z$  into:

$$Z = (1-F)(1-Q) \left| wa.H + M.H + \frac{\int_{-\infty}^{\theta^*} \eta f(\eta) d\eta}{1-F} H + \frac{\int_{-\infty}^{\theta^*} \theta q(\theta) d\theta}{1-Q} H - D(H) \right| \tag{A4}$$

(from lemma 4)

Substituting (1) and (2) from the main text into (A4), we have:

$$Z = \int_{\theta^*}^{\infty} \int_{\eta^*}^{\infty} [w_a.H + M.H + \eta.H + \theta.H - D(H)]q(\theta)f(\eta)d\theta d\eta \quad (A5)$$

Differentiating (A5) with respect to  $\theta^*$ , we have:

$$\begin{aligned} \frac{\partial Z}{\partial \theta^*} &= - \int_{\eta^*}^{\infty} [w_a.H + M.H + \eta.H + \theta.H - D(H)]q(\theta^*)f(\eta)d\eta \\ &= - (1-F).q(\theta^*). \{w_a.H + M.H + H.\theta^* + H.E(\eta|\eta > \eta^*) - D(H)\} \end{aligned} \quad (A6)$$

Therefore,

$$\begin{aligned} \partial W / \partial \theta^* &= \partial X / \partial \theta^* + \partial Y / \partial \theta^* + \partial Z / \partial \theta^* \\ &= - [-w_a.h + D(h) + w_a.H + M.H + H.\theta^* + H.E(\eta|\eta > \eta^*) - D(H)].(1-F).q(\theta^*) = 0 \end{aligned} \quad (A7)$$

By symmetry,

$$\partial W / \partial \eta^* = - [-w_a.h + D(h) + w_a.H + M.H + H.\eta^* + H.E(\theta|\theta > \theta^*) - D(H)].(1-F).f(\eta^*) = 0$$

(A8)

Information concerning job satisfaction and productivity cannot be exchanged *ex post*.

A necessary condition for achieving a constrained optimal contract derives from (A7)

and (A8). The contract is offered to ensure that workers will quit whenever job

satisfaction is too low, i.e.

$$\theta < \theta^* = - \{M + E(\eta|\eta > \eta^*) - w_a.h / H + w_a + [D(h) - D(H)] / H\} . \quad (A9)$$

(from (A7))

Equivalently, the firm will fire the workers whenever productivity is too low, i.e.

$$\eta < \eta^* = - \{M + E(\theta|\theta > \theta^*) - w_a.h / H + w_a + [D(h) - D(H)] / H\} . \quad (A10)$$

(from (A8))

[Equations (A9) and A(10) are (4) and (5) in the main text, respectively.]

These conditions imply that the party wishing to separate must be made to internalise the entire expected losses from the separation.

Next we show that it is possible to formulate a wage-hour contract in terms of the parameters of  $\eta^*$  and  $\theta^*$  to satisfy (A9) and (A10).

The firm will fire the worker if return is below the second period wage, that is if

$$w_a + M + \eta < w_2$$

or

$$\eta < \eta^* = -(w_a + M - w_2) \quad (\text{A11})$$

Substituting (A10) into (A11) gives:

$$-\{M + E(\theta|\theta > \theta^*) - w_a \cdot h / H + w_a + [D(h) - D(H)] / H\} = -(w_a + M - w_2)$$

or

$$-\{E(\theta|\theta > \theta^*) - w_a h / H + [D(h) - D(H)] / H\} = w_2 . \quad (\text{A12})$$

(This is equation (7) in the main text.)

The worker will quit if second period return is less than the outside opportunity, that is if

$$H \cdot w_2 + H \cdot \theta - D(H) < w_a \cdot h - D(h)$$

or

$$\theta < \theta^* = w_a \cdot h / H - w_2 - [D(h) - D(H)] / H . \quad (\text{A13})$$

Substituting (A9) into (A13) gives:

$$w_2 = w_a + M + E(\eta|\eta > \eta^*) = \text{MPL}_2 \quad (\text{A14})$$

where  $\text{MPL}_2$  is the expected productivity of the worker.

[(A14) is equation (8) in the main text.]

If the firm solves (A12) and (A14) simultaneously, it will achieve an optimal wage-hour  $(w_2^*, H^*)$  contract.

Can working hours allocated in the post-investment period serve to induce efficient turnover? That is, do we obtain  $\partial\theta^*/\partial H < 0$  and  $\partial\eta^*/\partial H < 0$ ? Substituting (A14) into (A12) and multiplying H on both sides produces

$$-H.E(\theta|\theta>\theta^*) + w_a.h -D(h) + D(H) = w_a.H + M.H + H.E(\eta|\eta>\eta^*) . \quad (A15)$$

Given  $\eta^*$ , differentiating (A15) gives

$$\partial\theta^*/\partial H = - [E(\theta|\theta>\theta^*)-D'(H)+ w_a + M+ E(\eta|\eta>\eta^*)]/[H.dE(\theta|\theta>\theta^*)/d\theta^*] . \quad (A16)$$

If the marginal disutility of working  $D'(H)$  is less than the sum of the second period wage rate and the expected job satisfaction, then

$$\partial\theta^*/\partial H < 0 \quad (A17)$$

(by Lemma 5).

By symmetry,

$$\partial\eta^*/\partial H = - [E(\theta|\theta>\theta^*)-D'(H)+ w_a + M+ E(\eta|\eta>\eta^*)]/[H.dE(\eta|\eta>\eta^*)/d\eta^*] . \quad (A18)$$

Again, if the marginal disutility of working  $D'(H)$  is less than the combined value of the second period wage and expected job satisfaction, then

$$\partial\eta^*/\partial H < 0 . \quad (A19)$$

(by Lemma 5).

[Equations (A17) and (A19) are (9) and (10) in the main text respectively.]

Therefore, within the marginal disutility constraints, equations (A17) and (A19) state that an increase in hours in the post-investment period will reduce the probability of separation.



### An efficient contract with a marginal hours' premium

Now we consider that additional working hours are compensated at a premium,  $k$ , where  $k > 1$ .

Firstly, if the firm decides to fire a worker, then equations (A11) and (A12) should be modified as the marginal product is now  $k.w_2$ . Thus, (A12) becomes

$$-\{ M + E(\theta|\theta>\theta^*) + w_a - w_a.h/H + [D(h)-D(H)]/H \} = - [w_a + M - k.w_2 ]$$

(This is equation (12) in the main text)

or

$$-\{ E(\theta|\theta>\theta^*) - w_a.h/H + [D(h)-D(H)]/H \} = k.w_2 . \quad (A20)$$

The premium also alters the worker's decision to quit:

$$w_2.h + k.w_2.(H-h) + \theta.H - D(H) < w_a.h - D(h)$$

or

$$\theta < \theta^* = w_a.h/H - w_2.h/H - k.w_2.(1 - h/H) - [D(h) - D(H)]/H. \quad (A21)$$

Substituting (A9) into (A21) gives:

$$- [M + E(\eta|\eta>\eta^*)] = -[ w_2.(\gamma+1) - w_a ] \quad (A22)$$

where  $\gamma = (k-1).(1 - h/H) > 0$ .

(This is equation (13) in the main text.)

That is:

$$w_2 = [ w_a + M + E(\eta|\eta>\eta^*) ] / (\gamma+1) < MPL_2 = w_a + M + E(\eta|\eta>\eta^*). \quad (A23)$$

If the firm solves (A20) and (A22) simultaneously, it will attain an optimal wage-hour  $(w_2^*, H^*)$  contract, conditional on the level of premium,  $k$ .

Now we turn to discuss the implications of this optimal contract.

First, as we discussed in the main text, we know that if  $k=1$  then  $\partial\theta^*/\partial H < 0$  and  $\partial\eta^*/\partial H < 0$  from (A17) and (A19). By the continuity assumption, there exists a  $k_{\max_2} > 1$  such that if  $k \in (1, k_{\max_2}]$  then  $\partial\theta^*/\partial H \leq 0$  and  $\partial\eta^*/\partial H \leq 0$ . That is, the working hours allocated to the trained workers can induce efficient turnover under the premium scheme.

Second is to establish that the premium can further induce efficient turnover; i.e.

$$\partial\theta^*/\partial k < 0 \quad (\text{A24})$$

and

$$\partial\eta^*/\partial k < 0 . \quad (\text{A25})$$

Re-write (A24) and (A25) as:

$$\partial\theta^*/\partial k = (\partial\theta^*/\partial H).(\partial H/\partial k) \quad (\text{A26})$$

and

$$\partial\eta^*/\partial k = (\partial\eta^*/\partial H).(\partial H/\partial k) . \quad (\text{A27})$$

We know that  $\partial\theta^*/\partial H < 0$  and  $\partial\eta^*/\partial H < 0$  for small  $k > 1$ . Hence to show (A24) and (A25) hold we need only to demonstrate that

$$\partial H/\partial k > 0 \quad (\text{A28})$$

for some  $k > 1$ . The logic is that if increasing  $k$  from  $k = 1$  would increase working hours  $H$  and increasing  $H$  will reduce sub-optimal separation, then a premium  $k > 1$  would improve efficiency.

In Results Appendix result (c) it is shown that if  $k=1$  then  $dH/dk > 0$ . Hence by the continuity assumption, there exists a  $k_{\max_3} > 1$  such that if  $k \in (1, k_{\max_3}]$  then  $dH/dk > 0$ . This establishes (A24) and (A25).

**(b) First- and second-period hours**

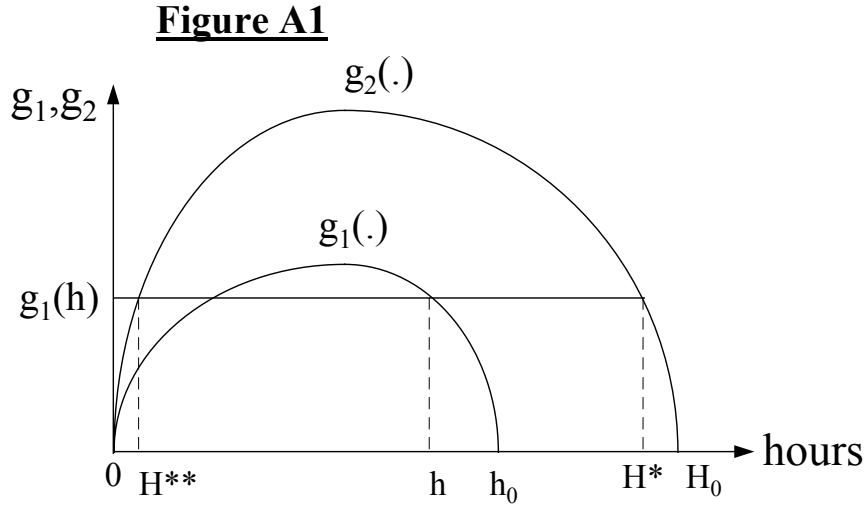
For any  $h \in (0, h_0)$  (where  $h_0$  satisfies  $w_a(h_0) - D(h_0) = 0$ ), equation (7) in the main text has two solutions  $H^*$  and  $H^{**}$  which satisfy  $0 < H^{**} < h < H^*$  if  $D(0) = 0$ ,  $D'(\cdot) > 0$  and  $D''(\cdot) < 0$ .

**Proof**

Equation (7) is the same as (A12) in Results Appendix (a). By substituting (A14) into (A12) we obtain (A15). Re-write equation (A15) as

$$w_a \cdot h - D(h) = H \cdot [w_a + M + E(\eta | \eta > \eta^*) + E(\theta | \theta > \theta^*)] - D(H)$$

Let  $w_b \equiv w_a + M + E(\cdot) + E(\cdot)$  and so we have  $w_b > w_a > 0$ . Define  $g_1(h) \equiv w_a \cdot h - D(h)$  and  $g_2(H) \equiv w_b \cdot H - D(H)$ . Since  $g_1''(h) = D''(h) < 0$  and  $g_2''(H) = D''(H) < 0$  both  $g_1(h)$  and  $g_2(H)$  are concave (see Figure A1). Also,  $g_2(x) - g_1(x) = (w_b - w_a)x > 0$  for any  $x > 0$ .



Hence  $H_0 > h_0 > 0$  where  $g_2(H_0) = g_1(h_0) = 0$ . From Figure A1, for any  $h \in (0, h_0)$  there are two solutions  $H^*$  and  $H^{**}$  for equation  $g_1(h) = g_2(H)$  and  $0 < H^{**} < h < H^*$ . **QED.**

**(c) The relation between second-period hours and the overtime premium**

We show here that (A28),  $\partial H/\partial k > 0$ , holds provided that  $k$  and the disutility of working are not too large.

Substituting (A23) into (A20) produces

$$(1+\gamma) \cdot [-E(\theta|\theta>\theta^*) + w_a \cdot h/H - D(h)/H + D(H)/H] / H = k \cdot [w_a + M + E(\eta|\eta>\eta^*)] \quad (C1)$$

where  $\gamma = (k-1) \cdot (1 - h/H) > 0$ .

Differentiating (C1) gives

$$A \cdot [-h/H^2 \cdot dH + dk \cdot (1-h/H) + (k \cdot h/H^2) \cdot dH] + (1+\gamma) \cdot B \cdot dH = G \cdot dk \quad (C2)$$

where

$$A = -E(\theta|\theta>\theta^*) + w_a \cdot h/H - D(h)/H + D(H)/H = k \cdot w_2 > 0 \quad (C3)$$

$$B = w_a \cdot h/H^2 + D(h)/H^2 + D'(H)/H - D(H)/H^2 > 0 \text{ (if } D(H) \text{ is not too large)} \quad (C4)$$

$$G = w_a + M + E(\eta|\eta>\eta^*) > 0 \quad (C5)$$

From (C2):

$$\frac{\partial H}{\partial k} = \frac{G - A \left| 1 - \frac{h}{H} \right|}{(1+\gamma) \cdot B + A \left( \frac{-h + kh}{H^2} \right)} > 0 \quad (C6)$$

where

$$G - A(1-h/H) = w_a \cdot h/H + M + E(\eta|\eta>\eta^*) + E(\theta|\theta>\theta^*) + D(h)/H - D(H)/H > 0 \quad (C7)$$

if  $D(H)$  is not too large. Both (C4) and (C7) would be satisfied if marginal disutility is constant (i.e. a linear disutility function) or the increase in disutility from period 1 to period 2,  $D(H) - D(h)$ , is less than the wage earning of period 1,  $w_a \cdot h$ .

# IZA Discussion Papers

No.	Author(s)	Title	Area	Date
61	R. Winkelmann	Immigration: The New Zealand Experience	1	10/99
62	A. Thalmaier	Bestimmungsgründe von Fehlzeiten: Welche Rolle spielt die Arbeitslosigkeit?	3	10/99
63	M. Ward	Your Everyday, Average Academic	5	10/99
64	M. Ward	Salary and the Gender Salary Gap in the Academic Profession	5	10/99
65	H. Lehmann J. Wadsworth A. Acquisti	Grime and Punishment: Job Insecurity and Wage Arrears in the Russian Federation	4	10/99
66	E. J. Bird H. Kayser J. R. Frick G. G. Wagner	The Immigrant Welfare Effect: Take-Up or Eligibility?	3	10/99
67	R. T. Riphahn A. Thalmaier	Behavioral Effects of Probation Periods: An Analysis of Worker Absenteeism	1/3	10/99
68	B. Dietz	Ethnic German Immigration from Eastern Europe and the former Soviet Union to Germany: the Effects of Migrant Networks	1	11/99
69	M.-S. Yun	Generalized Selection Bias and the Decomposition of Wage Differentials	6	11/99
70	I. N. Gang F.L. Rivera-Batiz	Immigrants and Unemployment in the European Community	1	11/99
71	L. Goerke	The Wedge	3	11/99
72	J. Fersterer R. Winter-Ebmer	Are Austrian Returns to Education Falling Over Time?	5	11/99
73	G. S. Epstein S. Nitzan	The Endogenous Determination of Minimum Wage	3	11/99
74	M. Kräkel	Strategic Mismatches in Competing Teams	5	12/99
75	B. Henry M. Karanassou D. J. Snower	Adjustment Dynamics and the Natural Rate: An Account of UK Unemployment	1	12/99
76	G. Brunello M. Giannini	Selective Schools	5	12/99
77	C. M. Schmidt	Knowing What Works: The Case for Rigorous Program Evaluation	6	12/99

78	J. Hansen R. Wahlberg	Endogenous Schooling and the Distribution of the Gender Wage Gap	6	12/99
79	J. S. Earle Z. Sakova	Entrepreneurship from Scratch: Lessons on the Entry Decision into Self-Employment from Transition Economies	4	12/99
80	J. C. van Ours J. Veenman	The Netherlands: Old Emigrants – Young Immigrant Country	1	12/99
81	T. J. Hatton S. Wheatley Price	Migration, Migrants and Policy in the United Kingdom	1	12/99
82	K. A. Konrad	Privacy, time consistent optimal labor income taxation and education policy	3	12/99
83	R. Euwals	Female Labour Supply, Flexibility of Working Hours, and Job Mobility in the Netherlands	1	12/99
84	C. M. Schmidt	The Heterogeneity and Cyclical Sensitivity of Unemployment: An Exploration of German Labor Market Flows	1	12/99
85	S. Pudney M. A. Shields	Gender and Racial Discrimination in Pay and Promotion for NHS Nurses	5/6	12/99
86	J.P. Haisken-DeNew C. M. Schmidt	Money for Nothing and Your Chips for Free? The Anatomy of the PC Wage Differential	5	12/99
87	T. K. Bauer	Educational Mismatch and Wages in Germany	1	12/99
88	O. Bover P. Velilla	Migration in Spain: Historical Background and Current Trends	1	12/99
89	S. Neuman	Aliyah to Israel: Immigration under Conditions of Adversity	1	12/99
90	H. Lehmann J. Wadsworth	Tenures that Shook the World: Worker Turnover in Russia, Poland and Britain	4	12/99
91	M. Lechner	Identification and Estimation of Causal Effects of Multiple Treatments Under the Conditional Independence Assumption	6	12/99
92	R. E. Wright	The Rate of Return to Private Schooling	5	12/99
93	M. Lechner	An Evaluation of Public-Sector-Sponsored Continuous Vocational Training Programs in East Germany	6	12/99
94	M. Eichler M. Lechner	An Evaluation of Public Employment Programmes in the East German State of Sachsen-Anhalt	6	12/99
95	P. Cahuc A. Zylberberg	Job Protection, Minimum Wage and Unemployment	3	12/99
96	P. Cahuc A. Zylberberg	Redundancy Payments, Incomplete Labor Contracts, Unemployment and Welfare	3	12/99

97	A. Barrett	Irish Migration: Characteristics, Causes and Consequences	1	12/99
98	J.P. Haisken-DeNew C. M. Schmidt	Industry Wage Differentials Revisited: A Longitudinal Comparison of Germany and USA	1/5	12/99
99	R. T. Riphahn	Residential Location and Youth Unemployment: The Economic Geography of School-to-Work-Transitions	1	12/99
100	J. Hansen M. Lofstrom	Immigrant Assimilation and Welfare Participation: Do Immigrants Assimilate Into or Out-of Welfare?	1/3	12/99
101	L. Husted H. S. Nielsen M. Rosholm N. Smith	Employment and Wage Assimilation of Male First Generation Immigrants in Denmark	3	1/00
102	B. van der Klaauw J. C. van Ours	Labor Supply and Matching Rates for Welfare Recipients: An Analysis Using Neighborhood Characteristics	2/3	1/00
103	K. Brännäs	Estimation in a Duration Model for Evaluating Educational Programs	6	1/00
104	S. Kohns	Different Skill Levels and Firing Costs in a Matching Model with Uncertainty – An Extension of Mortensen and Pissarides (1994)	1	1/00
105	G. Brunello C. Graziano B. Parigi	Ownership or Performance: What Determines Board of Directors' Turnover in Italy?	1	1/00
106	L. Bellmann S. Bender U. Hornsteiner	Job Tenure of Two Cohorts of Young German Men 1979 - 1990: An analysis of the (West-)German Employment Statistic Register Sample concerning multivariate failure times and unobserved heterogeneity	1	1/00
107	J. C. van Ours G. Ridder	Fast Track or Failure: A Study of the Completion Rates of Graduate Students in Economics	5	1/00
108	J. Boone J. C. van Ours	Modeling Financial Incentives to Get Unemployed Back to Work	3/6	1/00
109	G. J. van den Berg B. van der Klaauw	Combining Micro and Macro Unemployment Duration Data	3	1/00
110	D. DeVoretz C. Werner	A Theory of Social Forces and Immigrant Second Language Acquisition	1	2/00
111	V. Sorm K. Terrell	Sectoral Restructuring and Labor Mobility: A Comparative Look at the Czech Republic	1/4	2/00
112	L. Bellmann T. Schank	Innovations, Wages and Demand for Heterogeneous Labour: New Evidence from a Matched Employer-Employee Data-Set	5	2/00
113	R. Euwals	Do Mandatory Pensions Decrease Household Savings? Evidence for the Netherlands	3	2/00
114	G. Brunello A. Medio	An Explanation of International Differences in Education and Workplace Training	2	2/00

115	A. Cigno F. C. Rosati	Why do Indian Children Work, and is it Bad for Them?	3	2/00
116	C. Belzil	Unemployment Insurance and Subsequent Job Duration: Job Matching vs. Unobserved Heterogeneity	3	2/00
117	S. Bender A. Haas C. Klose	IAB Employment Subsample 1975-1995. Opportunities for Analysis Provided by the Anonymised Subsample	7	2/00
118	M. A. Shields M. E. Ward	Improving Nurse Retention in the British National Health Service: The Impact of Job Satisfaction on Intentions to Quit	5	2/00
119	A. Lindbeck D. J. Snower	The Division of Labor and the Market for Organizations	5	2/00
120	P. T. Pereira P. S. Martins	Does Education Reduce Wage Inequality? Quantile Regressions Evidence from Fifteen European Countries	5	2/00
121	J. C. van Ours	Do Active Labor Market Policies Help Unemployed Workers to Find and Keep Regular Jobs?	4/6	3/00
122	D. Munich J. Svejnar K. Terrell	Returns to Human Capital under the Communist Wage Grid and During the Transition to a Market Economy	4	3/00
123	J. Hunt	Why Do People Still Live in East Germany?	1	3/00
124	R. T. Riphahn	Rational Poverty or Poor Rationality? The Take-up of Social Assistance Benefits	3	3/00
125	F. Büchel J. R. Frick	The Income Portfolio of Immigrants in Germany - Effects of Ethnic Origin and Assimilation. Or: Who Gains from Income Re-Distribution?	1/3	3/00
126	J. Fersterer R. Winter-Ebmer	Smoking, Discount Rates, and Returns to Education	5	3/00
127	M. Karanassou D. J. Snower	Characteristics of Unemployment Dynamics: The Chain Reaction Approach	3	3/00
128	O. Ashenfelter D. Ashmore O. Deschênes	Do Unemployment Insurance Recipients Actively Seek Work? Evidence From Randomized Trials in Four U.S. States	6	3/00
129	B. R. Chiswick M. E. Hurst	The Employment, Unemployment and Unemployment Compensation Benefits of Immigrants	1/3	3/00
130	G. Brunello S. Comi C. Lucifora	The Returns to Education in Italy: A New Look at the Evidence	5	3/00
131	B. R. Chiswick	Are Immigrants Favorably Self-Selected? An Economic Analysis	1	3/00



132	R. A. Hart	Hours and Wages in the Depression: British Engineering, 1926-1938	7	3/00
133	D. N. F. Bell R. A. Hart O. Hübler W. Schwerdt	Paid and Unpaid Overtime Working in Germany and the UK	1	3/00
134	A. D. Kugler G. Saint-Paul	Hiring and Firing Costs, Adverse Selection and Long-term Unemployment	3	3/00
135	A. Barrett P. J. O'Connell	Is There a Wage Premium for Returning Irish Migrants?	1	3/00
136	M. Bräuningner M. Pannenberg	Unemployment and Productivity Growth: An Empirical Analysis within the Augmented Solow Model	3	3/00
137	J.-St. Pischke	Continuous Training in Germany	5	3/00
138	J. Zweimüller R. Winter-Ebmer	Firm-specific Training: Consequences for Job Mobility	1	3/00
139	R. A. Hart Y. Ma	Wages, Hours and Human Capital over the Life Cycle	1	3/00
140	G. Brunello S. Comi	Education and Earnings Growth: Evidence from 11 European Countries	2/5	4/00
141	R. Hujer M. Wellner	The Effects of Public Sector Sponsored Training on Individual Employment Performance in East Germany	6	4/00
142	J. J. Dolado F. Felgueroso J. F. Jimeno	Explaining Youth Labor Market Problems in Spain: Crowding-Out, Institutions, or Technology Shifts?	3	4/00
143	P. J. Luke M. E. Schaffer	Wage Determination in Russia: An Econometric Investigation	4	4/00
144	G. Saint-Paul	Flexibility vs. Rigidity: Does Spain have the worst of both Worlds?	1	4/00
145	M.-S. Yun	Decomposition Analysis for a Binary Choice Model	7	4/00
146	T. K. Bauer J. P. Haisken-DeNew	Employer Learning and the Returns to Schooling	5	4/00
147	M. Belot J. C. van Ours	Does the Recent Success of Some OECD Countries in Lowering their Unemployment Rates Lie in the Clever Design of their Labour Market Reforms?	3	4/00
148	L. Goerke	Employment Effects of Labour Taxation in an Efficiency Wage Model with Alternative Budget Constraints and Time Horizons	3	5/00
149	R. Lalive J. C. van Ours J. Zweimüller	The Impact of Active Labor Market Programs and Benefit Entitlement Rules on the Duration of Unemployment	3/6	5/00

150	J. DiNardo K. F. Hallock J.-St. Pischke	Unions and the Labor Market for Managers	7	5/00
151	M. Ward	Gender, Salary and Promotion in the Academic Profession	5	5/00
152	J. J. Dolado F. Felgueroso J. F. Jimeno	The Role of the Minimum Wage in the Welfare State: An Appraisal	3	5/00
153	A. S. Kalwij M. Gregory	Overtime Hours in Great Britain over the Period 1975-1999: A Panel Data Analysis	3	5/00
154	Michael Gerfin Michael Lechner	Microeconometric Evaluation of the Active Labour Market Policy in Switzerland	6	5/00
155	J. Hansen	The Duration of Immigrants' Unemployment Spells: Evidence from Sweden	1/3	5/00
156	C. Dustmann F. Fabbri	Language Proficiency and Labour Market Performance of Immigrants in the UK	1	5/00
157	P. Apps R. Rees	Household Production, Full Consumption and the Costs of Children	7	5/00
158	A. Björklund T. Eriksson M. Jäntti O. Raalum E. Österbacka	Brother Correlations in Earnings in Denmark, Finland, Norway and Sweden Compared to the United States	5	5/00
159	P.- J. Jost M. Kräkel	Preemptive Behavior in Sequential Tournaments	5	5/00
160	M. Lofstrom	A Comparison of the Human Capital and Signaling Models: The Case of the Self-Employed and the Increase in the Schooling Premium in the 1980's	5	6/00
161	V. Gimpelson D. Treisman G. Monusova	Public Employment and Redistributive Politics: Evidence from Russia's Regions	4	6/00
162	C. Dustmann M. E. Rochina-Barrachina	Selection Correction in Panel data Models: An Application to Labour Supply and Wages	6	6/00
163	R. A. Hart Y. Ma	Why Do Firms Pay an Overtime Premium?	5	6/00