

EUROPEAN UNIVERSITY INSTITUTE, FLORENCE

DEPARTMENT OF ECONOMICS

EUI WORKING PAPER No. 87/277

**EFFICIENCY WAGE CONTRACTS, UNEMPLOYMENT,
AND WORKSHARING**

by

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This paper was written while the author was visiting professor at the European University Institute for the academic year 1986-87. For valuable discussions he is grateful, without implication, to Katherine Abraham, Robert Hart, Serge-Christophe Kolm, Edward Lazear, Mario Nuti and Toshiaki Tachibanaki.

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Printed in Italy in April 1987
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Abstract

Efficiency Wage theories are generalized to include choice of effective working hours per worker, so costs of eliciting effort depends on employee's relative utility and aggregate unemployment. In Nash equilibrium, state-dependent hours, wages and employment imply unemployment in 'bad' states. By contrast, a prior, state-independent employment decision is compatible with full employment equilibrium (and worksharing), and plausibly generates lower non-wage costs. Various differences between Japanese and Western labor market behavior are explained with these models.

1. Introduction

Efficiency wage theories have emerged in recent years as one of the most promising explanations of persistent unemployment. Excellent surveys have been provided by Akerlof (1984), Stiglitz (1984) and Yellen (1984), while Bulow and Summers (1986) have developed a variety of applications of a particular model due to Shapiro and Stiglitz (1984). Although employment contract theories have failed to provide a convincing explanation of unemployment and nominal rigidity, a combination of efficiency wage setting and monopolistic competition is consistent with nominal rigidity and real fluctuations in the presence of small "menu costs" of adjustment and "nearly rational" behavior (Akerlof and Yellen, 1985; Mankiw, 1985).

A surprising omission in most of this literature is the lack of any distinction between traditional, layoff unemployment, and short-time working by (all) existing employees, as a response to cyclical fluctuation. This omission is shared by attempts to explain layoffs or employment fluctuation as the optimal (second best) response to informational asymmetry between employers and employees (Hall and Lilien, 1979; Hall and Lazear, 1984). As emphasized by FitzRoy (1981), Gordon (1982), and FitzRoy and Hart (1985), exclusive attention to the employment-unemployment dichotomy cannot help to explain the remarkable but usually neglected contrast between the cyclical behavior of labor markets in Japan and Western economies (particularly the U.S.). For as shown in detail by Hashimoto and Raisian (1986) and Tachibanaki (1987), most of the variation in Japanese employment is in weekly hours

per worker (especially overtime), and this prevalence of worksharing seems to have been the main proximate cause of very low aggregate unemployment in Japan in spite of substantial output (growth) fluctuation.

While temporary layoffs are unusual in Europe, worksharing is of limited aggregate importance and seems to have had little impact on persistently high unemployment. Various possible fiscal, legal and contractual explanations for observed international differences in employment behavior were examined and generally found wanting by FitzRoy and Hart (1985).

In this paper, efficiency wage -and contract- themes are joined in a natural generalization to accomodate both the intensive and extensive margins of employment variation. In the model of the next section, employment fluctuation is derived as a Nash-equilibrium response to productivity change with no assumption of wage rigidity. Optimal hours are state-independent only in special cases, and the cost of maintaining effective hours or effort declines with the relative utility of the wage-effort contract. Since this specification is consistent with various versions of efficiency wage theory, it would seem to reinforce a pessimistic conclusion that unemployment is really "natural", and unavoidable without government intervention.

In section 3, an alternative model of long-term contracts with state-independent employment but variable hours and wages is developed. Since motivation can be based on deferred rewards with little risk in this case, most of the arguments for efficiency

wage effects lose their force, and a full-employment, worksharing equilibrium with lower costs for monitoring becomes plausible.

This dichotomy of two "ideal types" of employment relationship turns out to be useful in explaining various stylized facts and differences between Japanese and other economies in section 4. Finally, some hints for policy measures to avoid the 'efficiency wage trap' are given, and the arguments are summarized in the conclusion.

2. Efficiency Wage Contracts

Most models of efficiency wages do not include hours of work as a choice variable, and thus rule out the possibility of work-sharing as a response to cyclical shocks. Employed workers are assumed to choose their effort, motivated by the threat of dismissal for shirking. Here we shall adopt an essentially dual approach as follows.

Employers can determine average effective hours worked, but at a cost which increases with the effort demanded. This cost includes monitoring, hiring, training and related expenditure. There is no presumption that an individual worker's effort can be precisely monitored or determined, only that average effort per worker, defined as effective hours, is an increasing function of monitoring and related expenditure, and of other variables. The production function for a firm is given by

$$Q = s F(h, N) \quad (1)$$

where s is a productivity parameter, h is effective hours per worker, and N is the number of employees. F is well behaved (concave increasing) and if output Q , the state s , and N are all known observables, then h can be deduced when the function F is known.

The cost per worker, C , of eliciting h effective hours is assumed to be a decreasing function of the overall unemployment rate, U , and of the utility ratio, $R = V/V_0$. Here utility of a worker in the firm is given by the usual well behaved function

$$V = V(h, W) \quad (2)$$

which is decreasing in h and increasing in the real wage, W ; and V_0 is just the utility level offered by other firms. Monitoring and other non-wage costs per worker are thus assumed to be a decreasing function

$$C = C(R, U) \quad (3)$$

and profit of the firm is

$$\pi = s F(h, N) - (C + W) N \quad (4)$$

This fairly general specification thus combines the basic efficiency wage notion with the idea of a contract specifying both hours (effort) and pay, which determine utility. In contrast to contract theory with infinitely elastic labor supply by perfectly

mobile workers, our firms are not constrained to provide workers with a given, market-determined level of utility. Instead, we only require that in symmetric equilibrium, identical firms all choose the same h and W , so $R = 1$. If one firm increases hours or lowers the wage, then all workers do not instantly quit, but non-wage costs do rise. However, if all firms changed their contracts for better or worse, from an initial equilibrium with identical utility, then non-wage (labor) costs would remain the same in this model.

This seems to be a reasonable approximation on several counts. Selection effects, turnover, monitoring, morale and motivation are all likely to depend primarily on relative utilities offered, rather than on absolute levels, for any given aggregate unemployment rate.¹

Given U and V_0 , we first assume that the firm chooses effective hours, employment, and the real wage after observing the state, s , to maximize profit. First-order conditions from (4) are respectively

$$s F_h/N = C_R V_h/V_0 \quad (5)$$

$$s F_N = C + W \quad (6)$$

$$1 = -C_R V_W/V_0 \quad (7)$$

We assume there is a unique interior solution for these conditions. Substituting (7) into (5) we find

$$s F_h/N = -V_h/V_W \quad (8)$$

This means that the marginal product of average effective hours (per worker) is equal to the marginal rate of substitution. But this is just the condition for efficient choice of hours or utilization of employed workers in any state. Thus we have the interesting result that efficiency wage contracts as defined here do generate efficient intensity of work for employees in any state.

However the general solution of (5)-(7) requires state-dependent wages and employment as well as hours, say $\hat{h}(s)$, $\hat{N}(s)$ and $\hat{W}(s)$, and there will be unemployment whenever \hat{N} is less than the full-employment supply of labor, which we assume is \bar{N} per (identical) firm.² Any one firm would reduce profits by employing more workers at a lower wage, so Nash equilibrium unemployment is possible. It is conceivable that "two-tier" wage systems could be profitable, say lower pay for newly hired workers when aggregate unemployment is high, but such systems are rare,³ and raise moral hazard problems. Employers would be tempted to lay off more employees than otherwise, and rehire at the lower rate, so we shall restrict attention to uniform pay for identical workers.

As an instructive example, consider the special case where the utility function is

$$V = (1 - h)^\alpha W^\beta, \quad \alpha, \beta < 1 \quad (9)$$

and profit is

$$\pi = s h^{\epsilon} N^{\lambda} - (C + W)N, \quad \lambda < 1 \quad (10)$$

with the cost function now given by

$$C = (N_0/\bar{N})/(V/V_0) = (1 - U)/R \quad (11)$$

N_0 is employment by other (identical) firms, so that the exogenous unemployment rate is approximately

$$U = (\bar{N} - N_0)/\bar{N} \quad (12)$$

and of course in symmetric equilibrium $N_0 = \hat{N}$ for all firms, and $V = V(\hat{h}, \hat{W}) = V_0$. First-order conditions then yield after some algebra⁴

$$\hat{h} = (1 + \beta)\epsilon / [\alpha\lambda + (1 + \beta)\epsilon] \quad (13)$$

$$\hat{N}^{2-\lambda} = s \lambda h^{\epsilon} \bar{N} / (1 + \beta) \quad (14)$$

$$\hat{W} = \beta \hat{N} / \bar{N} \quad (15)$$

Thus in this special case, effective hours per employed worker are state-independent, while the wage is proportional to employment for all states such that the full employment constraint $\hat{N} \leq \bar{N}$ is not binding.

When this constraint is binding, say for all $s \geq \bar{s}$, there is full employment = \bar{N} in each firm and (6) no longer holds. The equations (5) and (7) for optimal hours and wages then yield $\hat{W} = \beta$

and

$$\epsilon_s = \alpha N^{1-\lambda} \hat{h}^{1-\epsilon} / (1 - \hat{h}) \quad (16)$$

so that \hat{h} is an increasing function of s for $s \geq \bar{s}$. This extension could then be viewed as a model for the dichotomy between (fixed) standard and (variable) overtime hours.⁵

3. Worksharing Equilibrium

As a polar opposite to the case of state-dependent employment just considered, we turn now to a model of worksharing or state-independent, "permanent" employment by all firms. This model is most naturally interpreted in a multi-period context, with the long-term employment decision being made prior to knowledge of productivity (growth), but based on a subjective probability distribution over future states. In the extreme case of no mobility across firms, and lifetime employment, employees can be motivated primarily by the 'carrot' of deferred compensation and promotion prospects rather than current wages and the threat of dismissal for shirking.⁶ Long-term employment facilitates investment in firm-specific human capital, and costs of adjusting the size of the workforce in response to cyclical change in demand or productivity (reallocating existing workers to unfamiliar tasks after layoffs, rehiring, retraining, etc.) can be avoided.

These considerations suggest that the essential ideas of the efficiency wage model lose much of their relevance when employment

is predetermined and permanent.⁷ A simple contract model now seems more appropriate, where employees must be offered the competitive level of expected utility, and hours are chosen efficiently in each state. The Lagrangian for this problem is

$$L = E [s F - (\bar{C} + W)N] + \mu [E V(h, W) - A] \quad (17)$$

where E is the expectation over a known distribution of states, and \bar{C} represents constant non-wage costs, and we expect $\bar{C} < C(1, 0)$ due to economies of monitoring and training with long-run employment. A denotes alternative expected utility, and of course in general the model should be interpreted in terms of expected present values. First-order conditions for state-dependent or variable hours, predetermined employment, and the wage yield

$$s F_h = -\mu V_h \quad (18)$$

$$E [s F_N(h, N) - (\bar{C} + W)] = 0 \quad (19)$$

$$N = \mu V_W \quad (20)$$

Again we have efficient hours from (18) and (20), but this model is now compatible with full employment and can be solved for $\bar{h}(s)$, $\bar{W}(s)$ and μ in terms of $N = \bar{N}$.

To illustrate, consider the utility function

$$V = V(W - D) \quad (21)$$

with V concave, and $D = D(h)$ convex increasing. Let production again be $s F = s h^{\epsilon} N^{\lambda}$, and full employment be $\bar{N} = 1$ by choice of units. Then we obtain

$$\epsilon s = \mu D' V' (\bar{W} - D) \bar{h}^{1-\epsilon} = D^1(\bar{h}) \bar{h}^{1-\epsilon} \quad (22)$$

since

$$1 = \mu V' (\bar{W} - D) \quad (23)$$

which define increasing optimal functions $\bar{h}(s)$, $\bar{W}(s)$, consistent with full employment, while the multiplier μ follows from (19). From (23), it follows that

$$\bar{W} = w + D(\bar{h}) \quad (24)$$

where $w > 0$ is a constant,⁸ so pay consists of a base wage (w) plus direct compensation for the disutility, D , of effective hours worked in each state.⁹

In the worksharing equilibrium there are efficiency losses because employment is not generally optimal ex post. However, if the reduction in non-wage costs due to permanent employment is sufficiently great, then average net total output, say $\bar{Q} = E[s F(\bar{h}, \bar{N}) - \bar{C}]$, can still exceed the corresponding value $\hat{Q} = E[s F(\hat{h}, \hat{N}) - C(1, U)]$ for the economy in equilibrium with variable employment (and layoffs). The latter may also be Pareto-inferior to the former (worksharing) equilibrium, in the sense that expected utility under worksharing exceeds expected utility

with variable employment and an optimal income redistribution in the form of unemployment benefits.

However, even in this case, the benefits of state-independent, full employment have public good properties in the following sense. If all firms chose optimal employment according to the state of productivity, perhaps holding utility of employed workers constant (or approximately so) as in the example of the previous section, then a single firm would reduce expected profit by maintaining constant employment. Intuitively, the hourly wage would have to be raised in low productivity states with reduced hours in order to maintain income and utility, and to prevent excessive quits or reduced effort by dissatisfied workers. A similar argument applies also in good states, when extra hours are called for, and higher pay is needed to compensate for disutility of effort. The efficiency wage cost function $C(V/V_0, U)$ still applies when a single firm implements worksharing in an economy with generally variable employment. The transition to the low cost and mobility case of permanent employment by all firms thus clearly requires government policy measures with appropriate incentives for employers, a question which we take up in the next section.

The stability of worksharing equilibrium of course depends crucially on the strength of reputation effects in countering the temptation to increase profit in the short run by laying off workers in recession. Going beyond the simple, static model, other practical complications arise, for instance the problem of adjustment to permanently lower employment by a single, declining firm. Firms, as well as workers, should also be regarded as risk averse.

However such complications do not seem to invalidate the basic points made here.

4. Applications

The expectation (but not a formal guarantee) of lifetime employment in the same firm after leaving school is restricted to large employers in what might be called the 'primary sector' of the Japanese economy.* On the other hand, many Western firms do vary overtime hours and offer relative security to senior employees. Nonetheless, there remain a number of significant differences between Japanese and Western employment behavior, which have been comprehensively reviewed by Hashimoto and Raisian (1986) and Tachibanaki (1987). In this section we shall argue that several of these differences are best explained by a predominance of implicit employment contracts of the type modeled in section 3 above in Japan, and with efficiency wage contracts as in section 3 in Western economies.

One obvious response to the stylized facts of persistently high unemployment in Europe and apparently full employment in Japan has been to postulate inflexible wages under European collective bargaining, and "market clearing", flexible, wage and bonus payments in the Japanese system of decentralized bargaining.

* This sector covers about one third of total employment, and another third consists of family firms and self employed. The remainder, consisting of contingent and part-time employees, including most female workers, exhibits most employment variations.

Empirical comparisons of aggregate wage flexibility have not, however, been entirely conclusive,¹⁰ and FitzRoy and Hart (forthcoming) actually find that industry-level wages are often more responsive to specific labor market conditions in West Germany than in Japan. This and other findings cast serious doubts on the "market clearing" explanation for Japan. Here, two simple, contrasting models of employment have been developed. In the first, state-dependent employment is optimal for each firm, and the natural generalization of efficiency wages to efficiency wage contracts provides a firm foundation for a "natural" but fluctuating equilibrium rate of unemployment under quite general conditions. Wages were assumed to be flexible, with no exogenous menu or bargaining costs of adjustment imposed. The optimal, state-dependent wages generated by this model might certainly be modified under collective bargaining. However it would require an implausible reversal of traditional roles, with unions demanding lower wages than those offered by employers, to move towards fuller employment, and the converse seems to be more likely.

The second model shows that full-employment equilibrium is possible under different behavioral assumptions. Permanent employment is chosen ex ante to maximize expected profit, holding expected utility constant, while ex post optimal hours and wages are chosen after the state is known. This model is of course motivated by the stylized facts about long-run employment and cyclical variation of hours rather than workers in Japan. The dynamic interpretation is then used to justify the neglect of efficiency wage effects because permanent employees can be motivated by deferred

compensation and promotion, rather than the threat of job loss or quitting.

The reduced risk of firm-specific human capital investment in this model is consistent with the greater use of job rotation and less reliance on transferrable or general professional skills in Japan noted by Ouchi (1981). Also a lower ratio of supervisory to production employees is possible because information about individual effort and competence accumulates in the long run, and the option of shirking and then quitting is not generally avoidable. Less intensive current monitoring is thus required, so job satisfaction is likely to be greater than under intensive supervision with variable employment and unrestricted mobility. Indeed, the latter is often regarded as an alternative to the "voice" of employees in workplace decisions and provision of public goods, and it is precisely the specific investments embodied in long-term employees which encourage effective communication and cooperative labor relations, yielding both tangible and non-pecuniary benefits.¹¹

The reduced risks -and incentive benefits- of deferred rewards with long-run employment can also explain Tachibanaki's (1987) finding that age-wage schedules for various occupations are considerably steeper in Japan than in other countries.¹²

These arguments suggest that state-independent or "permanent" employment should indeed generate lower non-wage costs (of monitoring, mobility, etc.), which compensate for the non-optimality of ex post employment. The case is completed by reemphasizing the

stability of unemployment equilibrium with variable employment and efficiency wage contracts. In the Western economies closer to the state-dependent employment model, worksharing has had little impact on the aggregate effects of shocks, and only exceptional firms avoid cyclical reductions of employment. In such an environment it seems that an average individual firm cannot realize the benefits of worksharing and some government policy is required.

An interesting example in this connection is that of West Germany, which falls somewhere between the contrasting extremes of Japan and the U.S., and where neither (limited) worksharing nor highly responsive wage growth have avoided major cyclical and structural unemployment. The problem is considerably more serious than official unemployment statistics allow, because repatriation of foreign workers and an unprecedented decline in the labor force participation rate point to strong "discouraged worker" effects. As discussed in detail by FitzRoy and Hart (1985), there are fiscal incentives for worksharing, including generous unemployment compensation for short weeks, and substantial costs of separation in West Germany, yet the aggregate impact of short-time working has been extremely small.

The trend of recent legislation in most European countries has been to increase job security for employed workers by raising the costs of separation, while other non-wage costs have also been rising rapidly. These measures have increased the total expected costs of new hiring to such an extent that capital deepening and rapid productivity growth have been accompanied by steadily declining employment in manufacturing. At the same time, the new

start-ups and small enterprises which have accounted for most of the spectacular job creation in recent years in the U.S. are severely handicapped in West Germany and other European countries by lack of venture capital and by various bureaucratic barriers (Geroski and Schwalbach, 1985).

Both unions and employers in Germany seem to be in agreement on the desirability of maintaining standard working time and pay during downturns, even if substantial reductions of the work force are necessary.¹³ Apart from depressed industries such as steel or shipbuilding, short-time working is generally seen as a very temporary measure to ease the costs of adjustment, but not as a viable alternative to layoffs and unemployment. Even in view of the relatively restricted mobility of the German labor force, this is consistent both with trade union responsiveness to the median voter, and also with efficiency wage arguments against a prolonged reduction of hours and earnings in any one firm when full-time working is the rule elsewhere.

So far we have been concerned with economy-wide or cyclical adjustment, but of course firm-specific reduction of employment is one of the risks of entrepreneurship that has also been increased by European measures to establish job security. With relatively high barriers to mobility and to entry by new start-ups, but without a general commitment to widespread worksharing in cyclical downturns as in Japan, European policy seems to represent the worst of two worlds.

One particularly appropriate new measure would be the introduction of some form of experience rating for unemployment insurance at the same time as reducing total labor cost. For instance, if employers were themselves responsible for maintaining a substantial fraction of dismissed workers' income, until reemployment, then worksharing would be an attractive alternative during recession when the expected duration of unemployment is greatest. On the other hand, individual firms (or even industries) faced with declining demand would have an incentive to effect necessary reduction of their work force during periods of low aggregate unemployment, when new jobs can be found quickly. In contrast to this scheme, most of the existing components of non-wage costs represent employment-reducing taxes with little or no economic rationale.

As a final point, a worksharing response to declining demand should also encourage wage concessions, particularly in endangered firms and industries, since the whole work force stands to gain from arresting or reversing the decline, a situation which arises otherwise only when bankruptcy or close-down threatens. This may also explain part of the opposition of organized labor to worksharing, since trade union and other labor spokesmen in Europe are strongly committed to the idea of uniform wages for occupations, without regard to local or firm-specific conditions. Consistent with this ideology of so-called wage solidarity, regional and other differentials have shown little response to labor market conditions in recent years.¹⁴ Uniform wages are of course what competitive markets with perfectly mobile workers would generate, so it is somewhat surprising to find unions apparently imposing

this result in spite of obviously costly mobility. Efficiency wage theory in fact suggests that employers should basically also support uniform wages (with state-dependent employment) in order to elicit effort from employed workers at minimal cost, in spite of local variations in unemployment. Policy measures such as those discussed above are thus likely to be needed before worksharing can become a generally accepted initial response to any kind of decline which is also sufficiently persistent during aggregate downturns to avoid major unemployment.

5. Conclusion

The idea of efficiency wages has been generalized here to include the utility of both effort (effective hours) and wages. If the cost of eliciting effort depends on relative utility offered, then cyclical unemployment may result in equilibrium. This is a rather pessimistic conclusion because it does not depend on any particular model of motivation. On the other hand, Japanese experience suggests a very different model of long-run employment contracts. Lower costs are plausible when most employers then vary hours in response to cyclical shocks, and full-employment equilibrium becomes feasible. These alternative points of view as well as some direct evidence, suggest that greater wage or bonus flexibility are not the key to Japanese labor market performance because it is far removed from a spot market for labor. State-dependent efficiency wage contracts, by contrast, may exhibit greater wage

flexibility, and rigidities due to bargaining costs are not necessary to explain equilibrium unemployment.

A variety of stylized facts from international comparison of labor markets turned out to be consistent with the simple dichotomy -of- equilibria framework developed here. Problems with existing labor market policy and suggestions for alternative measures were briefly discussed, but the determinants of the differing response of hours and workers to aggregate fluctuations clearly require more detailed research before firm conclusions for government policy can be drawn.

Footnotes

1. This model is thus consistent with various kinds of incentives. Motivation at the margin solely by threat of dismissal for shirking, as in Shapiro and Stiglitz (1984), is hardly relevant for most European workers who have considerable job security. Piece rates are widely used in the U.S. and other Western economies (Seiler, 1984), and provide more flexible incentives, but the quit rate and associated costs are indeed likely to depend upon relative utilities.
2. Constrained solutions with employment rationing are discussed below.
3. See Jacoby and Mitchell (1986) for discussion of "two-tier" wage schemes.
4. Note that with $0 < \lambda < 1$, maximum profit is always positive. Then the interior solution \hat{h} from (13) is optimal for any $\epsilon > 0$, so this model allows the plausible case of constant returns to hours regarded as a utilization factor of fixed equilibrium with single-shift working.
5. This example is of course unrealistic in generating constant wages in overtime states. Other examples of this dichotomy are in FitzRoy and Hart (1985).
6. As admitted by Bulow and Summers (1986), this threat (on which their model is also based) may not be of primary importance for most workers in practice. On the other hand, promotion prospects are certainly relevant for many workers under state-dependent employment, particularly when tenure provides relative job security when layoffs are by inverse-seniority, as in most "primary sector" employment, especially with collective bargaining. The possibility of quitting when mobility costs are uncertain remains the most plausible foundation for efficiency wage effects.
7. With no interfirm mobility, there remains the possibility of initial selection or screening benefits from expected utility when worker quality varies. However much of the screening function is in practice performed by formal education and training credentials so it seems justifiable and appropriate to revert to the pure contract model as at least a good approximation in this case.
8. Assuming a unique interior solution.
9. Note that additively separable utility generates a constant wage income in our admittedly rather unrealistic case of risk-neutral firms.
10. So, for example, Hamada and Kurosa (1986), Hashimoto and Raisian (1986), OECD (1986), and Tachibanaki (1986) for review and critique of some studies.

11. For discussion of conditions for cooperative labor relations and resulting benefits, see FitzRoy and Mueller (1984), FitzRoy and Kraft (1984, 1986, 1987), and with reference to Japan, OECD (1986).
12. Bulow and Summers (1986) argue that monitoring costs could preclude short-time working, but their argument is based on the special "threat" model of motivation which becomes largely irrelevant with long-term employment and deferred rewards.
13. Unions have been demanding a shorter standard work week in several countries (but without any corresponding reduction in weekly wages), ostensibly as a device for "redistributing available work". For discussion and critique see FitzRoy (1986).
14. For discussion of wage differentials in West Germany see FitzRoy and Funke (forthcoming).

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