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JOB SHARING, EMPLOYMENT AND WAGES

by

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ABSTRACT

The paper analyzes the effects of job sharing, i.e. a reduction of working time, on wages and output with a monopoly trade union. The effects are related to how working time is determined initially: the wage increases if initial working time is smaller or equal than the trade union optimum, whereas the result is unclear when it is larger. It is never optimal for the trade union to reduce both wages and working time in response to recessionary supply shocks such as those of the seventies. The analysis may help to explain varying attitudes towards work sharing in different countries.
JOB SHARING, EMPLOYMENT AND WAGES*

A reduction of working time has in recent years been proposed in many countries as a remedy against unemployment. But economists seem as a rule to have remained quite sceptical. The standard answers are that the effects depend on the type of unemployment, the type of production function and wage behavior (cf. e.g. Hart and Sloane (1979), Drèze and Modigliani (1981), Hoel (1983a, b) or Charpin (1984).

This paper focuses on the importance of wage reactions. If one assumes classical unemployment and a standard neoclassical production function where labor input is given by the total amount of hours worked (= the number of workers times the number of hours per worker), the conclusions are obvious. If the real wage per hour is held constant, a reduction of working time will leave output and employment in hours unchanged but increase the number of employed workers. But if the real wage per hour increases, a reduction of working time will have a cost in terms of lower employment in hours and thus lower output. These effects may even be so strong that the number of employed workers (henceforth denoted employment) falls, as discussed by Hoel (1983a, b).

However, we know very little about the likely effects of job sharing on wages. In fact this seems to be the area where least research on the effects of job sharing has been done. We know that a common position of trade unions in many countries is that the wage income per worker should remain unchanged, which will increase the wage per hour (cf Charpin (1984)). Ad hoc considerations would also, as Hoel (1983a) points out, seem to tell us that, since a large part of employers' wage costs are fixed in the sense that they are connected to the number of workers and not to the number of hours worked (costs for on-the-job training,
administration, canteen etc.), there is a large chance that the wage cost per hour for the employer may increase even if the actual wage paid out per hour remains unchanged.

A conventional Phillips-curve approach does not give much help. In most Phillips-curve explanations of wage behavior, the number of unemployed workers is used as an explanatory variable. If a reduction of working time leads to a reduction of the number of unemployed workers, one would according to such an explanation expect an increase in employment to put upward pressure on wages. This would tend to decrease employment again. If the Phillips curve conforms to the natural-rate hypothesis, one would in the end expect a return to the original level of unemployment.\(^1\) The problem with such an analysis is that the structural parameters of the Phillips-curve equation cannot be expected to remain unchanged when job sharing is introduced. If all workers become affected by unemployment through a reduction in working time, one would expect this to counteract the tendencies towards an increased wage.

The road that will be pursued here is to study the effects on wages with the help of a model of trade union behavior. We shall follow e.g. Oswald (1982), Calmfors (1982) and Sampson (1983) and assume that the wage is set by a monopoly union that tries to maximize the utility of its members, whereas the role of employers is confined to determining employment given the trade union-determined wage.\(^2\) This approach has well-known drawbacks as discussed by e.g. McDonald and Salow (1981) and Oswald (1983): it does not produce a Pareto-efficient outcome for employers and workers.\(^3\) On the other hand, it is simple and could be regarded as a reasonable approximation if one believes that the factors governing trade union behavior are the most important
ones in the wage formation process. But strictly speaking, what I develop is a theory of trade union bargaining goals.

The paper consists of four sections. In section 1 the basic model is laid out. Section 2 analyzes the effects of a once-and-for-all reduction in working time that is imposed by the government. Section 3 discusses how the outcome is related to how working time has been determined initially. Section 4 finally discusses how both the optimal wage and optimal working time for the trade union is likely to react in response to a recessionary supply shock.

1. The basic model

The individual worker has a utility function

(1) \[ V = V(c, h), \]

where \( V \) = utility, \( c \) = consumption and \( h \) = working time. \( V_c > 0, V_h < 0, V_{cc} < 0, V_{hh} < 0 \) and \( V_{ch} > 0. \)

A worker is either employed or unemployed. If he is employed, he receives a wage income \( wh \) where \( w \) = the wage per unit of time (hour). It is a real economy without money. There is only one good, which I use as numéraire. All incomes are spent. Hence the utility function of an employed worker can be written

(2) \[ V = V(wh, h). \]

The utility of an unemployed worker is denoted \( \bar{V} \).

Given total employment, those to become unemployed are singled out by random draw. Hence if \( N \) = employment (the number of employed workers) and \( M \) = the number of workers, the probabilities of being employed or unemployed are \( \frac{N}{M} \) and \( \frac{M-N}{M} \) respectively. Then the expected utility \( U \) of an individual worker is
\[ U = \frac{N}{M} V(\text{wh}, h) + \frac{M-N}{M} \bar{V}. \]

There exists only one trade union that organizes all workers (M thus also measures the number of members in the trade union). If all workers are alike, it is natural to think of this trade union as maximizing the expected utility of an individual member. In effect this amounts to the same thing as maximizing a utility function with the same weight for all members.  \(^4\)

The monopoly union faces a large number of firms. I assume a standard constant -returns -to -scale production function

\[ Q = F(K, L), \]

where \(Q = \text{output, } K = \text{capital and } L = \text{labor measured in hours.} \)

If I assume a fixed capital stock, profit maximization gives the demand for labor in hours

\[ L = L(w), \]

where \(L_w < 0 \) and \(L_{ww} > 0. \)

The number of workers demanded than is

\[ N = \frac{L(w)}{h}. \]

If working time is taken as exogenous, and we assume an interior solution, the trade union chooses the wage that satisfies the following first-order condition (to simplify we choose units of measurement so that \(M = 1\) below).  \(^6\)

\[ \frac{\partial U}{\partial w} = \phi = \left\{ V_L + \frac{L_w}{h} \left[V(\text{wh}, h) - \bar{V}\right]\right\} = 0 \]
The first term measures the utility gain of a wage increase that stems from increased consumption of those employed. The second term measures the utility loss that follows from the decrease in employment as soon as we impose the condition that \( V(\text{wh}, h) > \bar{V} \), i.e. that the utility of an employed worker is always larger than that of an unemployed.\(^7\) In an optimum these two effects must counterbalance.

I assume that the second order condition for a maximum \( \frac{\partial^2 U}{\partial w^2} = \phi_w < 0 \) is fulfilled.\(^8\)

The utility maximization can be illustrated in a wage-employment diagram (Fig. 1). The L-line shows employment in hours as a function of the wage. The trade union's utility function is illustrated by a map of indifference curves. As shown by Oswald (1982) and Calmfors (1982), the indifference curves are downward sloping and convex to the origin. In terms of the diagram, the trade union solves its maximization problem by choosing the wage that allows it to reach the highest indifference curve, i.e. the point in which the marginal rate of substitution between the wage and employment (in hours) equals the slope of the labor demand schedule.

2. **An exogenous reduction of working time**

In this section I shall analyze the effects of a once-and-for-all reduction of working time that is imposed by the government.

To obtain the effect on the wage of a reduction of working time, I differentiate the first-order condition (7) with respect to \( w \) and \( h \).
(8) \[ \phi_h \frac{dh}{dh} + \phi_w \frac{dw}{dh} = 0. \]

where

(9) \[ \phi_h = \frac{L_w}{h} V c_w - \frac{L_w}{h^2} \left( V(wh, h) - \bar{V} \right) + \frac{L_w}{h} V h + LwV cc + LV ch. \]

This gives

(10) \[ \frac{dw}{dh} = - \frac{\phi_h}{\phi_w}. \]

Since the second-order condition for a maximum ensures that \( \phi_w < 0 \), the sign of \( \frac{dw}{dh} \) is equal to the sign of \( \phi_h \). If \( \frac{dw}{dh} < 0 \), a reduction of the working time causes a wage increase and makes output and employment in hours fall and thus the effect on the number of employment workers ambiguous.

As can be seen from equation (9), \( \phi_h \) and thus \( \frac{dw}{dh} \) cannot be signed unambiguously. But it is easy to interpret the various terms.

The first term, \( \frac{L_w}{h} V_c \), captures that a reduction of working time by reducing the wage income, \( wh \), of an employed worker decreases the utility loss of becoming unemployed. This reduces the negative effects of raising the wage and thus creates an incentive to push up the wage per hour.

The second term, \( -\frac{L_w}{h^2} [V(wh, h) - \bar{V}] \), captures that the reduction of employment in hours that occurs for a given wage increase will affect more workers if working time is shortened. This increase the negative effect of a wage increase and thus creates an incentive to reduce the wage.

The third term, \( \frac{L_w}{h} V_h \), captures that a reduction of working time and the corresponding increase in leisure by increasing the utility
of an employed worker, increases the utility loss of becoming unemployed, which creates an incentive to lower the wage per hour.

The fourth term, \( LwV_{cc} \), captures that a reduction of the working time of an employed worker causes his wage income \( w \) and thus also his consumption to decrease. Hence the marginal utility of consumption increases. This makes a higher wage per hour more profitable and thus creates an incentive to raise the wage.

The fifth term, \( LV_{ch} \), captures that a reduction of working time may have a direct cross effect on the marginal utility of consumption. If it increases, i.e. if consumption and leisure are Edgeworth complements, there is an incentive to raise the wage and vice versa.

Although one cannot thus in general conclude what will happen to the wage per hour and thus to output and employment, equation (9) specifies which factors are important. The probability that a shortening of working time will indeed cause a wage increase, and thus make output and employment in hours fall, increases if

(i) the marginal utility of consumption, \( V_c \), is large

(ii) \( V(wh, h) - \bar{V} \) is small, i.e. there is a small difference between the utility levels of employed and unemployed workers

(iii) the absolute value of \( V_h \) is small, i.e. the marginal utility of leisure is small

(iv) the absolute value of \( V_{cc} \) is large, i.e. if the marginal utility of consumption is rapidly decreasing

(v) \( V_{ch} \) is negative, i.e. consumption and leisure are Edgeworth complements.
The only variable that can be controlled by the government is the difference between the utility levels of employed and unemployed workers, \( V(wh, h) - \bar{V} \). It is obviously important that this difference is not too small if a reduction of working time is to produce desired results.  

3. **An interpretation of the results**

One way of interpreting the above results is to relate them to what working time is initially. More specifically, I shall show that the effect on the wage rate depends upon the relation of initial working time to the level that is optimal for the trade union.

3.1 **Optimal working time for the trade union**

Suppose as a point of reference that not only the wage but also working time has been set initially so as to maximize the trade union utility function. Then both the earlier equation (7) and equation (11) below must be satisfied as first-order conditions, if we assume an interior solution.

\[
\frac{\partial U}{\partial h} = \lambda = \frac{L}{h} \left\{ V_{cW} + V_h - \frac{1}{h} [V(wh, h) - \bar{V}] \right\} = 0.
\]

The first term measures the utility gain from increased consumption for those employed when working time increases. The second term measures the utility loss from decreased leisure for those employed. The third term measures the utility loss arising from the reduction in the number of employed workers when working time is increased. In an optimum the first term must exactly counterbalance the second and the third.
I assume that the second-order conditions for a maximum $\phi_w < 0$,

$$\lambda_h < 0 \text{ and } \phi_w \lambda_h > \phi_h^2 = \lambda_w^2$$

are fulfilled.\(^{10}\)

To understand equation (11), it is helpful to compare with the ordinary labor supply decision of an individual employed worker. If he were to determine his working time on the basis of his utility function (2) for a given wage, he does this so that

$$\frac{\partial V}{\partial h} = \Gamma = wV_c + V_h = 0$$

By comparing equations (11) and (12), it is clear that for a given wage $\frac{\partial U}{\partial h} = \lambda = 0$ implies $\frac{\partial V}{\partial h} = \Gamma > 0$. For a given wage, all workers when acting collectively through the trade union thus prefer shorter working time than employed workers that act individually. The reason is that the trade union not only weighs consumption against leisure but also takes into account that a reduced working time decreases the risk of unemployment.

It is also of interest to compare how the optimal working time for an individual employed worker and for the trade union responds to an exogenous wage change. The effect for an individual employed worker - i.e. the ordinary labor supply effect - is obtained through differentiation of equation (12) which gives

$$\Gamma_w \frac{d\Gamma}{dw} + \Gamma_h \frac{d\Gamma}{dh} = 0$$

and

$$\frac{dh}{dw} = -\frac{\Gamma_w}{\Gamma_h}.$$  

$\Gamma_h < 0$ by way of the second-order condition for a maximum and $\Gamma_w = V_c + h(wV_{cc} + V_{ch})$. We then have $\text{sgn} \frac{dh}{dw} = \text{sgn} \frac{\Gamma_w}{\Gamma_h} \cdot \frac{V_c}{\Gamma_h}$ is the
substitution effect which is positive. \( - \frac{h(wV_{cc} + V_{ch})}{\Gamma_h} \) is the income effect which is negative if leisure is a normal good as I shall assume.

The effect on the optimal working time for the trade union is obtained through differentiation of equation (11), which gives

\[
\lambda_w \frac{dw}{dh} + \lambda_h dh = 0
\]

and

\[
\frac{dh}{dw} = -\frac{\lambda_w}{\lambda_h}.
\]

\( \lambda_h < 0 \) by way of the second-order condition for a maximum and

\[
\lambda_w = \frac{L}{h} [V_{cc} + V_{cc}^{hw} + V_{ch} - V_c] = L(wV_{cc} + V_{ch}) < 0 \quad \text{if leisure is a normal good.}
\]

Then it follows that \( \frac{dh}{dw} < 0 \). Whereas the effect of a wage increase on the optimal working time (labor supply) of an individual employed worker depends upon the relative size of the substitution and income effect, a wage increase always reduces the optimal working time for the trade union. The reason is that when the trade union takes the decision on working time there is only an income effect. The substitution effect (which measures the incentive to raise working time when the wage goes up and a given increase of working time therefore is associated with a larger increase in consumption and utility) is cancelled out by an equal effect in the opposite direction that arises because a higher wage means a larger utility loss for the worker who loses his job (cf the expression for \( \lambda_w \) above).

3.2 The effects on the wage of a reduction of working time

I shall now use the above analysis to discuss the likely sign of \( \phi_h \) in equation (9). By comparing equations (9) and (11), equation (9) can be rewritten as
\[ \phi_h = \frac{L_w}{L} \lambda + L(wV_{cc} + V_{ch}). \]

The second term \( L(wV_{cc} + V_{ch}) \) is negative if leisure is a normal good. Then the following conditions can be drawn.

(i) If initial working time is optimal or smaller than optimal for the trade union, \( \lambda = \frac{\partial U}{\partial h} \geq 0 \) and thus \( \phi_h < 0 \) and \( \frac{dw}{dh} < 0 \). An exogenously imposed reduction of working time then always increases the wage at the same time as it reduces the utility of the trade union.

(ii) If initial working time is larger than optimal for the trade union, \( \lambda = \frac{\partial U}{\partial h} < 0 \) and thus \( \phi_h \leq 0 \) and \( \frac{dw}{dh} \leq 0 \). The wage may then increase or fall in response to an exogenously imposed reduction of working time, at the same time as trade union utility is increased.

The results can be illustrated diagrammatically. In Fig. 2, the \( \lambda \)-line is the locus of combinations of wage and working time that is optimal for the trade union according to equation (11). The slope is negative as shown by equation (16). The \( \phi \)-line is the locus of combinations of wage and working time that fulfills equation (7). Point A represents the global optimum for the trade union around which indifference contours have been drawn. From equations (9a) and (10) we know that the \( \phi \)-line must be negatively sloped if working time is smaller than or equal to the trade union optimum. But it must be less sloped than the \( \lambda \)-line if the second-order condition for a maximum is to be fulfilled. When working time is larger than the trade union optimum, the \( \phi \)-line will eventually become positive.

If both the wage and working time have been set so that trade union utility is maximized, the economy is in A. But if the
government controls working time, the economy may be on any point along the $\phi$-curve. The effect on the wage of a reduction of working time can then be read off as a leftward movement along the $\phi$-curve. As can be seen, the effect depends upon the initial position.

To draw definite conclusions about the real world one would need a model that also specifies who has determined working time initially and according to which principles. I shall leave this question open and simply conclude that the effect of a reduction of working time in my model depends upon how working time initially is related to the optimal level for the trade union.

However, one conclusion that can be drawn is the following. Since there is a serious risk that an exogenously imposed reduction in working time causes the wage to increase and output to decrease, a better alternative could be to make a reduction of working time conditional upon an unchanged wage within some form of social contract. The trade union will accept such an offer if it makes a utility gain from it.

4. **Supply shocks and optimal working time**

This final section analyzes a recessionary supply shock of the type that the world experienced in the seventies and asks how the optimal wage and the optimal working time for the trade union are likely to be affected. The aim is to try to explain varying attitudes among trade unions towards work sharing.

I now formulate the labor demand function as

\[(5a) \quad L = L(w, \alpha)\]
where $L_w < 0$, $L_\alpha < 0$, $L_{ww} \geq 0$ and $L_{w\alpha} \leq 0$. $\alpha$ is a shock parameter, an increase of which represents a recessionary supply disturbance that shifts the labor demand schedule to the left. I leave it open how the shock affects the slope of the labor demand schedule.

The optimal wage and the optimal working time for the trade union are defined by equations (7) and (11). To obtain the effect of the supply shock I now differentiate both equations with respect to $w$, $h$ and $\alpha$. This gives

(17) \[ \phi_w \, dw + \phi_h \, dh + \phi_\alpha \, d\alpha = 0 \]

and

(18) \[ \lambda_w \, dw + \lambda_h \, dh + \lambda_\alpha \, d\alpha = 0, \]

where

(19) \[ \phi_\alpha = V_c \left( L_\alpha + \frac{L_{w\alpha}}{h} \right) [V(wh, h) - \bar{V}] \geq 0 \]

and

(20) \[ \lambda_\alpha = \frac{L_\alpha}{L} \lambda = 0 \text{ around the optimum.} \]

Consequently, we have

(21) \[ dw = - \frac{\phi_\alpha}{\phi_w} \, d\alpha - \frac{\phi_h}{\phi_w} \, dh \]

and

(22) \[ dh = - \frac{\lambda_w}{\lambda_h} \, dw \]

Substitution of (22) into (21) gives:

(23) \[ dw = - \frac{\phi_\alpha}{\phi_w - \phi_h \frac{\lambda_w}{\lambda_h}} \, d\alpha \]
From the earlier analysis we know that if leisure is a normal good, and we are close to the optimum, it holds that $\phi_w < 0$, $\phi_h < 0$, $\lambda_w < 0$, $\lambda_h < 0$ and $\phi_w - \phi_h \frac{\lambda_w}{\lambda_h} < 0$.

Equation (23) shows that the sign of $dw/d\alpha$ depends upon $\phi_\alpha$. If the slope of the labor demand schedule is unchanged ($L_{wa} = 0$) or if it is flattened ($L_{wa} < 0$), $\phi_\alpha < 0$ and then the wage falls. But if the labor demand schedule is steepened ($L_{wa} > 0$), it may occur that $\phi_\alpha > 0$ and thus that the wage increases.\(^{14}\)

Equation (22) shows that optimal working time will always move in the opposite direction to the optimal wage. When the wage falls, optimal working time for the trade union thus increases. When the wage increases, optimal working time decreases. If both the wage and working time initially have been set according to the union's preferences, it will thus never be optimal for it to respond to a recessionary supply shock with a reduction of both the wage and working time.\(^{15}\)

The two possibilities are illustrated in Figs. 3a and 3b. If $\phi_\alpha < 0$, a given working time is associated with a lower wage according to equation (21): the $\phi$-curve is shifted downwards. If $\phi_\alpha > 0$, a given working time is associated with a higher wage: the $\phi$-curve is shifted upwards. The new global optima are at B and B' respectively.

My analysis may shed some light on the attitudes of trade union movements in different countries. In the Scandinavian countries, the trade union movements have on the whole been against job sharing as a response to the unemployment that emerged in the seventies, but they have accepted significant real wage reductions.\(^{16}\) In continental Europe, trade union movements have instead been in favor of reducing
working time but they have often demanded a higher wage per hour to compensate for the fall of wage income.17

If we assume that the typical European economy found itself in a trade union optimum such as A and A' in the early seventies before the supply shocks, the case in Fig. 3b is compatible with the attitude of continental trade unions. The Scandinavian attitude is harder to explain, with the help of Fig. 3a, since it predicts that trade unions should argue in favor of increased working time. But if we assume that the initial position was one where trade unions set the wage but working time was larger than optimal for the trade union such as in C, one could get a Scandinavian situation in Fig. 3a where trade unions after a supply shock want unchanged working time. In Fig. 3b one gets in this case a larger discrepancy between actual working time and the trade union optimum, which would motivate an increased interest in reduction of working time.

My model offers no motivation for why initial working time should be larger than optimal for the trade union as was discussed above,18 but the frequent trade union demands for shorter working time in all European countries - including the Scandinavian ones - in the early seventies gives the hypothesis some plausibility.

5. Conclusions

I have analyzed job sharing in a model with a standard neo-classical labor demand schedule and where a monopoly trade union sets the wage. The following conclusions emerged.

1) In general it is not clear how a reduction of working time affects the wage per hour and thus output and employment. The risk for a wage increase is larger, the smaller the utility difference between an employed and an unemployed worker.
2) The wage outcome of a reduction of working time is related to how initial working time has been determined. If initial working time is optimal or smaller than optimal for the trade union, the wage increases if leisure is a normal good. If initial working time is larger than optimal for the trade union, the wage may rise or fall.

3) It is never optimal for a trade union to respond to a supply shock (decreasing the demand for labor) by reducing both the wage and working time. The optimal response for the trade union is to change these variables in opposite directions, but it is not in general clear which should be increased and which decreased.

When deriving the above propositions, it was shown that for a given wage, the optimal working time for the trade union - i.e. all workers when acting as a collective - is always smaller than the optimal working time for an individual employed worker when acting on his own. It was also shown that there is only an income but no substitution effect from a wage change on the optimal working time of the trade union.
FOOTNOTES

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1. This is indeed the conclusion by Ström (1983).

2. This approach originates with Dunlop (1944). Cf also Drèze and Modigliani (1981), Layard (1982) and Calmfors and Horn (1983).

3. By bargaining about both the wage and employment, both workers and employers could increase their utility. However, actual wage bargaining in systems with some centralization as in e.g. the Scandinavian countries, Austria or the Netherlands does not take place in this way. Central employers' federations have the right to bargain about wages but not over employment: employment decisions are taken by individual firms given the wage determined in central bargaining. A more elaborate theory of wage bargaining needs to take strike costs into account more explicitly e.g. along the lines suggested by de Bruyne and van Rompuy (1981).


5. Since it can be shown that \( L_{wW} = - \frac{K F_{LLL}}{F_{LL}^3} \), \( F_{LL} < 0 \) is not sufficient for determining the sign of \( L_{wW} \). It will depend upon the sign of the third derivative \( F_{LLL} \), which we usually put no restrictions on.


7. Unless this condition is fulfilled, all workers would choose to be unemployed.
8. \[ \phi_w = LhV_{cc} + 2L_w V_c \frac{L_{ww}}{h} [V(wh, h) - \bar{V}] \]. The condition that \( \phi_w < 0 \) is thus fulfilled unless \( L_{ww} \) is very positive. This puts a restriction on how convex the labor demand schedule may be.

9. In e.g. countries like Sweden and Denmark, where unemployment benefits often amount to 80–90% of the pay of an employed worker, the risk that a reduction of working time will cause wages to increase thus seems larger than elsewhere.

10. \[ \lambda_h = \frac{L_h}{h} [w^2 V_{cc} + V_{hh} + 2wV_{ch}] \]. The condition \( \lambda_h < 0 \) is fulfilled unless \( V_{ch} \) is very positive, i.e. unless consumption and leisure are very strong Edgeworth substitutes. The condition \( \phi_w \lambda_h > \phi_h^2 = \lambda_w^2 \) can be reduced to:

\[
\phi_w \lambda_h > \phi_h^2 = \lambda_w^2 \text{ can be reduced to } L_w^2 w^2 V_{cc} - \frac{L_w^2}{h} V_{cc}^2 + 2 \frac{L}{h} L_{ww}^2 V_{cc} V_{hh} + \frac{L_w^2}{h^2} w^2 (V - \bar{V}) V_{hh} + 2L_w^2 V_{cc} V_{ch} - 2 \frac{L_w^2}{h^2} V_{cc} V_{ch} + 4 \frac{L}{h} L_{ww} V_{ch} - 2 \frac{L_w^2}{h^2} L_{ww} (V - \bar{V}) V_{ch} - \frac{L_w^2}{h^2} V_{ch}^2 > 0 \text{ which cannot be signed unambiguously.}
\]

11. The second-order condition that \( \Gamma_h < 0 \) has to be fulfilled. This condition is the same as \( \lambda_h < 0 \), since \( \Gamma_h = w^2 V_{cc} + V_{hh} + 2wV_{ch} \) (cf. footnote 10).

12. As discussed above, this will be the case if the trade union determines the wage but the decision on working time is taken by the individual employed workers.

13. This way of modelling a supply shock covers a relative price increase for raw material inputs such as oil as well as a productivity decline or a reduction of the capital stock.

14. Cf. also Oswald (1979) and Calmfors (1982) for a discussion of "parallel-shift" and "slope" effects of changes in labor demand.
15. This conclusion derives from two sources. First, working time is not affected by a recessionary shock given the wage. A recessionary shock affects the marginal utility of working time directly only by changing the number of employed workers \( N = \frac{L}{h} \) in equation (11). But since the expression within brackets must be zero in an optimum, this has no effect on the marginal utility of working time. Second, as discussed above, a wage change has only an income but no substitution effect on the optimal working time for the trade union.

16. Cf. e.g. TCO (1983).


18. Note again that this will be the case if working time has been determined by employed workers. Another possible reason could be that trade unions do indeed determine working time but that there are longer lags involved here than in wage setting. Then it may be natural that actual working time lagged desired working time in a period of economic growth as we had up till the beginning of the seventies.
REFERENCES


Layard, R., 1982, "Is Incomes Policy the Answer to Unemployment", Economica, August.


Oswald, A., 1979, "Wage Determination in an Economy with Many Trade Unions", Oxford Economic Papers, No. 3.


