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WORKSHARING AS A POLICY TO INCREASE EMPLOYMENT: AN EVALUATION

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PREFACE

Work sharing policies are seen as possible solutions for the problems of large scale unemployment, particularly in Europe. As part of the WRR-project 'entrepreneurial society' the hypothesis was cast that work sharing policies might have an adverse effect: instead of increasing the number of people employed, decreasing it. On behalf of this question the Economics Institute Tilburg (EIT) was asked to produce a 'state of the art' of research on the effects of work sharing policies and to perform a small empirical investigation of the matter at hand. As it turns out, the question appeared to be a lot more complicated than was thought in advance, both theoretically and empirically. The results of this study show that theoretically there is much to say against work sharing policies. Empirically, though, possible employment effects - positive nor negative - could not convincingly be found, in spite of the thorough econometric tools applied in this study.

The WRR thanks the researchers Arie Kapteyn, Asghar Zaidi and Adriaan Kalwij for their efforts.

Mr. J.P.H. Donner
Chairman of the WRR

Contents

1. INTRODUCTION [1]

In circles of policymakers the idea of worksharing is often viewed as a potential instrument for reducing unemployment, or equivalently to increase the number of people in paid employment. This idea is based on the simple notion that in a given period a fixed amount of labor input required to produce a fixed volume of goods and services can be shared between persons who are already employed and those who are unemployed. It is argued that in this way a trade-off can be made between positively valued leisure of employed persons and unwanted leisure of unemployed persons. However, economists as well as employers are generally sceptical about the success of this policy prescription. The fallacy of this seemingly simple idea is made clear in the literature especially by its impact on wages, wage costs, and output. In this study, we seek to provide a survey of the most pertinent theoretical and empirical contributions to this literature, and in addition to provide new empirical evidence on the efficacy of worksharing as a policy tool to reduce unemployment or to increase employment. In section 2, we outline the factors which are considered crucial in the literature in determining the effects of a reduction in working time. In the discussion of these factors, we also summarize relevant empirical results. In section 3, we provide a brief review of some selected public policy experiments with respect to worksharing. In section 4, we present new empirical results regarding the consequences of worksharing for unemployment and output. Final conclusions are drawn in section 5.

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2. A SURVEY OF THE LITERATURE

2.1 Factors influencing the effect of a reduction in working time

One can distinguish different forms of worksharing. The three main ones are:

1. A reduction of the number of hours worked per time period, often denoted as 'shorter hours'
2. Early retirement of the currently employed;
3. Part-time work and job sharing.

We will discuss all of them. Our discussion starts by concentrating on shorter hours, since this relatively straightforward case brings out many important issues. Once these have been addressed, it is easier to also discuss the other forms of worksharing.

The main factors considered important in the literature in affecting the outcome of a shorter hours policy can be categorized by the headings discussed below. We describe how different researchers have evaluated these factors in their studies.

Almost all factors to be discussed appear to affect the outcome at the micro-level, but most of them also have effects on a macro-level. It is useful to mention at the outset that the two most important factors in the success of worksharing are the direct effect on employment and the indirect effect via an induced wage change on employment. These two issues are covered in the first two headings. As will become clear in the discussion below, the effects of worksharing on wages and wage costs are controversial, and these largely determine the outcome of the worksharing policy. There are however several additional features which influence the outcomes, and these are discussed in subsequent headings. These features show that the issue in question is quite complex and that the scope for worksharing may differ across countries and across industries within a country.

2.1.1 *The structure of production*

At the heart of any analysis of the possibilities of a successful implementation of worksharing lies a consideration of the structure of production. As a starting point for a discussion of the literature we borrow a model from Calmfors and Hoel (1988), which brings out some of the main issues at stake:

Consider a firm which produces output according to a production function with three factors of production: the number of persons employed (N), the number of hours these persons work (h), and the capital stock (K). That is, output (Y) is generated according to $Y = F(N, h, K)$. A more restrictive specification would be $Y = F(L, K)$, where L is labor input. The second specification is a special case of the first one, if L is taken to be a function of N and h. An instructive choice for the relation between L and h and N is: $L = G(h).N$. The function $G(.)$ transforms hours worked into 'efficiency units'. An obvious special case is where $G(.)$ is the identity, i.e. $L = h.N$. In this simple specification perfect substitution is assumed between number of people employed and number of hours worked. This may be a restrictive assumption, as it would require for instance that the productivity of workers is not affected by the number of working hours.

When $L = G(\mathrm{h}).N$, the fact that the productivity of a worker is related to his or her working time is taken into account. Unless h is very large, it is reasonable to assume that G is an increasing function of h, i.e. if more hours are spent on the job, labor input is bigger. For small values of h, not only G but also its first derivative with respect to h, G_h, may be small due to start-up time needed for any job to done. If the number of hours spent on the job increases, the hours become more productive until an area of decreasing marginal productivity is entered, i.e. the second derivative G_{hh} becomes negative. For what follows, it is assumed that hours worked will be in this area. The function L can also be written as $L = g(h).h.N$, where $g(h)$ gives the average productivity per hour of each worker, i.e. $g(h) = G(h)/h$. The assumptions on G and its derivatives translate into conditions on g and its derivatives as follows: if h is small g_h will be positive (average productivity per hour goes up with increasing hours), but when h increases g_h becomes negative (average productivity per hour starts falling).

With respect to capital services, it can be assumed that $K = lk$, where K = Capital services, l = operating time of the plant, and k = Capital stock. The number of shifts on the plant can be defined as $S = l/h$. Capital services can be assumed fixed (as in Calmfors, 1985), or variable (by varying the operating time of the plant l, as in Calmfors and Hoel, 1988).

For the moment we assume (still following Calmfors and Hoel, 1988) that a firm has to pay wages to its employees according to the following wage schedule:

$$W = a + w_0 h \text{ if } h \leq h_0 \tag{2.1a}$$
$$W = a + w_0 h_0 + w_1 (h - h_0) \text{ if } h > h_0 \tag{2.1b}$$

where W is the cost per worker; a is a fixed cost component, h_0 is the number of 'standard hours' or 'normal working time'. If the number of hours h is less or equal to h_0, a wage rate w_0 is paid. If the number of hours exceeds h_0, a (higher) overtime wage rate w_1 is paid.

As noted in the Introduction, the simplest motivation for worksharing is one where output is taken to be fixed, and one assumes that one can redistribute the amount of work necessary to produce the output among the currently employed and the currently unemployed. Let us start therefore with precisely this case. For a given level of output Y a firm tries to minimize costs. We also assume for the moment that capital is fixed and that worksharing does not affect the utilization of capital or the number of shifts needed. In this simple framework, cost minimization amounts to a choice of employment N and working time h such that total labor cost $C=W.N$ is minimal under the restriction that $Y = F(g(h).h.N, K)$ with Y fixed. It is straightforward to derive the first order conditions for cost minimization in this case. They are:

$$\begin{aligned} \frac{w_0}{W} &= \frac{G_h}{G} \text{ for } h < h_0 \\ \frac{w_1}{W} &= \frac{G_h}{G} \text{ for } h > h_0 \\ \frac{w_0}{W} \leq \frac{G_h}{G} &\leq \frac{w_1}{W} \text{ for } h = h_0 \end{aligned} \tag{2.2}$$

where G_h is the derivative of G with respect to h. We will provide successive interpretations of these conditions.

G_h is the increase in labor input if h is increased by a small amount, whereas w_0 is the cost to the firm of this increase in labor input (for the case where actual hours are below standard hours). So G_h / w_0 is the increase in labor input per unit of money obtained by letting employees work longer hours. G is the extra labor input obtained by hiring one additional worker, while W is the associated cost to the firm. So G/W represents the extra labor input per unit of money obtained by hiring an additional worker. The condition states that these two ratios have to be equal. This is entirely intuitive: if the condition would not hold, one could always lower costs by adjusting working time and the number of employees in opposite directions [2].

For the second case ($h>h_0$) an analogous interpretation holds true. The third condition represents a 'corner solution'. Since the marginal cost of additional hours changes discretely at $h=h_0$, we do not obtain an equality, but an inequality. Yet, the interpretation is very similar. It is not possible to lower cost by having employees work fewer hours and hire more workers nor by doing the opposite.
We can use these conditions to analyze the change in demand for labor if the standard working time h_0 is being reduced. Clearly, if the optimal number of hours in the initial situation is below h_0, a reduction of standard working time has no effect [3].

Consider the case where in the initial situation, i.e. before the reduction of standard hours, the firm required its workers to work overtime. To analyze the effects of this, first consider

$$\frac{w_1}{W} = \frac{w_1}{a-(w_1-w_0)h_0+w_1 h}$$

the ratio w_1/W:

Clearly, this ratio falls if we reduce h_0. In view of our assumption on G_h condition (2.2) implies that the number of hours worked will increase, and hence that total employment N will fall. The reason for this result should be obvious. The reduction in standard hours has increased W, the price of a worker, but has left the price of an additional hour unaffected. In response to this change in relative price, the firm will use more of the input the price of which has not changed (hours), and will use less of the input the price of which has gone up (employees).

2 Of course, an equivalent way of interpreting the optimality condition is to say that the marginal rate of substitution between hours and workers has to satisfy the familiar condition that it equals the corresponding input price ratio.

3 We ignore the case where initially actual hours are below standard hours, but where standard hours fall so much as to fall below the previous optimal number of hours. The consequences of this case can be understood by looking at the third case.

Next, consider the case of the corner solution, i.e. the case where initially all workers work standard hours. Since w_1 and w_0 are not affected by the fall in standard hours, whereas W increases, the ratios w_1/W and w_0/W will fall. It cannot be said *a priori* what the effect of a fall in standard hours will be. If the optimal solution remains a corner solution, then clearly the number of hours will fall and employment will go up. It is possible however, that it will become advantageous to the firm to require its workers to work overtime, in which case it cannot be said *a priori* what the employment effects of a reduction in standard hours will be.

Returning to the case where initially actual hours were less than standard hours, conceivably the reduction in standard hours may move the optimum to the corner, or even to a situation where it is optimal to work overtime. Also in this case it is not possible to state *a priori* what the employment effects will be.

Finally, we notice (as do Calmfors and Hoel) that the strong result that worksharing reduces employment in the case where overtime is involved in the initial situation, depends on the assumption that overtime wages are constant. If overtime wages would go up, the more hours of overtime are put in, then the outcome of the analysis becomes ambiguous: the cost of an additional hour may become so high that it becomes more attractive to hire additional employees. Toedter (1988) lets the overtime premium increase (slowly) with overtime. Under his specification actual hours move in the same direction as standard hours. Yet, also in his analysis the effects of shorter hours on employment remain ambiguous, i.e. depend on additional conditions.

The available empirical evidence on the reaction of actual hours to a change of standard hours seems to indicate that actual hours follow standard hours, though possibly not completely. Hunt's (1996) empirical work on the micro-data of GSOEP (The German Socio-Economic Panel) suggests that at least for *Arbeiter* (hourly workers) in manufacturing a one-hour fall in standard hours led to a fall in actual hours of between 0.85 and 1.0. De Regt (1988) finds that a 1% reduction in standard hours reduces actual hours by 0.89% for the Netherlands over the period 1954-1982, whereas according to Hart and Sharot (1978) a 1% reduction in the standard hours for the UK over the period 1961-1972 resulted in a 0.92% reduction in actual working hours.

So far, the firm's output was taken as given. The empirical results quoted in the previous paragraph in combination with the theoretical models discussed would indicate that in this case a reduction in standard hours would reduce actual hours as well, and thereby shorter hours would probably increase employment. Although the assumption of exogenous output may be appropriate for some firms in the public sector (or for the government), it certainly is not appropriate for the vast majority of private firms. If we assume that firms aim at profit maximization, then an increase in labor cost entailed in a standard working time reduction leads to a 'scale effect' which reduces total output and total labor use [4]. Thus, *in addition* to the effects discussed above, we now find a negative effect of worksharing on employment.

Calmfors and Hoel (1988) consider some additional cases, where the firm may now also vary its operating time. The employment results of worksharing remain ambiguous.

To summarize, in some cases one can unambiguously establish a detrimental employment effect of worksharing, whereas in other cases the employment effects are ambiguous. So far, the analysis takes wages (but of course not total wage costs) as given. Yet, the interaction of hours and wages will be seen to be of prime importance for a further evaluation of the employment effects of worksharing. To this we now turn.

2.1.2 *Worksharing and wages*

To set the stage, let us first consider a model introduced by Calmfors (1985). Regarding employer behavior his model is rather similar to the model by Calmfors and Hoel (1988) introduced above. The major simplification is that the wage schedule is now flat, i.e. no distinction is made between normal hours and overtime, and hence all hours are paid at the same rate w. For the discussion below, this is not very important. The employer's attempt to maximize profits will again lead to a demand for workers which is a function of wages and exogenously set hours:

$$N = N(w, h) \tag{2.3}$$

[4] See Calmfors and Hoel (1988) for the derivation of thisresult.

Under reasonable assumptions one can establish that employment will fall if wages rise: $N_w<0$. The effect of the number of working hours on employment is once again uncertain, i.e. the sign of N_h cannot be determined without further specific assumptions.

In the model it is assumed that there is one union with monopoly power who sets wages, while balancing the goals of high wages and the risk of unemployment. Given the wage set by the union, firms then decide on unemployment according to (2.3) above. The union is assumed to maximize the average utility of its members (both employed and unemployed). The utility of an individual worker is $V=V(c,h)$, where c is consumption. For employed workers this implies that utility is given by $V=V(wh,h)$, whereas for unemployed people utility will be $V(b,0)$, where b is an unemployment benefit. Thus, the union will maximize

$$\frac{N}{M}V(w,h)+\frac{M-N}{M}V(b,0)$$

where M is the total number of members of the union (or the total number of workers), and hence M-N is the number of unemployed members (or unemployed people). Maximization of this objective function with respect to the wage rate w subject to (2.3) yields the optimal wage rate for the union. The first order condition for a maximum is

$$\phi \equiv NhV_c+N_w[V(wh,h)-V(b,0)]=0$$

where subscripts indicate partial derivatives. From this one can derive the response of wages to hours:

$$\frac{dw}{dh}=-\frac{\phi_h}{\phi_w}$$

It can be established that φ_w is negative. Thus, the sign of the expression depends on φ_h. It turns out that the expression is quite complicated and can only be signed in special cases.

If we now sum up what we can say about the total effect of a reduction in hours on unemployment, we note that the total effect of shorter hours on employment can be decomposed into a direct effect and an induced effect:

$$\frac{dN}{dh} = N_h + N_w \frac{dw}{dh} \tag{2.4}$$

On the right hand side of this expression, only N_w is unambiguously negative. The other two components cannot be signed, and thus without further assumptions we cannot say what the employment effect of a reduction in working time will be.

Calmfors (1985) also considers some special cases, e.g. the one most favorable for effective worksharing where employment and working time are perfect substitutes. The conclusion remains that the net effect on wages of a change in working time is ambiguous. In addition, he considers the possibility that the initial situation does not conform to an optimum for the trade union. For the same special case with perfect substitutability between hours and employees, he concludes that if initial working time is optimal or smaller than optimal for the trade union, the wage per unit of time must always increase in response to an exogenously imposed reduction in working hours. If initial working time is larger than the optimal for the trade union, the wage may increase or decrease as a result of a reduction in working time.

In order to obtain some more insight in the likely wage effects of shorter hours, it would be helpful if we would know more about the likely size of the components in (2.4). Houpis (1993) expresses (2.4) in elasticity form as

$$\varepsilon_{Nh} = \underline{\varepsilon}_{Nh} + \varepsilon_{NW} * \varepsilon_{Wh}$$

where ε_{Nh} is the *total* elasticity of employment with respect to hours, $\underline{\varepsilon}_{Nh}$ is the *partial* employment elasticity with respect to hours (i.e. assuming fixed wages), ε_{Nw} is the employment elasticity with respect to wages and ε_{Wh} is the wage elasticity with respect to hours. Houpis first provides a survey of studies which have computed $\underline{\varepsilon}_{Nh}$ and reports that a sensible range of the estimates of $\underline{\varepsilon}_{Nh}$ is from -0.5 to -0.8. The author then argues that in practice reductions in hours are jointly negotiated with other measures aimed at cutting employers' costs and increasing productivity. Focusing on the theoretical predictions about the size and sign of the indirect effect, the author shows that if hours are initially at (or above) their optimal level for the individual worker, a reduction in working hours will never lead to an increase in hourly wages.[5] The author refers to his own empirical work (Houpis, 1990), and the work of other researchers (e.g. Nickell and Andrews, 1983; Bean, Layard and Nickell, 1986), to argue that the negative relationship between weekly hours of work and the hourly wage cannot be substantiated. In his view, these results support the idea that workers also accept 'income sharing' along with work sharing (i.e. a fall in the workers' weekly income in proportion to the fall in weekly hours can be expected). In that case, the overall employment outcome of reductions in working hours would depend *only* on the direct employment effect.

Booth and Schiantarelli (1987) use the same model as Calmfors, but make specific assumptions about the production function (Cobb-Douglas) and the utility function of workers (Stone-Geary) and try to use empirical evidence from the literature to establish reasonable parameter values. They conclude "that the employment effect of a cut in hours is more likely to be negative". They also look at several variants of the model, including dynamic ones, and efficient bargaining models, where unions decide on both wages and employment [6]. Their overall conclusions remain the same: most likely shorter hours induce higher unemployment.

Freeman (1997) rules out that wage demands from trade unions are the principal reason for the minimal effect of worksharing policies. This is because most trade unions recognize that a demand for full compensation of the reduction in working hours makes worksharing costly and potentially counter-productive. He refers to the fact that at least in some countries where the worksharing policy is pursued (for instance Belgium and the Netherlands) wage restraint is generally viewed as a necessary component of worksharing agreements.

5 Freeman (1997) argues that a possible situation in a recession, when the worksharing policies are more likely to be initiated, is that employees are working less than the desired number of hours (say, without any overtime). In such situations the demand for the maintenance of weekly or monthly income may be higher.

6 The situation in which firms have 'the right to manage' and unions set wages is not Pareto efficient.

Hunt (1996) uses the micro-dataset of the German Socio-Economic Panel (GSOEP) to analyze the effect of the reduction in standard working hours which were achieved by trade unions in (West) Germany starting from 1985. The author finds that although the reduction in *standard* working hours led to a fall in *actual* working hours (see above), the fall in earnings is almost fully compensated for by a rise in hourly wage. These results are inconsistent with the hypothesis that standard hours reductions accompanied wage restraint (as argued by Houpis, 1993). Hunt (1996) refers to Franz and Smolny (1994) who use a macro time series model using quarterly data for German manufacturing from 1970-1989 and find that in certain industries hourly wages rose as a result of a reduction in standard hours. Hunt (1996) also refers to the manufacturing time series results for Sweden (Holmund and Pencavel, 1988) and for Norway (Nymoen 1989); both these studies suggest that hourly wages rise when standard hours fall.

Dur (1997) examines empirically whether a reduction in working time has a direct impact on wages. His estimation results for the Netherlands show that the coefficient which measures the impact of a reduction in the number of contractual hours on wages, is significantly different from zero. The value of the coefficient implies that a 1% reduction in the working time will increase the hourly wage by about 0.45%. This result is said to conform with results for Australia, Denmark, Germany and Finland. In his view, this result shows why employers are generally sceptical about the success of worksharing.

Obviously, the results of Dur (1997) and Hunt (1996) contrast with the results presented in Houpis (1993) who believes that (hourly) wages are not likely to rise as a result of a reduction in working hours. This highlights the fact that a major difference between the proponents of the worksharing policy and those who oppose this policy may lie in their estimate of its effect on wages.

The models discussed so far were of the monopoly union type. Most studies categorize the trade union behavior into two classes (e.g. Booth and Ravallion, 1993). In the first model the union and firm bargain over wages and working hours, while in the second model the union determines wages and working hours unilaterally. The first model is commonly referred to as an 'efficient bargaining model' whereas the second is referred to as a 'monopoly union model'. In both models the firm is assumed to retain the right to manage employment.

On the basis of a theoretical model which incorporates the notion of 'efficiency units' (i.e. the productivity of workers is affected by the number of working hours; as postulated in Calmfors and Hoel (1988), Booth and Ravallion (1993) show that the effect on employment of a cut in hours is positive if the absolute wage elasticity of labor demand does not exceed the share of variable labor costs in the total wage bill. This statistic is referred to as 'elasticity-share test', and is valid only in an efficient bargaining model (when all mutual gains from bargaining over wages and working hours have been attained). This test would not hold in the monopoly union model. In the monopoly union model, a reduction in working hours can boost employment only if it accompanies a sufficient cut in unit labor costs. This result provides a strong argument against attempts to reduce working hours in the countries dominated by strong (monopoly) trade unions, unless sufficient cuts in labor costs can be assured by the trade unions.

The elasticity-share test for the United Kingdom shows a positive impact on employment as a result of a cut in working hours (under the assumption that all mutual gains from bargaining over wages and hours have been attained). For Australia the results are ambiguous. The disaggregated results for Australia show that in seven out of 12 industries the employment will increase as a result of a cut in working hours (when wages and hours have been bargained efficiently). This outcome shows that hours (or changes in them) may be best determined at the industry level rather than at the national level, especially when employment effects are of concern.

A stack different from the one in the papers discussed so far, is taken by Hoel and Vale (1986). Rather than considering a union with monopoly power, they look at the other extreme, where there are no unions and firms set wages unilaterally. Taking capital and other production factors as given, a firm's production function is given by $Y=F(L)$, where Y is output and L is labor input. The specific feature of this paper is the definition of labor input:

$$L=(h-tq)N$$

As before, N is the total number of employees; t is the training cost of a new employee, and q is the number of employees quitting per period (so that they have to be replaced by new employees who require training). Hours worked h are set exogenously by a policymaker. The quit rate q is taken to be a function of the wage paid by this firm relative to the wage paid by other firms and of the unemployment rate, i.e.

$$q = q(\frac{w}{w^*}, u) \tag{2.5}$$

where w^* is the average wage paid by other firms and u is the unemployment rate.

In this setup shorter hours will make labor less productive. This shifts the first order condition for profit maximization by an individual firm in the direction of higher wages, since thereby the firm can reduce the number of quits. However, *all* firms will do this, and hence w^* will rise proportionally with w, so that in the end the number of quits is not affected by the across-the-board wage increase. The only thing left, according to (2.5), to reduce quits is a higher unemployment rate. Thus the authors show that shorter hours will have two effects: higher wages and higher unemployment.

An argument that also stresses the importance of initial training costs of new employees, is advanced by Riechel (1986) who observes that capital intensive (labor-saving) investments entail higher initial training costs than labor-intensive investments, and as a result the marginal cost of new employment is higher in comparison to the marginal cost of additional hours worked by persons already employed. Therefore, labor-saving investments are considered detrimental to a worksharing policy. His econometric results indicate that in the Netherlands during the period 1970-1978 the trend was towards labor-saving investments. However, the high and prolonged degree of wage restraint in the Netherlands has affected the relative price of labor, and as a result there has been a sharp decline in the labor-saving investment for the subperiod 1980-1984. According to Riechel, this development improved the longer-term scope for worksharing in the Netherlands.

As a third mechanism affecting wages, one can consider the case where initially shorter hours reduce unemployment. If a reduction in working hours would boost employment, the conventional Phillips curve theory would imply an increase in wages which in turn reduces employment. If the Phillips curve conforms to the natural rate hypothesis, it can be expected that the economy would return to the original level of unemployment (Strøm, 1983), but with higher wages. A similar argument is advanced by Layard, Nickell, and Jackman (1991). They argue that the reduction in working hours creates an inflationary pressure by (initially) reducing unemployment. Since the changes in working hours do not effect the mix of unemployment and inflation which the government prefers, it is very likely that the government allows unemployment to rise again in order to control inflation. According to the authors, "the net result of shorter working hours is then no reduction in unemployment, but a reduction in output".

In the approaches discussed so far, firms were assumed to adjust employment in reaction to a change in wages. There are however several cases in which such an adjustment is not likely. These come under headings such as *efficiency wages, search equilibria, implicit contracts, insider-outsider theories*, etcetera. This is not the place to discuss these theories. To drive home the main implication it is sufficient to just briefly mention one disequilibrium theory. In this we follow Drèze (1985). He considers implicit contracts in combination with an insider-outsider setup. The basic idea here is that workers are risk-averse and hence are willing to trade some income for job security. Since firms are usually assumed to be less risk-averse this leads to a mutually advantageous 'implicit contract' between workers and firms where on average workers are paid below their marginal productivity. In return, firms commit to keep the workers on in bad times, when marginal productivity falls below the wage paid to the workers. A second element of this implicit contract is that it discriminates against 'outsiders', i.e. those who are not employed by the firm. This entails that in bad times, the firm does not resort to hiring new employees, who might be willing to work for considerably lower wages than the current employees. One can interpret several labor market institutions as formalizations of this idea, e.g. legal protection against lay-offs, last-in first-out firing rules, etcetera.

The result of the implicit contract will be that in periods with high unemployment wages will be downwardly rigid, *and* that firms will not hire the currently unemployed, not even at much lower wages than the currently employed. Furthermore, the employed are then paid above their marginal product. This situation is not Pareto optimal and theoretically worksharing might be a solution. By letting the employed work a little less, they maintain their job security, the firm can get closer to the optimum conditions where wages should be equal to marginal productivity and by hiring new employees (possibly at relatively low wages) these individuals gain entrance to job and income security which raises their utility. And finally, it saves on unemployment benefits which reduces a welfare decreasing externality.

Although it is important to realize that neoclassical models which posit equality of marginal products and (marginal) wages may not always describe reality well, particularly during recessions, it should be noted that the analysis above does not actually make predictions about the employment effects of worksharing. It only points at market failures and the need to do something about them. Drèze does discuss several forms of worksharing and their scope for success, but this discussion is not tightly related to the analysis of the unemployment problem itself as given here. We will summarize his discussion in section 3 where we look at the actual experience with worksharing policies in different countries.

2.1.3 *Rigidities in the labor market*

In addition to the wage-costs and productivity factors, there may also be rigidities in the labor market which indirectly influence the success of a worksharing policy. The most notable ones are rigid labor laws, inflexible work arrangements, and slow administrative and labor litigation procedures. These rigidities may make it unattractive for the employer to hire new employees, even if the current employees work fewer hours per week. Many of these aspects have effects similar to the fixed wage costs or the initial training costs in the models discussed under the first two headings. Since the fixed costs of hiring new employees form one of the main reasons why firms may prefer to have employees work longer hours rather than hire new employees, alleviation of labor market rigidities may be an effective way of increasing employment, without invoking any specific worksharing arrangement. As to the unemployed, their willingness to accept a job will partly depend on the wage they can earn in employment relative to the benefits they may be receiving. If the number of standard hours is reduced, and this is accompanied with a lower weekly wage, the attractiveness of finding a job may fall. It may thereby become more difficult for firms to find new workers, which then possibly translates into higher wages. This in turn depresses employment.

In Riechel (1986), the importance of cost and productivity factors and rigidities in the labor market are investigated by estimating a labor demand model for the manufacturing sector of the Netherlands and seven other European countries. The estimates indicate that labor market rigidities, which give rise to labor costs other than the recurrent direct wage costs, have been quite high in the Netherlands. These rigidities (along with other factors) have reduced the speed with which firms adjust their employment and working hours (the coefficients indicate that adjustment in employment and working hours are quite low compared to other countries). The high degree of labor market rigidity, in combination with other labor market characteristics in the Netherlands, are reported to be 'inimical to worksharing and long-term employment growth' in the Netherlands.

2.1.4 *What are the profiles of unemployed persons?*

The characteristics of the unemployed are also an important factor in making worksharing successful. Especially in situations where the duration of unemployment is long, the unemployed may have lost some of their skills, which reduces their productivity. It does not even matter whether the lower productivity of the unemployed is real or only perceived by firms; in both cases there will be a negative employment effect. This can be seen most easily by referring to the model of Calmfors and Hoel (1988). Consider the case where a firm would want to respond to shorter hours by hiring new employees. If the new employees are perceived to be less productive than the current ones, this is equivalent to a situation where their wages would have to be higher. The firm will find itself then in a corner solution, and the firm may very well end up requiring its employees to work longer hours (or reducing output), rather than hiring new employees. Similarly, if the unemployed are perceived to require more training than the current employees before they can attain the same productivity level, this affects the fixed costs in the wage schedule (2.1), and again the effect on employment is unambiguously negative.

So far, we have implicitly assumed that all workers are homogeneous, i.e. that their skills are identical or differ only in level, not in type. This implies that we can easily substitute workers for one another. Of course, this is not true. Different people have different types of skills and an organization usually combines workers with different types of skills in some (optimal) way.

To the extent that the unemployed are different from the employed, what matters is whether their skills are complements or substitutes. Suppose for instance that most of the unemployed are unskilled and that skilled and unskilled labor are complements. It is then conceivable that a reduction in work time of skilled labor actually decreases the demand for unskilled labor and therefore for the unemployed. This point was made by Freeman (1997). Freeman believes that one of the principal reasons for a limited success of a worksharing policy lies in the difference between the skills of unemployed and employed persons.

2.1.5 *Labor supply responses*

In the situation where a reduction of standard hours is accompanied by a fall in income, and the household has a preference for income (say due to financial commitments such as mortgage payments) over leisure, the reduction in the official working time will result in an increase in working hours of household members already employed [7], or in an addition of a second (or third) earner in the household, or a combination of both. The ultimate decision will depend not only on labor supply preferences of different members, but also on work opportunities and the structure of labor demand (such as flexibility in the working time). If there are constraints on extending the working time of persons already employed, additional members of the household may become active. This situation is often referred to as an 'added worker effect'. An opposite effect on the labor force is the 'discouraged worker effect' which is a situation in which people will leave the labor force because the chances of finding a job are lower, say due to recession. If during periods of high unemployment and wage restraint (the situations where a policy of worksharing is more likely to be initiated) the 'added worker effect' dominates, the unemployment rate may rise due to the fact that the participation rate has increased. Notably, the added worker effect can be stronger if the unemployment benefits are higher than the social security benefits available otherwise. Riechel (1986) reports on high growth in the participation rate of women and in the preparedness to work overtime in the Netherlands during the period in which income losses were observed. In the author's view this trend suggests that the added worker effect dominates and that the majority of households in the Netherlands are 'income preferers' instead of 'leisure preferers'. Kooreman and Kapteyn (1985) have

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[7] Alternatively, they may start looking for a second job. Multiple job holdings areparticularly prevalent in the US, but also in the Netherlands the number of people holding more than one job appears to be rising.

investigated the interaction of labor supply of spouses in the context of a household labor supply model. In a simulation of the effects of a reduction of hours worked by the male partner in a household, it is estimated that the hours worked by the female partner will increase just enough to maintain the previous level of household income. This is consistent with Riechel's observation. Moreover, as female wage rates are generally lower than male wage rates, the additional number of hours worked by the female in the household will on average be more than the reduction in hours by the male.

Riechel (1986) emphasizes that a distinction should be made between long-term and short-term labor supply responses. It is quite possible that the increase in the participation rate and a preference towards income is a reflection of short-term financial constraints. In the long run, when financial commitments are relaxed, households are likely to move towards their 'normal' income/leisure preferences which may involve a move towards leisure preference, and therefore the worksharing policy may be more successful in the long run than in the short run. However, this will also require that individuals within a household prefer shared employment and shared leisure, instead of specialization where for example one spouse is a full-time worker (one who is prepared to do overtime work) and the other stays at home. In the latter case, according to Riechel (1986), the family labor supply preferences will be in conflict with the reduction of average working hours for the worksharing policy.

Whether or not households will respond to a reduction in working time is thus dependent on their situation (i.e. are they currently in equilibrium or not), but also whether they have a preference for leisure or for income. These preferences may differ across countries. Bell and Freeman (1994) find for instance that Germans work considerably fewer hours than Americans, *and* that Americans are more likely to prefer more hours of work, whereas the Germans are more likely to prefer fewer hours of work. What holds true for the Germans probably holds true for most of the European Union countries in general. One of the reasons for this difference suggested by Bell and Freeman is a difference in earnings inequality and social safety nets.

Freeman (1997) also mentions the labor supply response as a principal reason behind a limited success of worksharing policies. He mentions the fact that real wages have been stagnant or falling for large segments of the US work force, and a restraint in wage growth is observed in the 1990s in most countries in Europe. Given these trends, it is less likely that the workers will be willing to engage in a worksharing scheme. He also refers to the subjective opinions of the workers to support his argument. In 1985, almost 93% of all workers in the US desired the same or more hours of work and earnings, and in 1989 about 56% of all Europeans preferred an increase in pay compared to 34% who preferred shorter working hours.

2.2 **Early retirement, part-time work and job sharing**

2.2.1 *Early retirement*

The idea of early retirement, of course, is to replace older workers by younger ones. Referring to the framework of Calmfors and Hoel (1988), one might suspect two major differences. First of all, older employees often receive a higher wage than younger ones. Replacing older employees by younger ones then reduces the total wage cost per employee, but also the marginal wage cost of an additional hour. On the other hand, subsuming training costs, and perhaps the present discounted costs of severance pay, under fixed costs raises the wage cost per employee. In total, then, we have an ambiguous effect on the wage cost per employee and a negative effect on the wage cost per hour of the new employees. The firms faces the choice to either hire a young replacement of the retired employee or to require its remaining workers to work more hours. In the situation sketched here, the decision to hire a new young employee will mainly be driven by the total wage cost of such an employee. One should note that if early retirement is encouraged jointly with a policy of shorter hours, this works against the replacement of older workers by younger ones, as the higher fixed costs of the younger workers weigh more heavily in a situation with shorter hours. Without going into much detail, it would seem that also here the employment effects of early retirement are ambiguous.

In terms of macro or wage effects, any initially favorable effect of early retirement on unemployment that does not shift the natural rate of unemployment (the NAIRU) will leak away through a more strict anti-inflation policy. As argued in Layard, Nickell and Jackman (1991), the case for early retirement is also made on the basis of the assumption that the early retirement program will keep the total output produced in the economy unchanged. The authors refer to the empirical work of David Grubb for 19 OECD countries, in maintaining that the inflationary pressure rises as much when the labor force is reduced (through the early retirement program) as it would rise when employment is increased by a reduction in working hours. If some workers retire early, and the number of jobs remain unchanged, inflationary pressure would rise. Since the government is expected to choose a similar mix of inflation and unemployment as in the period before the early retirement program, the unemployment rate will revert to its former level. The net effect of the early retirement program will be a reduction in output and the number of jobs in the economy. Layard, Nickell and Jackman (1991) also provide a graphical illustration of a possible relationship between an increase in early retirement and an increase in unemployment for the period 1975-1989.The countries that have experienced growth in early retirement (the United Kingdom, the Netherlands, France and Spain) are those with the highest increase in unemployment over the period considered.

An additional consideration may be the following: if early retirement benefits are generous (as they tend to be, in order to induce as many older employees as possible to exit early) their financing becomes a problem. Generally, early retirement is financed by some form of pay-as-you-go. Thus if many employees retire early, this raises taxes on labor and hence raises the wage costs to the firm. This affects employment adversely.

2.2.2 *Job sharing and part-time work*

Job sharing involves splitting a full-time vacancy into two or more part-time vacancies, while retaining all the rights and privileges which are normally provided with the full-time jobs. In some countries, job sharing can be distinguished from traditional part-time work for the fact that part-time jobs do not always provide the same terms and conditions as full-time jobs. In most countries, partly as a result of recent efforts by Governments and trade unions to remove differences between part-time and full-time work, job sharing and part-time work can be treated analogously. Job sharing and part-time work are also used in combination with other flexible work systems, such as a partial (early) retirement in which older workers share their jobs with younger workers.

The most often quoted advantages of job sharing and part-time work include improved productivity, access to a wider range of skills and a larger pool of potential full-time employees, reduced absenteeism and training opportunities for younger people. These schemes also have potential disadvantages, including administration costs, coordination problems (particularly in job sharing), divided responsibilities and time delays. Some employers believe that part-timers are less committed to their jobs than are full-time employees (as noted by Roche et al., 1996). In principle, the employment effects of this policy are similar to those of shorter working hours. Unless part-time work is associated with lower wages, one may again expect the wage costs of part-timers to be higher than those of full-timers and hence the employment effects of such a policy will be ambiguous.

Drèze (1985) concludes that job sharing in Europe has not developed as a policy instrument to deal with unemployment, nor that it has spread among men (with the exception of early retirees). A high incidence of part-time work is in general associated with an above average rise in the participation rate of women, which indicates that promoting part-time work and job sharing may also increase the participation of women in the workforce and as a result unemployment may not fall. Roche et al. (1996) conclude by saying that: "The literature is inconclusive about the real potential for job sharing. What is clear, however, is that without changes in employers' attitudes, job sharing will not contribute to employment creation in any meaningful sense, except through government-initiated schemes in the public sector".

3. A SURVEY OF PUBLIC POLICY EXPERIMENTS WITH RESPECT TO WORKSHARING

In this section we seek to outline various worksharing measures pursued in Europe, and the evaluations of these programs as carried out in different studies. Following the framework of section 2, we first provide a description of public policy experiments with respect to changes in working hours. This is followed by a description of the policy measures promoting early retirement and job sharing.

3.1 Shorter hours

In 1981, the *French* socialist government aimed at a reduction of normal working time per week from 40 to 35 hours within a period of 5 years. Underlying this policy was the belief that shorter working time at all levels would help reduce unemployment. Initially, the working time was reduced from 40 to 39 hours a week, the paid leave was increased from 4 to 5 weeks, with full compensation for workers and restrictions on overtime. The program was pursued for one year and then was halted as a failure. Jallade (1991) documents the details of this government initiative of a reduction in working time. Jallade argues that any small employment benefit achieved was more than offset by the damage caused to competitiveness as a result of a rise in wage costs and the emergence of a 'hiring-freeze' mentality amongst employers. He points to three crucial lessons to be drawn from the French experiment. *First*, any across-the-board restriction of the reduction in working time is ineffective because it is ill adapted to the circumstances in individual firms. *Second*, there are risks attached with accelerating a trend that reflects economic constraints. *Third*, there are practical difficulties in promoting employment through a reduction in the working week: if the reduction does not go far enough the result is higher productivity with no additional jobs, and if it goes too far, wages rise excessively. Jallade concludes that governments, rather than focusing on the relationship between working hours and employment, need to look at working time in the context of enhancing industrial competitiveness and should adopt other ways to create new jobs.

A proposal by the *Belgian* Government in 1979, to subsidize a reduction of the working week from 40 to 36 hours in combination with some 'wage-moderation', was rejected by employers and some unions. In the period from 1983 through 1986, Belgium initiated the so-called '3-5-3' plan in order to encourage employees to share work and firms to increase employment. In this plan, firms paid a 3% lower increase in wages and they were asked to reduce working time by 5% and increase employment by 3%. The objective was to create 75,000 jobs through negotiations at the sectoral level and at the level of individual firms. The program is reported to have created 23,000 jobs (relative to a labor force of roughly 2.9 million employees).

A related policy initiative was referred to as the 'Hansenne experiments', named after the Minister of Employment who set it up. These experiments sought to reorganize the working time of firms with a view to redistributing the work available. This was an experimental scheme that allowed deviations from legally established rules, implying that the problems such as the choice of normal working hours, weekly closing time and night shifts are to be resolved without any legal constraints at the individual firm level. The unions showed reservations to the success of these experiments, primarily because of the threat to the rights of labor that these experiments engender. According to Roche et al., (1996), the net job creation linked to these experiments was very limited.

De Rongé and Molitor (1991) have concluded their survey of Belgian experience with respect to changes in working hours by saying that "the reduction of working hours, which has been a central theme for mobilization of the working class movement, is today presented by trade unions in nearly identical terms to those used in the 1930s. This, in spite of the fact that the technical and organizational conditions of production have been transformed, along with the general cultural context of the work. In this context, one of the major difficulties of the trade unions has been their tendency to reply to new yearnings with old suggestions and formulas".

In the *Netherlands*, a sharp increase in unemployment in the 1970s and a rapid rise in the size of the labor force in the 1980s provided the context for a centralized agreement between employers and trade unions in 1982. In this agreement a gradual reduction of working time per week was planned, and it was linked to the suspension of index-linked annual growth in wages. Although there were variations in the level of reductions in working time (ranging from a few days a year to a 36-hour working week), for most employees working time was reduced to 38-hours per working week. The Netherlands Central Bureau of Statistics estimated that by the end of 1984 about 72% of the nation's work force had experienced some form of reduction in working time. In August 1985, the Government reduced the working time for civil servants to 38-hours per week in the hope of sharing public employment. Moreover, the authorities decided that 30% of all vacancies that required no special work experience should be filled by persons working a maximum of 32 hours a week. It became common practice to employ workers younger than 26 for 32 hours per week.

However, in 1985 and especially in 1986, the labor unions and the political parties abandoned the reduction in working time as the most important policy initiative to combat unemployment. De Neubourg (1991) provides three main reasons for this. First, working time reductions did not generate as many new jobs as its defenders had hoped. On the basis of macroeconomic models he estimates that as a result of shorter working hours unemployment would decline only by 1% in the short run, and thus a reduction in working time is a relatively ineffective policy for reducing unemployment. Second, inflation in that period became nearly zero percent per year. Since reductions in working time were to be financed by foregoing the benefits of wage indexation, no inflation means that further reductions in working time can be financed only by diminishing nominal wages or by raising wage costs (measures which are unlikely to gain support from both workers and employers). Third, workers' support for reduction in working time was never convincing and it declined further because of the disappointing employment effects and the minimal growth in wages.

In 1985, the Ministry of Social Affairs and Employment published results of a survey which analyzed the effects of shorter hours on employment. The survey covered 583 firms with more than 20 employees. The results show that in almost 80% of the firms some form of a reduction in working time was realized or planned. In 17% of these firms, new jobs were created and in another 26% new jobs were expected to be created. In about 7% of these firms jobs were said to have been saved, and in 6% of the firms jobs were expected to be saved. However, in 4.5% of the firms jobs were lost, and in another 4.5% jobs were expected to be lost in spite of the working time reduction. When asked about the reasons for low employment effects, 35% of these firms attributed it to productivity growth, 22% to overcapacity, 15% to the reduction of production time and 9% to reorganizational problems (De Neubourg, 1991: 140). On the basis of this study and other research involving smaller firms, De Neubourg estimates that around 20 per cent of all lost hours had been replaced by new employment. Moreover, unemployment does not decline by the same number of persons as the number of newly created jobs, for two reasons. First, a reduction in working time leads to an increase in labor supply, and second, it is likely that people may also hold a second job as a consequence of a working time reduction.

In the view of Riechel (1986: 536): ''the Dutch authorities emphasized (in the early 1980s) growth-oriented policies as well as policies that tend to reduce the relative price of labor and have considered worksharing schemes as only supplementary measures.'' De Neubourg (1991) concludes: "working time policy did not create a growth in employment that can be assumed to lower overt unemployment considerably". De Neubourg also concludes: "judged from workers' opinions and from the programs of labor unions and political parties, it seems most plausible that working time will not be reduced further in the years to come. Employers' organizations and labor unions are currently discussing wage claims and labor-market flexibility. These are now set to become the major issues in Dutch collective bargaining".

For *Germany*, the example of the steel industry (IG Metall) stands out. In 1984, IG Metall succeeded in reducing the work week and achieved a drop from 40 to 38.5 hours a week. The subsequent drops reduced the working hours per week to 37.5 in 1987, 37 hours in 1989, 36 in 1993 and 35 in 1995 (for a detailed survey of changes in working hours, see Bosch, 1990) and Blyton, 1992). In exchange, employers were allowed to allocate hours more flexibly. Moreover, it was agreed that there would be no renegotiation of working hours before 1998.

Seifert (1991) analyzes the extent to which working time reductions in Germany during the period 1984 to 1990 have contributed to rising employment. He provides a survey of twelve studies which estimated the employment effect of the reductions in working time in different time periods, and then uses the results of these studies to estimate the total employment effect exerted by all the working time reductions since 1985. In his view about 20% of all new employment (roughly 420,000 jobs out of the total 2.12 million new jobs) during the period in question can be attributed to reductions in standard working time. Seifert notes the discrepancy between increasing employment and decreasing unemployment figures in the years in question. The fact that the number of registered unemployed declined comparatively little between 1984 and 1990 is to be attributed to the considerable rise in labor supply which can also be attributed to the decline in working time. Seifert also refers to the report of the employers' association which concludes that "standard working time reductions are now considered an unsuitable, if not actually counterproductive, employment policy measure, because they act as a brake on growth and productivity". The employers maintain that without the higher wage increase (which would have been possible if working hours had not been reduced) demand is suffering from a decline in purchasing power which has led to a slower economic growth.

As mentioned earlier, Hunt (1996) examines the impact of the reduction in standard working hours in (West) Germany, and her conclusion substantiates the claim of trade unions that the reduction in working hours has been attained with full-compensation of loss in earnings. Hunt concludes by saying that "examination of wages and actual hours does not lead to an unambiguous prediction of the net effect on employment of reducing working hours".

In 1979, workers in the *British* engineering industry started a series of 1- and 2-day national strikes in pursuit of a shorter working week. Although the initial demand was for a 35-hour week, the eventual settlement was a reduction for manual workers from 40 to 39 hours of work per week, and an increase in basic holiday entitlement to 5 weeks. As to employment effects, it appears that the reductions in working time were largely offset by increased overtime and higher productivity resulting from changes in technology and work pace (as noted by Roche et al., 1996).

The subsequent 1989-1990 dispute of the British shipbuilding and engineering unions secured a reduction in the standard working week to 37 hours. The agreement contained provisions which intended to defray some or all costs of the reduction in hours. As a result of this reduction in working hours, the productivity of workers increased substantially (as reported in Richardson and Rubin, 1993: 41). However, the absolute number of people employed did not increase [8].

[8] Among EU Member States, the United Kingdom has the largest number of average weekly hours. It is virtually unique in having little or no regulation concerning working time (as noted by Roche et al., 1996).

Blyton (1992) notes that an important similarity between the British and German campaigns of workers for a reduction in working hours is that while both started their campaign in the engineering sector, there are clear signs that these shorter hours agreements subsequently served as the basis for a more widespread reduction in working time. In Germany, as noted by Bosch (1990), by 1989 almost nine out of every ten employees covered by collective agreements had a working week below 40. Similarly in Britain, there are indications that the agreements reached between the engineering unions and individual firms within the employers' federation sector have been mirrored in non-federated engineering companies (most notably, vehicle manufacturers) and in non-engineering sectors (as noted by Blyton, 1992: 428). However, contrary to the presumptions of the trade unions, this reduction in working hours has not resulted in any decline in the overall unemployment rate in any of the two countries (as can be seen in Figure 4.1 below).

3.2 **Early retirement**

In *France*, the first early retirement scheme was established in 1972, as a result of a tripartite agreement. The scheme 'Contrats de Solidarité', which started in January 1982 and lasted for two years, was considered a big success (especially in industry) with respect to its take-up. This scheme consisted of contracts between the Government and business firms whereby the wage earners aged 55-59 were allowed to retire keeping 70% of their gross wages, provided they were replaced by new workers on a one-to-one basis. By the end of 1983, about 60% of all workers aged 60 or over had effectively retired under one guise or another, leaving room for the recruitment of nearly 210,000 additional workers (Jallade, 1991: 73). However, as noted by Roche et al. (1996), some 50% of the replacements did not come from the ranks of the unemployed but were new entrants. The generous benefit package and high take-up contributed to high costs, leading the Government to cancel the scheme within three years of its duration. Jallade (1991) notes that the loss of valuable skills was also seen as a drawback.

In April 1983 the retirement age was lowered from 65 to 60. Since about 60% of all workers aged 60 or above already took retirement under 'Contrats de Solidarité' and since the statutory age of 60 is the minimum age at which people are entitled to retire (provided they have completed a full career of 37.5 years), this 1983 policy initiative did not turn out to be a drastic step. No mandatory replacements were required for workers opting to retire after the age of 60. According to Jallade (1991), the direct employment effect of lowering the retirement age will be relatively small because the new policy substitutes for some of the early retirement schemes and also because in times of uncertainty firms are anxious to keep wage costs down and are therefore reluctant to replace experienced workers by new. However, the indirect effect on employment resulting from changes in work organization of firms and on increases in productivity is expected to be considerable.

In the *United Kingdom*, the Job Release Scheme which was introduced in 1977 offers a weekly allowance to older workers retiring early, provided their employers replace them by an unemployed person. The allowance is paid until the age of normal retirement, and varies (from £48 to £61 per week) with family and health status. Participation in the program is entirely voluntary. The scheme had a relatively low cost per job created, and Government evaluations show that the majority of applicants were from semi-skilled and unskilled lower income groups with no access to company pension schemes. The take-up of this scheme was limited, partly because of high age limits and relatively low payments (see Roche et al., 1996).

A method to reduce official unemployment figures is to count older unemployed workers among the retired. In 1983, regulations were introduced which allowed reclassification of older unemployed persons as retired. They received pensions instead of unemployment benefits and were no longer required to sign on. As mentioned in Roche et al. (1996), the growth of early retirement schemes was related to the development of 'internal' labor markets and was part of employees' fringe benefit programs, rather than reflecting a response to employment promoting policies. It is mainly for this reason that early retirement programs were concentrated in administrative and managerial grades, and in certain types of industries and in the public sector.

In *Belgium*, women over 55 and men over 60 are eligible for early retirement pensions, with mandatory replacements by unemployed persons aged under 30. However, within individual private agreements it is allowed to depart from this age requirement for retirement by settling on a lower age. This relaxation allowed firms to use early retirement as a way to shed workers. Between 1976 and 1985 more than 500,000 workers were affected by this measure. This formula has not been very popular with older workers on whom it was imposed, but has generally been well accepted by younger workers who saw it as a way to enhance their own job security (De Rongé and Molitor, 1991). One of the salient features of the early retirement program in Belgium is its high take-up. As a consequence, at present the Belgian labor force participation rate of people over 55 is among the lowest in the member countries of the European Union. The present approach combines phased early retirement and part-time work, with support from both employers and the State (Roche et al., 1996).

In *Germany*, an agreement reached in February 1996 provides an increase in the minimum early retirement age for men from 60 to 63 over the period 1997-1999. For women the early retirement age remains unchanged. This agreement arose because of the strain imposed on pension funds by the widespread use of employers of the early retirement programs to lay off workers. The State also provides incentives to encourage workers over 55 to take on part-time employment prior to retirement. In these provisions, the State provides 20% of the part-time wage of younger workers employed to substitute for older workers opting to work part-time.

In *the Netherlands*, the early retirement schemes guarantee an employee a benefit equal to about 70 to 80% of last earnings up to the age of 65. In these programs, the payment of early retirement pensions usually requires a complete withdrawal from the labor market. Moreover, these programs do not require any mandatory replacement for early retired workers. One of the conclusions which Drèze (1991) derives from the British, French, Dutch and Belgian experiences is that “a mandatory replacement provision seems to make a crucial difference in terms of job creation”. Drèze reports that in contrast to the very high replacement rates for countries with mandatory replacement for early retired workers (the UK, France and Belgium), for non-mandatory programs (as in the Netherlands) figures as low as 10 to 20% for replacement rates are mentioned.

As reported in Kapteyn and De Vos (1996), next to the early retirement schemes introduced in the 1980s two alternative exit routes out of the labor force have been, and still are, quantitatively important. The first of these is the disability insurance scheme, which has been used by both employers and employees to facilitate an early exit of employees from the labor force. The second exit route is through unemployment. The authors detail the strong incentives provided by the various exit schemes to retire early.

Plausibly the dramatic fall in labor force participation among elderly workers in the Netherlands is due to these incentives. One implication of the strong financial incentives to retire early is that the schemes are very costly to society (they are essentially all financed on a pay-as-you-go basis). This may be expected to increase wage costs for all employees, and hence have adverse employment effects.

3.3 Job sharing and part-time work

In the *United Kingdom*, a Job-Splitting Scheme was introduced in 1982. This scheme offered a subsidy to splitting existing jobs, encouraging employers to create additional employment. In this scheme, incentives were provided to fill one full-time job by two unemployed persons, one employed and one unemployed person or two existing full-time workers changing to part-time work. The scheme has been criticized on several grounds. It only allowed employers to take on unemployed persons for fewer than 16 hours per week, the limit above which the workers become entitled to legal protection against unfair dismissal. Moreover, there were no pension rights protections and because the scheme offered incentives to employ unemployed people, it may have indirectly discriminated against those who voluntarily opt to shift from full-time work to part-time work.

A Part-Time Job Release Scheme introduced in 1983 allowed early retirees to phase their retirement by sharing their jobs with an unemployed person. The employers were given a grant to recruit such a person. Participation in this program was disappointing for some of the reasons mentioned above. Apparently, British employers showed little interest in the idea of job sharing, and coupled with the fact that trade unions did not show much enthusiasm for this idea either, the idea of job sharing was not considered successful in the United Kingdom (Roche et al., 1996).

In *France*, the 'Contrats de Solidarité' scheme was replaced by a scheme offering incentives for half- time early retirement with replacement. That scheme, parallel to the British Job Splitting Scheme, was considered equally unsuccessful (Drèze, 1985).

In *Belgium*, job sharing has been combined with early retirement schemes and sabbatical leave, allowing for the recruitment of unemployed people to fill the posts on a part-time basis. In particular, the State promoted job sharing initiatives in the public sector with the aim of reducing unemployment. Employees in public administration work a reduced working week in their first year of employment, and people who are already employed can opt to cut their working time by 50%. In the education sector staff can work part-time before retirement: in this scheme employees over 50 years of age receive a reduction in their salary proportionate to the reduction in working time along with a bonus of 25% of their remaining salary if they do not take up any other job. Staff in local administration can also opt for part-time early retirement if they have been employed for at least 20 years, are aged over 55 and agree to retire at 60 (Roche et al., 1996).

In *the Netherlands*, part-time work has greatly expanded. As a result, part-time working is much more common in the Netherlands than in other European countries. The Netherlands Central Planning Bureau has calculated that the growth of part-time work increased the number of employed by 300,000 between 1979 and 1990. This in itself is an interesting example of the fallacy underlying the convential argument for worksharing, as the calculation is based on the notion that total employment in hours is given and that the increase in part-time work has led to a sharing of this total number of hours by more people. De Neubourg (1991) disagrees with the claim of the Government that work sharing (one form of which is part-time work) made significant contributions to employment growth. Nevertheless, in his view, the work sharing policies in the form of incentives for part-time work did help to reduce the imbalance between male and female workers.

The overall conclusion of Freeman (1997) is that the work sharing programs in Europe did not have much success in generating employment. This conclusion is also shared by Drèze (1985) who views the European experience with worksharing policies as a confirmation of 'theoretical warnings' about worksharing. The countries in which worksharing has been attempted already have work patterns in which extensive use is made of part-time work and have low levels of initial working time. According to Freeman (1997), the worksharing policy can be expected to have more potential for success in countries where the employees work long hours (such as Spain, Japan, the US and Canada).

4. EMPIRICAL ANALYSIS

The principal aim of the empirical analysis is to show whether or not employment is affected by worksharing. As has become clear in the previous sections, various studies have been undertaken to assess the employment effects of worksharing. Generally, these studies are of a partial nature. One either looks at particular sectors or firms and tries to establish whether jobs have been created or saved, or one considers particular aspects, e.g. whether wages have risen as a result of worksharing. The sector or firm studies are incomplete in the sense that there are several mechanisms involved that cannot be taken into account. One cannot reliably say what would have happened to output if worksharing had not been pursued: effects on labor market variables, like wages and their effects on employment at other firms have to be abstracted from, etcetera.. The consideration of particular aspects, like wage effects is useful to gain insight in the importance of certain mechanisms, but clearly they will also not tell the whole story.

Since potentially the effects of worksharing are so complicated and wide-ranging, the natural way to study these effects is by looking at whole economies. Hence, we endeavour to compare economies over time and across countries. By looking at an aggregate level, one can accommodate all sorts of feedbacks and secondary effects that cannot be dealt with by analyses at the firm or sector level. The aim of our empirical analysis is therefore to provide a systematic comparison of the experiences in different countries and to draw conclusions from that.

The outline of this section is as follows. Section 4.1 describes the data collection. Section 4.2 formulates and estimates the empirical model. The aim of the model is not primarily to obtain an accurate picture of the interplay between working hours, early retirement, labor supply, GNP, etcetera. Rather, we want the data to speak for themselves as much as possible. Our setup therefore is a vector autoregressive system, which *a priori* does not impose causal links. Rather we follow an approach of diagnostic testing to find out what the data can tell us about the direction of the causality between the variables involved. Section 4.3 provides a discussion of the statistical appropriateness of the specification of our model. Section 4.4 presents a structural model which allows for interaction of the endogenous variables within periods. In principle, this provides additional insight into the short-run dynamics of the processes involved. On the other hand, the outcomes will rest more strongly on assumptions made, and hence are less robust. To get some more feeling for the quantitative importance of various effects, Section 4.5 contains the results of some simulations of different scenarios, using the model of Section 4.2.

4.1 The data

We have gathered data on unemployment, employment, working time, wage rates, Gross National Products (GNP), Consumer Price Indices (CPIs), and demographic characteristics of the population on a yearly basis for 13 OECD countries. The data cover the time period 1971-1994.

Statistics on employment, population size, GNP and the CPI are taken from the 'International Financial Statistics' of the International Monetary Fund (IMF).[9] Employment is defined as the number of persons in paid work or self-employment. The size of the population is a midyear estimate. The CPI is a Laspeyres price index of the cost of living.

Statistics on unemployment and on the size of the population between 15 and 64 years of age are taken from the *Employment Outlook* and *Labour Force Statistics : 1970-1993* of the Organisation for Economic Co-operation and Development (OECD). Unemployment is (roughly) defined as the number of persons without employment and who are available for work and seeking work. The unemployment rate is defined as the number of persons unemployed divided by the number of persons participating in the labor force (i.e. all unemployed and employed individuals).

Statistics on wages and working time are harder to obtain. An important criterion is that the data must be consistent over time and across countries. Different data sources use different definitions of the wage rate or working time. Therefore, combining information from different data sources may lead to inconsistencies in the constructed data set. For this reason, statistics on the wage rates and working time are taken only from the publications of the International Labour Office (ILO). Working time is defined as the actual number of

9 We made use of the database provided by DATASTREAM to obtain this information.

working hours per week of an average worker in the non-agricultural sector. It must be noted here that these data on working hours are not ideal for the purpose of this paper. Possible adverse effects of work-sharing as described in the literature are typically associated with contractual limitations on the number of hours worked. Reliable data on contractual hours, however, are not available. The data we use on actual hours worked are not only influenced by such contractual limitations, but e.g. also by the share of part-time workers in the labor force. Therefore we also present a model in which the share of part-time workers is used as an additional explanatory variable.

The wage rate is defined as the corresponding gross earnings per hour. ILO statistics on wages and working time are available for 13 OECD countries: the United States, Canada, Japan, Australia, New Zealand, Belgium, France, Germany, Luxembourg, the Netherlands, Portugal, Spain and the United Kingdom. However, not for all 13 countries information on wages and working time is complete. For Canada we have information on working time from 1983 up to and including 1993 and for Spain from 1977 up to and including 1992. For the United Kingdom we have no information on working time before 1973. Only for Germany, New Zealand and the US, statistics on wages and working time were available for the year 1994. This leaves us with 281 observations [10]. We did not find a data source that could complement the ILO statistics on wages and working time in a consistent way. All information on earnings in the ILO are nominal and in national currencies. We use the CPI to convert the nominal wage rate into a real wage rate. In the empirical analysis a logarithmic specification together with the country-specific effects will control for differences in currencies.

Statistics on part-time employment are taken from the *Employment Outlook* of the OECD and *Employment in Europe* of the European Commission. The definition of part-time employment varies considerably across OECD countries. Countries usually report part-time employment based on a cut-off point of 30 or 35 hours per week. It can be based on usual working hours, actual working hours or even the respondents' perception. This makes this variable difficult to compare across countries. We have statistics on part-time employment for the US and New Zealand over the period 1971-1994, for Spain over the

10 In short: we have 11 observations for Canada, 24 for Germany, New Zealand and the US, 16 for Spain, 21 for the United Kingdom and 23 observations for the remaining seven countries.

period 1982-1994, for Portugal over the period 1979-1994, for the Netherlands over the period 1975-1994, and for the remaining eight countries over the period 1973-1994. However, for these last eight countries we have many missing observations between 1973 and 1979. We used linear interpolation to fill these gaps. Altogether, inclusion of part-time employment in our dataset implies a loss of an additional 30 observations. Thus, if we want to use part-time employment in the analysis we are left with 252 observations.

In Figures 4.1 to 4.10 the variables of most interest for each of the 13 countries are shown. These variables are respectively the unemployment rate, the employment rate, the real hourly wage rate (indexed, 1990=100), the actual hours of work per week (indexed, 1990=100), the inflation rate, real GNP per capita (indexed, 1990=100), labor supply (i.e. unemployment plus employment) as a share of the total population, the proportion of employed persons working part-time (indexed, 1990=100), the share of the population between 15 and 65, and total population size. For most countries we see similar patterns over the period 1971-1994: the unemployment rate has mostly gone up with the notable exception of the US; the real wage rate has gone up (again with the exception of the US, and to a lesser extent Canada); the number of working hours per week have gone down in most countries; the inflation rate exhibits a cyclical pattern plus a downward trend in most countries; GNP per capita is generally rising; labor supply as a proportion of the total population is rising in the US, Canada, Japan, the UK, and Portugal, whereas it is falling or rather stable in other countries; the proportion of part-time workers appears to be going up everywhere.

Figure 4.1: Employment rate over the period 1971-1994, per country

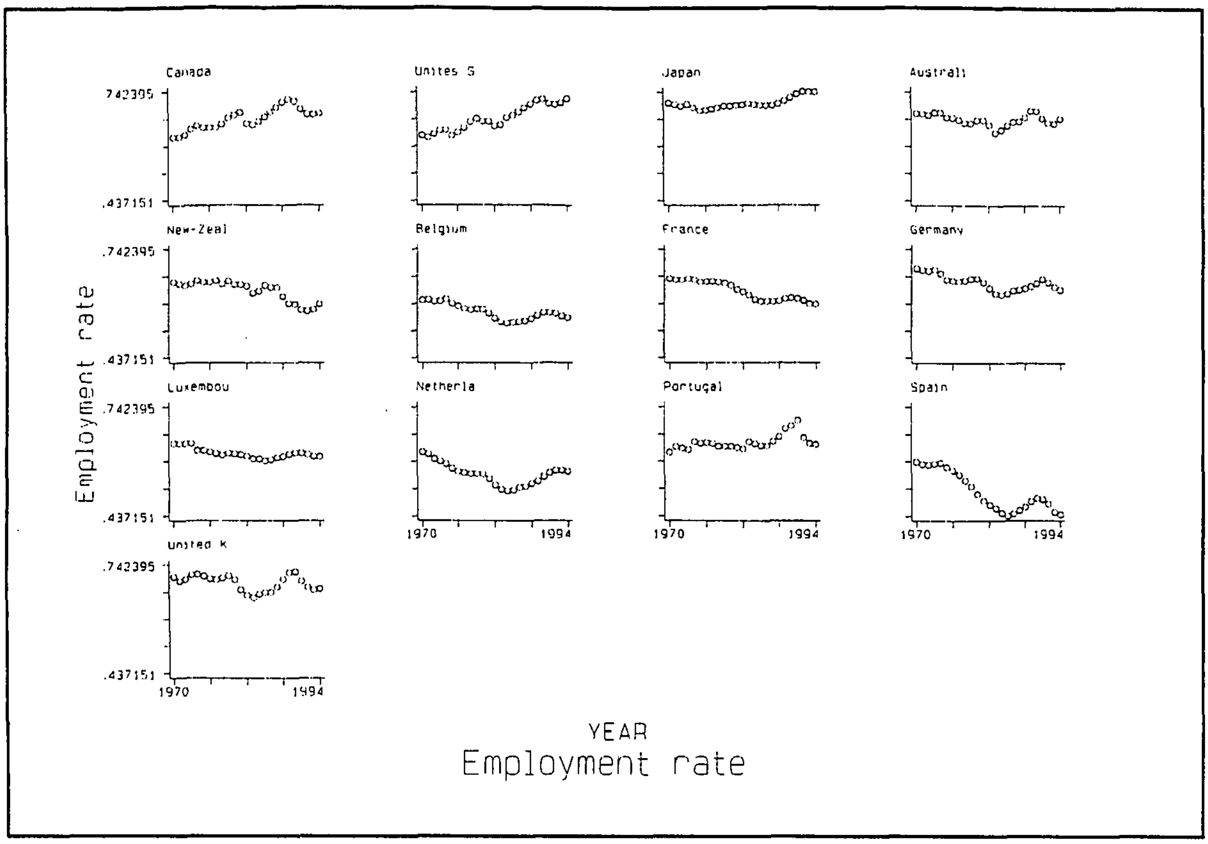


Figure 4.2: Unemployment rate over the period 1971-1994, per country

Figure 4.3: Real hourly wages over the period 1971-1994, per country (1990=100)

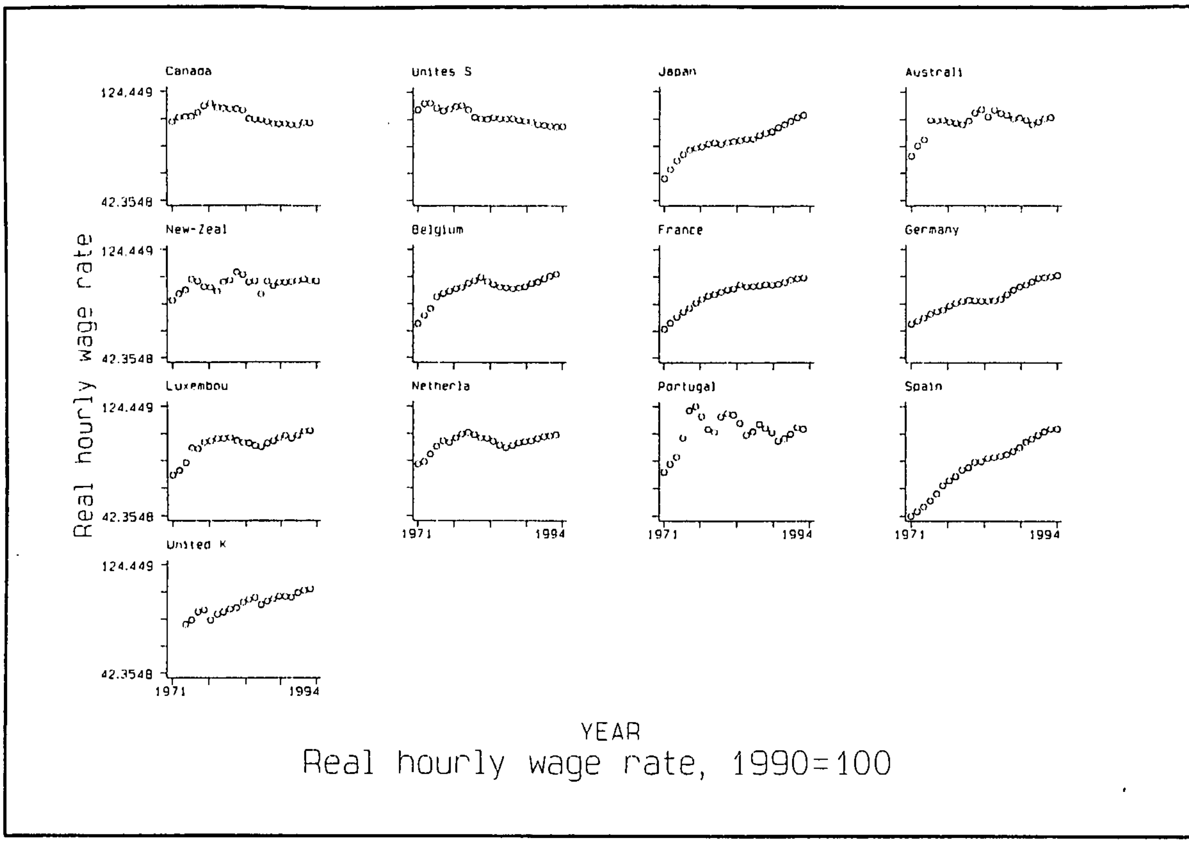


Figure 4.4: Average working hours per week over the period 1971-1994, per country

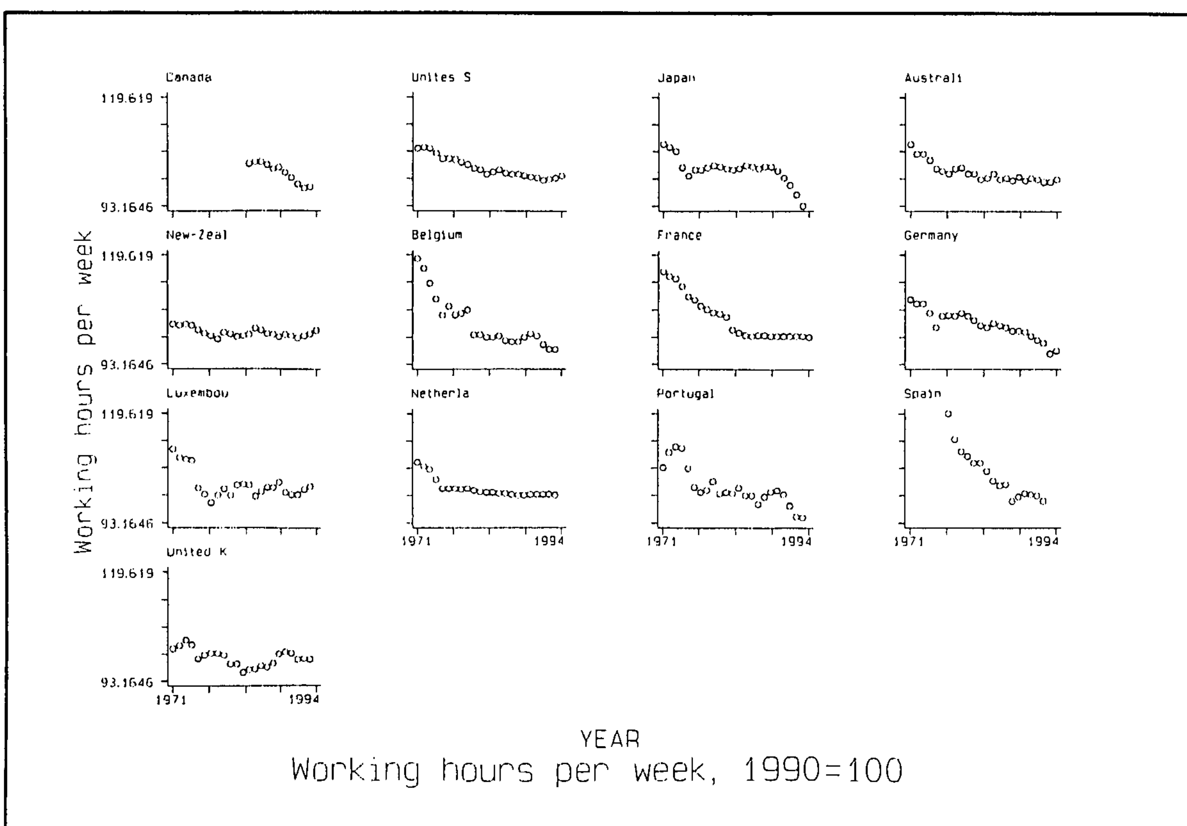


Figure 4.5: The inflation rate over the period 1971-1994, per country

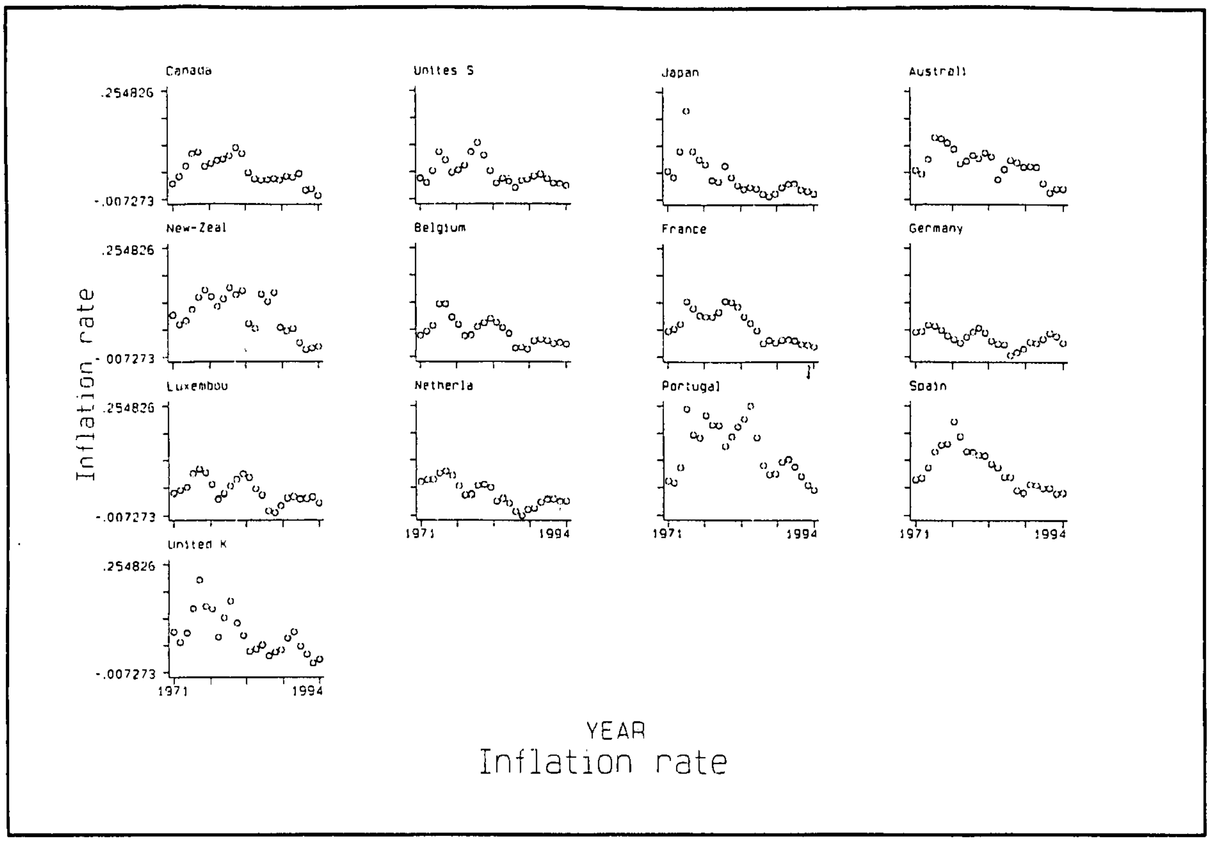


Figure 4.6: Real GNP per capita over the period 1971-1994, per country

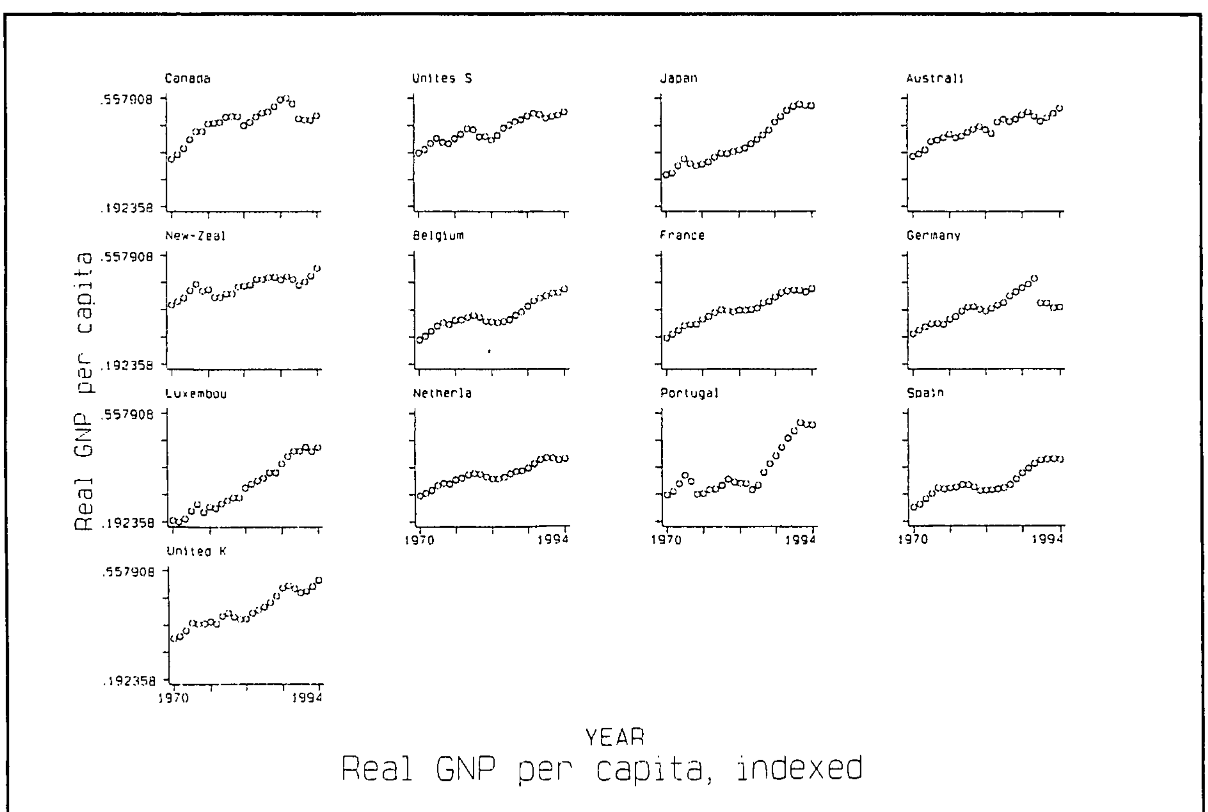


Figure 4.7: Labor supply (employed + unemployed) as a ratio of the population size over the period 1971-1994, per country

Figure 4.8: share of part-time employment in total employment over the period 1971-1994, per country (1990=100)

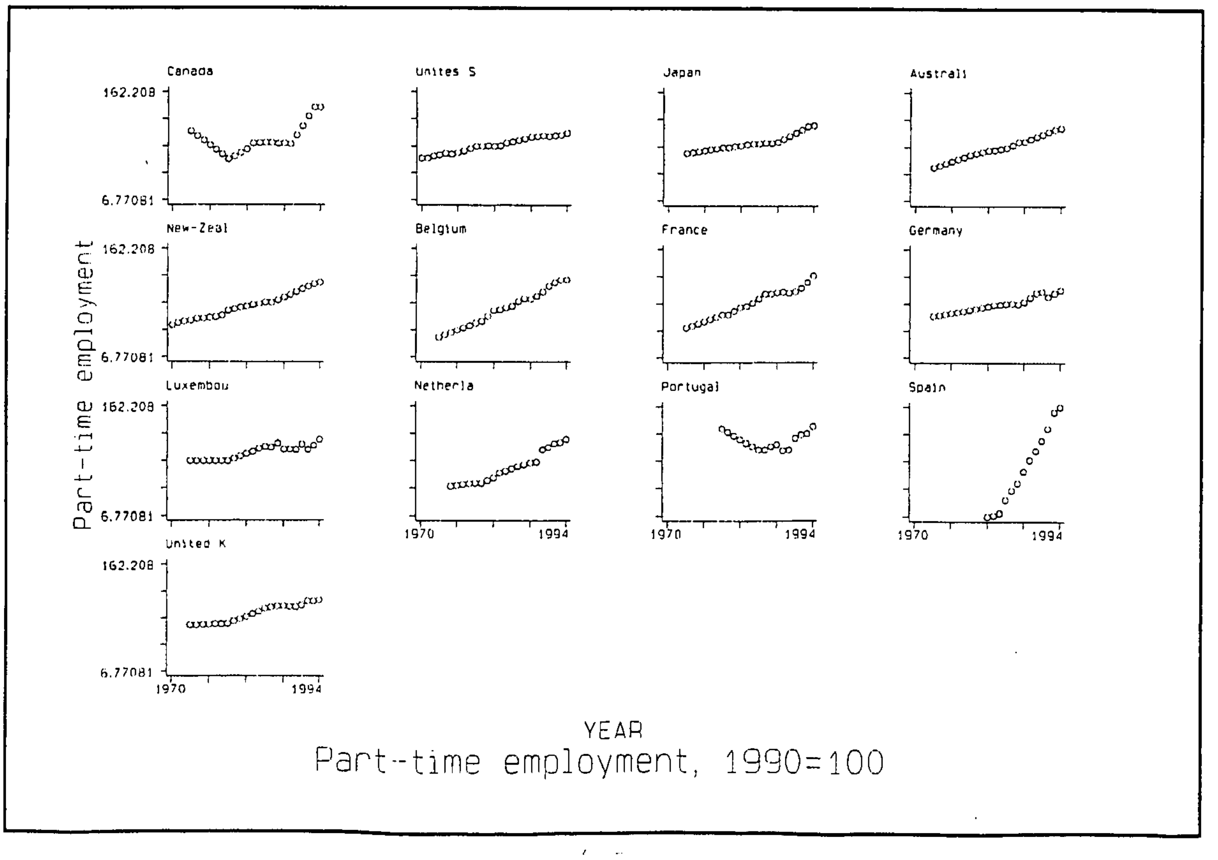


Figure 4.9: Share of the population between the age of 15 and 65 in the period 1971-1994, per country

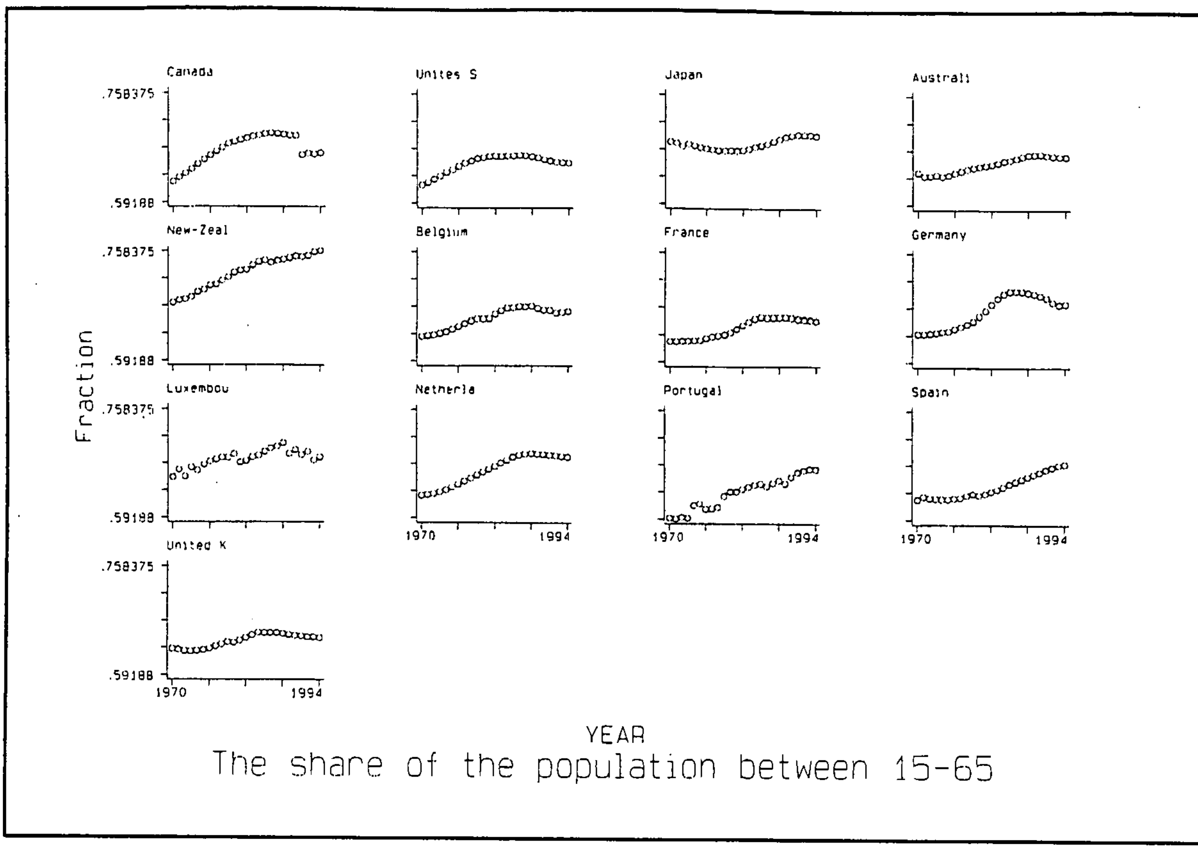
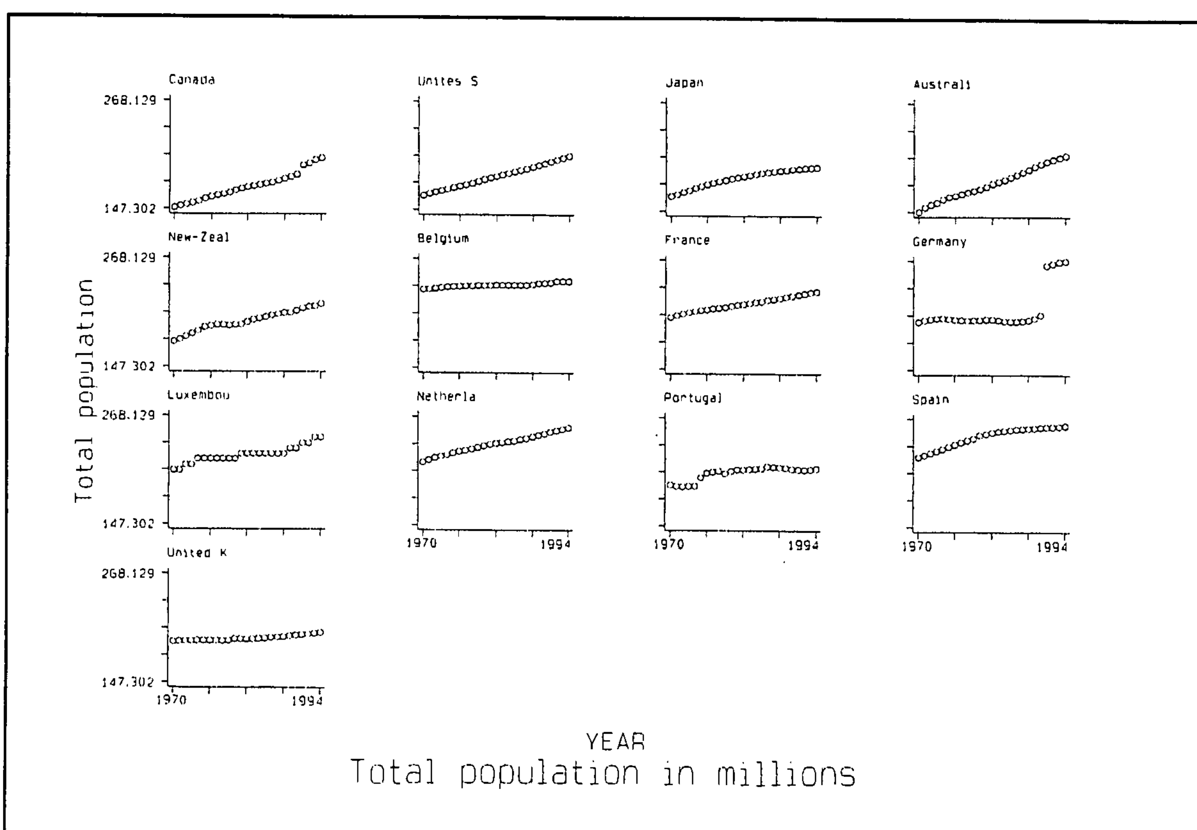


Figure 4.10: Total population in millions, in the period 1971-1994 per country



4.2 Causal relationships between variables of interest

We consider the dynamic relation between the following variables: rate of employment (E_{it}), real hourly wages (W_{it}), working hours (H_{it}), GNP per capita (Y_{it}), labor supply (L_{it}) measured as the ratio of the size of the labor force and the total population, and the CPI (P_{it}). Furthermore, we include the effect of two exogenous variables, to wit total population size (S_{it}) and the share of the population between 15 and 64 years (V_{it}). Initially, we model this dynamic relation in the following VAR (Vector AutoRegression) form:

$$\begin{pmatrix} E_{it} \\ W_{it} \\ H_{it} \\ Y_{it} \\ L_{it} \\ P_{it} \end{pmatrix} = \begin{pmatrix} \mu_i^e \\ \mu_i^w \\ \mu_i^h \\ \mu_i^y \\ \mu_i^l \\ \end{pmatrix} + \begin{pmatrix} \alpha_1^e \alpha_2^e \alpha_3^e \alpha_4^e \cdots\cdots \alpha_{17}^e \alpha_{18}^e \\ \alpha_1^w \alpha_2^w \alpha_3^w \alpha_4^w \cdots\cdots \alpha_{17}^w \alpha_{18}^w \\ \alpha_1^h \alpha_2^h \alpha_3^h \alpha_4^h \cdots\cdots \alpha_{17}^h \alpha_{18}^h \\ \alpha_1^y \alpha_2^y \alpha_3^y \alpha_4^y \cdots\cdots \alpha_{17}^y \alpha_{18}^y \\ \alpha_1^l \alpha_2^l \alpha_3^l \alpha_4^l \cdots\cdots \alpha_{17}^l \alpha_{18}^l \\ \alpha^p \alpha^p \alpha^p \alpha^p \cdots\cdots \alpha^p \ \alpha^p \end{pmatrix} \begin{pmatrix} E_{it-1} \\ E_{it-2} \\ E_{it-3} \\ W_{it-1} \\ \vdots \\ P_{it-2} \end{pmatrix} + \begin{pmatrix} \beta_1^e \beta_2^e \cdots \beta_8^e \\ \beta_1^w \beta_2^w \cdots \beta_8^w \\ \cdots\cdots \\ \cdots\cdots \\ \beta_1^l \beta_2^l \cdots \beta_8^l \\ \beta^p \beta^p \cdots \beta^p \end{pmatrix} \begin{pmatrix} S_{it} \\ S_{it-1} \\ S_{it-2} \\ S_{it-3} \\ \vdots \\ V_{it-3} \end{pmatrix} + \begin{pmatrix} \varepsilon_{it}^e \\ \varepsilon_{it}^w \\ \varepsilon_{it}^h \\ \varepsilon_{it}^y \\ \varepsilon_{it}^l \\ \varepsilon^p \end{pmatrix} \qquad (4.1)$$

Countries are indexed by i and the time period is indexed by t. The variables μ_i are country-specific dummy variables. The country-specific dummy variables account for various things. Since all variables are in logs, the dummies absorb differences in units across countries (e.g. differences in population size, or currencies). Additionally, the country-specific dummies also account for unobserved differences across countries. The error terms ε_{it} of each equation have mean zero, finite variance and are allowed to be correlated. By testing restrictions on the parameters of this system we test for the different causal relationships. To be more precise, we test for the presence of Granger causality (e.g. Spanos, 1986). For instance, a rejection of the null-hypothesis H_0: $\alpha_1^w=\alpha_2^w=\alpha_3^w= 0$ in the second equation implies that the history of employment has a significant impact on current wages, i.e. a change in employment causes a change in wages. It is then said that employment (Granger) 'causes' wages. If on the other hand the null-hypothesis would be accepted, we would accept the hypothesis that employment does not cause wages.

In addition to the system of equations (4.1) we will also consider a similar system but with employment replaced by unemployment. We cannot consider unemployment and employment in one system, as there is a definitional relation between employment, unemployment and labor supply.

As a further variant, we also look at extensions of the system of equations (4.1) where an additional equation for part-time is added. Since the use of the part-time variable induces a loss of observations (see above), we carry out most of the analyses without this variable.

The estimation of a system like this requires some care. It is well-known that estimation of each of the equations by OLS will lead to inconsistent estimators unless the number of periods considered goes to infinity. The reason for this lies in the presence of the country dummies. A relatively simple way around this is to take first differences, so that the country dummies drop out. One then has an error term which becomes a moving average. This means that every endogenous variable on the right hand side of the transformed equations which is dated t or (t-1) is potentially correlated with the transformed error. A way to get around this problem is to use instrumental variables. Any exogenous variable or any endogenous variable dated (t-2) or earlier is a valid instrument (see for instance Holtz-Eakin, Newey, and Rosen, 1988). Following their approach, we write the equations as first differences, and use lagged endogenous variables dated (t-2), (t-3), (t-4), or (t-5) as instruments along with the exogenous variables [11].

The estimation results of the system of equations (4.1) are reported in tables A1 to A3 of Appendix A for three versions: the six equations in (4.1), a version with the part-time variable added to the VAR, and a version of (4.1) with employment replaced by unemployment. The results of the corresponding Granger causality tests are reported in Table 4.1. In view of the purpose of the current analysis we mainly concentrate on the relation between hours worked per week, employment, and wages.

Table 4.1 suggests that hours worked per week are hardly affected by wages. The main variable having an effect on hours worked per week is the growth of the population. One

[11] We have ignored the correlation between the error terms of the equations in (4.1). This is justified by the fact that the right hand side variables in all equations are identical. It is well-known that in such a case estimation equation by equation yields identical results as systems estimation.

possible interpretation is that population growth affects the age distribution of the labor force. The estimation results in Table A1 then tell us that a younger labor force works fewer hours than an older one. This is confirmed by the results for part-time work, which show that population growth has a significant effect on the share of part-time work in the economy.[12] Not surprisingly, the specification including part-time work shows an effect of the percentage of part-time work in the past on the average number of hours currently worked in the economy.

[12] This may largely be the result of a cohort effect in female labor force participation. In many countries the younger cohorts of females participate more in the labor market than the older cohorts. Since females work more often part-time than males, this will reduce the average number of hours worked per week.

Table 4.1: F-tests, the null-hypothesis is no causal relationship

Null-Hypothesis	Model 4.1	Include part-time	Null-Hypothesis	Unemployment rate, instead of empl. rate
W ≠> E	0.14	0.26	W ≠> U	0.20
H ≠> E	0.77	1.51	H ≠> U	0.20
Y ≠> E	2.77*	1.05	Y ≠> U	2.36*
L ≠> E	1.04	1.00	L ≠> U	0.42
P ≠> E	0.35	1.53	P ≠> U	0.29
S ≠> E	2.54**	2.96**	S ≠> U	2.48**
V ≠> E	0.72	1.43	V ≠> U	0.88
D ≠> E		0.53	D ≠> U	
E ≠> W	1.58	1.09	U ≠> W	1.30
H ≠> W	0.45	0.52	H ≠> W	0.93
Y ≠> W	2.57*	1.28	Y ≠> W	2.80**
L ≠> W	1.52	0.94	L ≠> W	0.43
P ≠> W	0.87	0.11	P ≠> W	1.07
S ≠> W	1.07	1.05	S ≠> W	0.85
V ≠> W	1.62	0.63	V ≠> W	1.05
D ≠> W		0.09	D ≠> W	
W ≠> H	1.15	0.85	W ≠> H	1.38
E ≠> H	0.49	0.52	U ≠> H	1.53
Y ≠> H	0.31	0.45	Y ≠> H	0.55
L ≠> H	1.02	0.58	L ≠> H	0.79
P ≠> H	1.29	0.02	P ≠> H	2.01
S ≠> H	3.36**	2.37*	S ≠> H	2.94**
V ≠> H	0.23	0.38	V ≠> H	0.21
D ≠> H		4.66**	D ≠> H	
W ≠> Y	0.71	0.53	W ≠> Y	0.17
H ≠> Y	0.23	0.50	H ≠> Y	0.27
E ≠> Y	1.69	0.70	U ≠> Y	5.41**
L ≠> Y	1.28	1.63	L ≠> Y	0.26
P ≠> Y	0.58	0.59	P ≠> Y	0.18
S ≠> Y	6.83**	39.96**	S ≠> Y	96.85**

V ⇏ Y	0.60	0.75	V ⇏ Y	0.11
D ⇏ Y		0.41	D ⇏ Y	
W ⇏ L	0.62	0.85	W ⇏ L	0.89
H ⇏ L	1.53	0.65	H ⇏ L	1.50
Y ⇏ L	1.58	0.15	Y ⇏ L	1.17
E ⇏ L	0.95	1.38	U ⇏ L	0.99
P ⇏ L	0.11	2.86**	P ⇏ L	0.10
S ⇏ L	6.4**	7.84**	S ⇏ L	5.73**
V ⇏ L	23.6**	32.04**	V ⇏ L	22.75**
D ⇏ L		0.94	D ⇏ L	
W ⇏ P	0.72	0.67	W ⇏ P	1.95
H ⇏ P	0.94	0.76	H ⇏ P	1.18
Y ⇏ P	1.26	0.62	Y ⇏ P	0.48
L ⇏ P	2.42*	2.24*	L ⇏ P	2.48*
E ⇏ P	1.19	0.75	U ⇏ P	3.29**
S ⇏ P	1.46	1.19	S ⇏ P	1.17
V ⇏ P	1.97	1.10	V ⇏ P	1.18
D ⇏ P		0.11	D ⇏ P	
W ⇏ D		0.58	W ⇏ D	
H ⇏ D		1.51	H ⇏ D	
Y ⇏ D		0.53	Y ⇏ D	
L ⇏ D		0.04	L ⇏ D	
P ⇏ D		0.26	P ⇏ D	
S ⇏ D		4.50**	S ⇏ D	
V ⇏ D		1.73	V ⇏ D	
E ⇏ D		0.21	U ⇏ D	

* significant at the 10% level
** significant at the 5% level

Wages appear to be only weakly influenced by the other variables in the model. Both in the specifications with employment and with unemployment there is a causal effect of GNP per capita on wages. This effect disappears if we include part-time work in the model.

As to labor supply (defined as the size of the total labor force divided by population size) we find a strong demographic influence (if the total population or the total population between the age of 15 and 64 goes up, this raises labor supply). Remarkably enough, there is a significant effect of inflation on labor supply in the specification including part-time work. It is not clear how to interpret this. The size of the effect is not large, however.

As regards employment or unemployment, the main effects on these variables are from GNP per capita and population growth, both with a positive effect on employment (and a corresponding negative effect on unemployment). There is no evidence of a causal effect of number of working hours, labor supply, or the share of part-time workers on employment or unemployment. Moreover, Tables A1, A2, and A3 show that the effects are often in the 'wrong' direction. Specifically if one decreases hours worked per week, Table A1 shows that this tends to reduce employment. A similar outcome is found in Table A2 (where part-time work is introduced as an additional explanatory variable). The specification of Table A3 (unemployment instead of employment) leaves open the possibility that shorter hours reduce unemployment, but estimates are completely insignificant. Tables A1 and A2 suggest a slightly positive long-run effect of labor supply on employment (the sum of the coefficients for the three lags of L_t is positive). Table A3 on the other hand allows a long-term positive effect of labor supply on unemployment (more labor supply implies higher unemployment).

4.3 Statistical considerations and sensitivity analyses

The estimation of the system of equations (4.1) in first difference form avoids a potential complication with the data used here, namely that some of the data series would have a unit root. The first differencing turns any I(1) variable into an I(0) variable. Thus we can resort to 'classical' statistical inference and employ standard asymptotic theory.

In view of the way the data have been collected, one would suspect that measurement error might be a problem in some cases. As pointed out by Holtz-Eakin, Newey and Rosen

(1988) a simple way to check this is to repeat the estimation of the complete model (4.1) but to use instruments dated (t-5) or earlier. The results of the associated causality tests are not reported here, but the main finding with respect to the alternative instrument set can be summarized very succinctly: very few variables are still significant. This results in very few causality tests yielding significant effects. In particular, once again no causal effects of working hours per week or of total labor supply on employment are found.

Returning to further diagnostic testing of specification (4.1) in first difference form, we consider the quality of the instruments used. The results of the partial F-tests in Table 4.2 indicate that most instruments correlate significantly with the right hand side variables in (4.1) to be valid instruments. The cases where no significance is found indicate that we may have to be careful in making statistical inference based on conventional asymptotic distribution theory (cf. Bekker, 1994; Staiger and Stock, 1997). The tests of over-identifying restrictions for the instruments generally yield satisfactory results. The only equation which appears to be specified too restrictively is the one for GNP per capita. The tests indicate that some of the instruments should appear in the equation for GNP directly, implying that possibly more lags would be needed to completely characterize the dynamics in GNP per capita. Since the explanation of GNP is not of central importance for our study, we do not attempt further improvements in the specification. To a lesser extent, the same comment can be made about the equation for wages.

Table 4.2: Goodness of fit and the tests for the validity of the instruments. The number of observations is 216 per equation.

Equation	Goodness of fit R^2	Validity of the instruments Over-identifying restrictions	Partial F-test
Employment	0.33	6.48	1.10
Wage	0.28	25.9*	2.05**
Hours	0.19	21.6	1.88**
GNP	0.38	30.2**	1.89**
Labour Supply	0.42	6.05	1.81**
Consumer Price Index	0.29	9.7	1.42

* significant at the 10% level
** significant at the 5% level
Over-ID test: critical value Chi (18) = 28.9

Table 4.3 presents some more test outcomes. The first column presents a test of serial correlation between the errors in the first differenced form of the model and errors two periods earlier. Recall that we have assumed that the errors in the original version of the model were serially uncorrelated. This implies that errors in a first differenced version follow an MA(1) process, i.e. now errors of subsequent years are correlated, but not errors that are more than one year apart. The tests indicate that this condition is satisfied in all cases.

Table 4.3: Model specification tests

Equation	Serial Correlation 1)	Heteroscedasticity 2)	Non-Linearities 3)
Employment	-0.89	0.72**	5.57**
Wage	0.89	4.83**	0.98
Hours	1.09	5.86**	0.68
GNP	0.45	0.21	2.82**
Labor Supply	0.37	25.3**	4.10**
Consumer Price Index	-1.56	4.46**	0.19

* significant at the 10% level
** significant at the 5% level
1) Student t-test
2) Cook-Weisberg test
3) RESET-test

The second column indicates significant heteroskedasticity. This is less of a problem than the other outcomes. Heteroskedasticity only affects the efficiency of the estimated parameters, not their consistency. To make sure that our statistical inference is not affected by the heteroskedasticity of the errors, we have used White standard errors throughout.

The third column indicates that the functional form of the model for GNP per capita, employment, and labor supply may be too restrictive. The fact that the equation for GNP exhibits specification problems may reflect the same problem as with the tests on over-identifying restrictions with respect to the instruments, namely that more lags are necessary to obtain a fully satisfactory specification. Clearly, the log-linear specification may be too restrictive in some cases. Therefore, the specifications adopted will mainly have to be seen as local approximations.

Pesaran and Smith (1995) have pointed out that the assumption implicit in equation system (4.1), that slope parameters are identical across countries, may lead to considerable biases if the hypothesis is not true. In principle, one might hope that by assuming that parameters are identical across countries, one would estimate some 'average' relationship across all countries. However, Pesaran and Smith (1995) show that if the explanatory variables exhibit positive autocorrelation, the average long-run effect of the right hand side variables on the dependent variables will be over-estimated. One should note that this effect would tend to bias our tests for causal effects of hours worked per week or of total labor supply in the direction of finding causal effects even if these do not exist. So, the fact that we do not find such effects of hours or labor supply on unemployment cannot be ascribed to such a bias, on the contrary.

4.4 A semi-structural model

The analysis so far has been of a reduced form nature. By allowing generous parameterizations and by performing various specification tests, we have tried to let the data speak for themselves as much as possible. Yet, it may be of interest to consider some of the underlying relationships in more depth. For that purpose we consider some structural models of which (4.1) can be seen as a reduced form. Since the limited set of endogenous and exogenous variables we are considering clearly cannot describe all interactions between the endogenous variables of interest, we will term these models 'semi-structural'.

We consider six equations, one for each endogenous variable. In contrast to (4.1) we now include on the right hand side of each equation a number of contemporaneous endogenous as well as exogenous variables. At the same time we exclude some variables, which on *a priori* grounds are believed not to be relevant for the explanation of the variable of interest. In Table 4.4, we indicate per equation which variables are included and which ones are excluded. All variables are again in log-form, although for simplicity this is not shown in Table 4.4. All equations satisfy the necessary order conditions for identification of the parameters, but the equations for ln(W), ln(Y) and ln(P) do not satisfy the necessary and sufficient rank conditions. Hence, the parameters in these equations are not identified.

In Table 4.5 we consider a somewhat different set of exclusion restrictions. Now only the equation for ln(W) remains unidentified. We found it impossible to come up with plausible exclusion restrictions which would identify the parameters in the log-wage equation. To avoid arbitrariness as much as possible we have therefore simply accepted the fact that the wage equation is not identified. Table 4.6 summarizes the result of 2SLS-estimation of the models given in Tables 4.4 and 4.5. For clarity we present the parameter estimates for the contemporaneous variables only.

Table 4.4: Included and excluded variables per equation for model 1 (subscript '-1' means all lagged variables, 'x' means included, and '0' means excluded)

	E	E_1	W	W_1	H	H_1	Y	Y_1	L	L_1	P	P_1	S	S_1	V	V_1	Equation identified?	# of excl. restrictions
E	-	x	x	x	x	x	x	x	x	x	0	0	0	0	0	0	Y	12
W	x	x	-	x	x	x	x	x	x	x	x	x	0	0	0	0	N	8
H	x	x	x	x	-	x	x	x	0	0	0	0	0	0	x	x	Y	12
Y	0	0	x	x	x	x	-	x	x	x	x	x	0	0	x	x	N	8
L	x	x	x	x	x	x	0	0	-	x	0	0	x	x	x	x	Y	8
P	x	x	x	x	0	0	x	x	x	x	-	x	0	0	x	x	N	8

Table 4.5: Included and excluded variables per equation for model 2 (subscript '-1' means all lagged variables, 'x' means included, and '0' means excluded; symbols in bold indicate differences with Table 4.4)

	E	E_1	W	W_1	H	H_1	Y	Y_1	L	L_1	P	P_1	S	S_1	V	V_1	Equation identified?	# of excl. restrictions
E	-	x	x	x	x	x	x	x	x	x	0	0	0	0	0	0	Y	12
W	x	x	-	x	x	x	x	x	x	x	**0**	**0**	0	0	**x**	**x**	N	8
H	x	x	x	x	-	x	x	x	0	0	0	0	0	0	x	x	Y	12
Y	0	0	x	x	x	x	-	x	x	x	x	x	**x**	**x**	**0**	**0**	Y	8
L	x	x	x	x	x	x	0	0	-	x	0	0	x	x	x	x	Y	8
P	x	x	x	x	0	0	x	x	x	x	-	x	0	0	x	x	Y	8

Table 4.6: Estimates of the parameters corresponding to the contemporaneous endogenous variables (standard errors are in parentheses)

Equation	Model 1						Model 2					
	H	W	Y	E	L	P	H	W	Y	E	L	P
dlnE	0.37 (0.23)	-0.01 (0.08)	0.01 (0.05)	-	0.22 (0.15)	-	Estimates identical with model 1					
dlnW	Parameters not identified						Parameters not identified					
dlnH	-	0.15* (0.09)	0.04 (0.05)	0.30 (0.24)	-	-	Estimates identical with model 1					
dlnY	Parameters not identified						0.82 (0.65)	0.28 (0.25)	-	-	0.02 (0.41)	-0.19 (0.42)
dlnL	-0.21* (0.12)	0.01 (0.04)	-	0.45** (0.10)	-	-	Estimates identical with model 1					
dlnP	Parameters not identified						-	-0.37** (0.14)	-0.02 (0.10)	-0.29 (0.67)	0.53 (0.98)	-

* significant at the 10% level
** significant at the 5% level

Although very few estimates are significant, some findings are still of interest. First of all, we find at total labor supply is positively related to total employment [13]. This points to a discouraged worker effect: if employment opportunities decrease, fewer workers will be seeking work. Although not significant, we do find the expected negative relation between hours worked and total labor supply. This negative effect of hours worked would indicate an added worker effect: if both the number of hours per week and earnings of the primary worker in a household fall, then the secondary worker will start looking for a job.

The positive (though not significant) effect of total labor supply on employment may come as a bit of a surprise.[14] Two comments can be made here. First of all, it certainly runs counter to the intuition of a simple-minded argument for worksharing: rather than being constant, the size of the cake actually increases faster than the number of eaters. Secondly, without further analysis, one can only speculate about the exact mechanism behind this finding. A possible interpretation would be that in the short run a fall in labor supply (e.g. due to early retirement) has such detrimental effects on production that employment falls by more than the reduction in labor supply (see also below). As to the effect of shorter working hours, we observe that a reduction of hours will decrease employment, although again the effect is not significant. Apparently, also this method of artificially reducing labor supply may lead to a fall in production which reduces employment more than the fall in labor supply. In the longer run, the economy will reach a new equilibrium where most of the negative effects of shorter hours or early retirement disappear. This follows from the VAR-estimates presented earlier, which indicated an insignificant effect of shorter hours or early retirement (though still negative) on employment.

The model estimated here is not rich enough to provide the precise reason for the possible adverse short-run effects of shorter hours or early retirement on employment. The literature survey presented in Chapter 2 has provided a number of mechanisms that may be at work. For instance, if the currently unemployed are very different from the currently employed

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13 Since labor supply is measured as the sum of unemployment and employment, any measurement error in unemployment or employment transmits into measurement error in labor supply. One might suspect, therefore, that this may lead to spurious correlations between labor supply and employment, or between labor supply and unemployment. However, the 2SLS-estimation procedure amounts to instrumenting of the endogenous variables on the right hand side of each equation. Among other things, this will take care of spurious correlations due to measurement error.

14 Again, we can rule out correlated measurement errors as a cause of this finding, due to the IV-estimation method.

(or have complementary skills rather than substitutable ones), an artificial reduction in labor supply will not get many of the unemployed a job. At the same time, the reduction in labor supply implies a fall in earnings (remember that wages are a separate explanatory variable) which will reduce consumption and thereby aggregate demand. Since, furthermore, shorter hours increase labor costs, the demand for labor may fall. In the longer run, these effects are mitigated. The VAR-estimates suggest that in the new equilibrium employment will not be appreciably different.

The other effects found in Table 4.6 are of less interest for the purpose of this study. Hours worked respond positively to higher wages (statistically significant at the 10% level) and to more employment (not significant). A different effect of worksharing may be a loss in output. The estimates for the GNP per capita equation in model 2 suggest that shorter hours per week lead to a reduction in output, although the effect is not significant. The effect of total labor supply on output appears to be negligible.

4.5 **Simulations**

Since the primary motivation for this paper lies in an evaluation of the effects of worksharing policies in the Netherlands, we use the VAR-estimates to simulate a number of counter-factuals for the Netherlands. The simulations all assume that hours per week and labor supply can be taken as exogenous. This is consistent with the notion of worksharing which after all is predicated upon the belief that working hours and labor supply can be manipulated to achieve policy goals.

In the first simulation we assume that total labor supply follows its actual time path since 1970, and working hours per week have not changed since 1976. Figures 4.11a to 4.11d show the time path of employment, unemployment, the real hourly wage, and weekly working hours. Not surprisingly, in view of the estimation results presented earlier we find that this 'long hours scenario' would have led to more employment and less unemployment than actually observed during this period. Hourly wages would have been lower as well.

In the second simulation we consider the effect of a one-time extra reduction of weekly working hours by 5% in 1980. Figures 4.12a to 4.12d present the results of this simulation.

Unemployment would have been a couple of percentage points higher. Employment would have been appreciably lower. Wages would have been higher.

These simulations are purely illustrative. In view of the relatively few significant coefficients in the VAR-estimates, one should not attach too much value to them.

Figure 4.11a: Simulation results for the Netherlands based on estimation results of model 4.1: ***Employment***

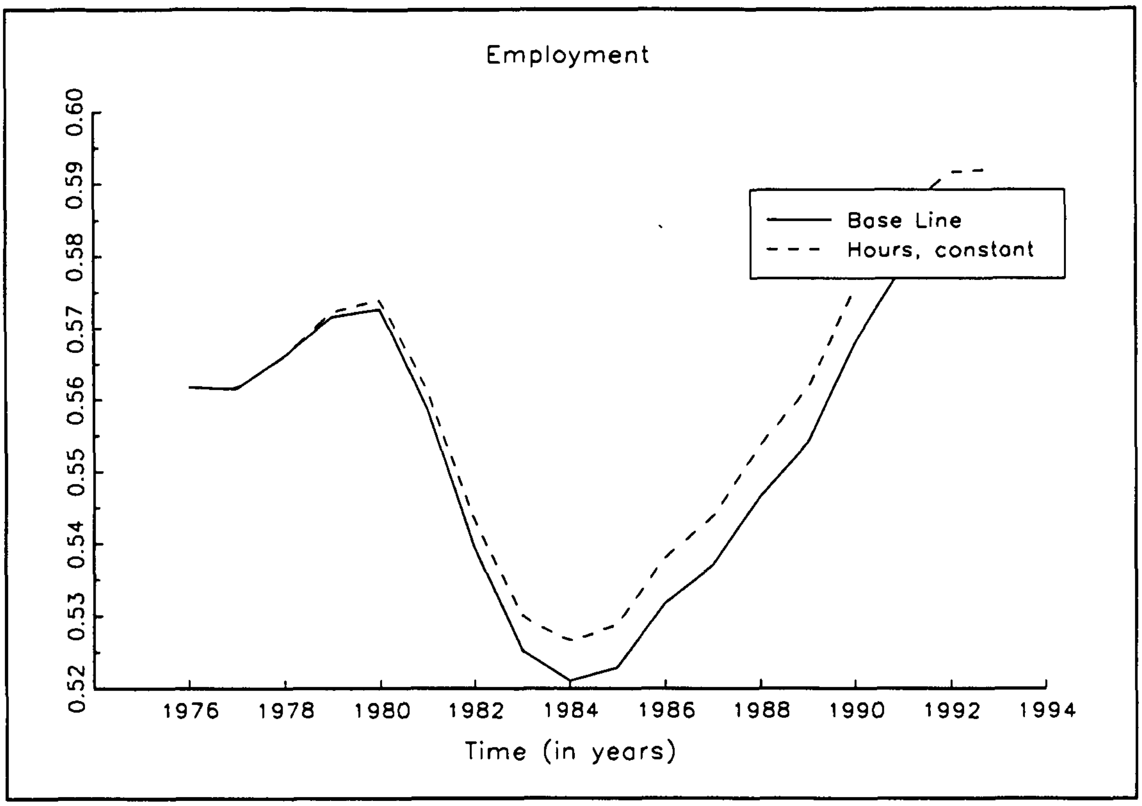


Figure 4.11b: Simulation results for the Netherlands based on estimation results of model 4.1: *Unemployment*

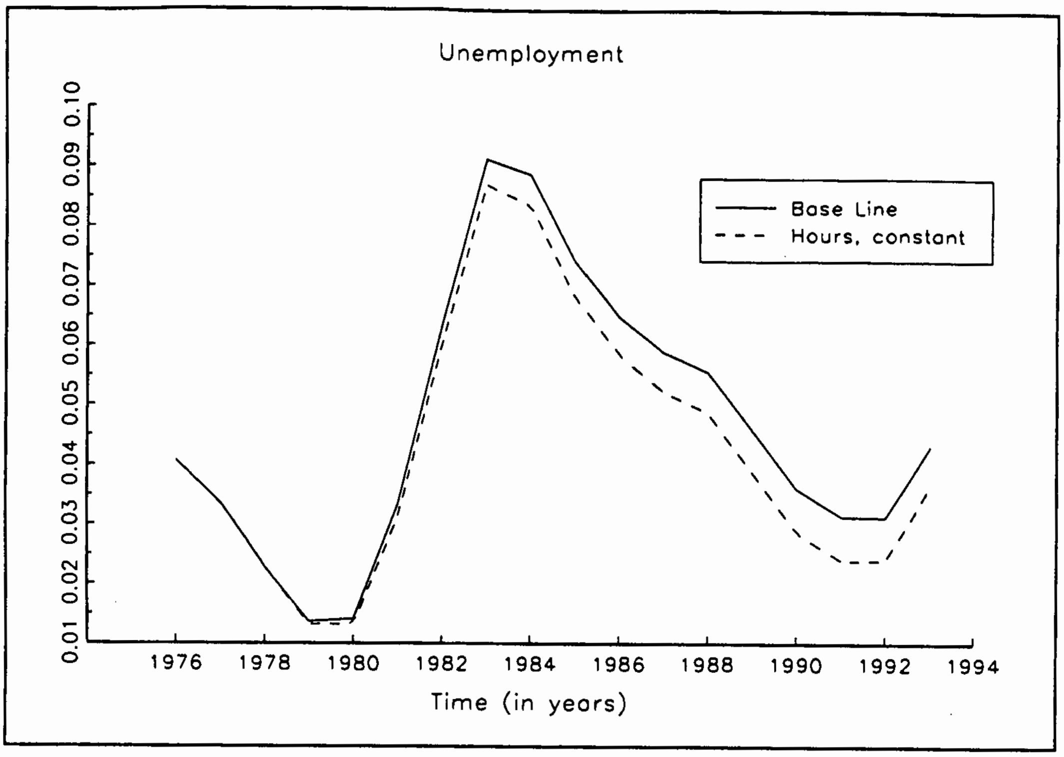


Figure 4.11c: Simulation results for the Netherlands based on estimation results of model 4.1: *Real hourly wage*

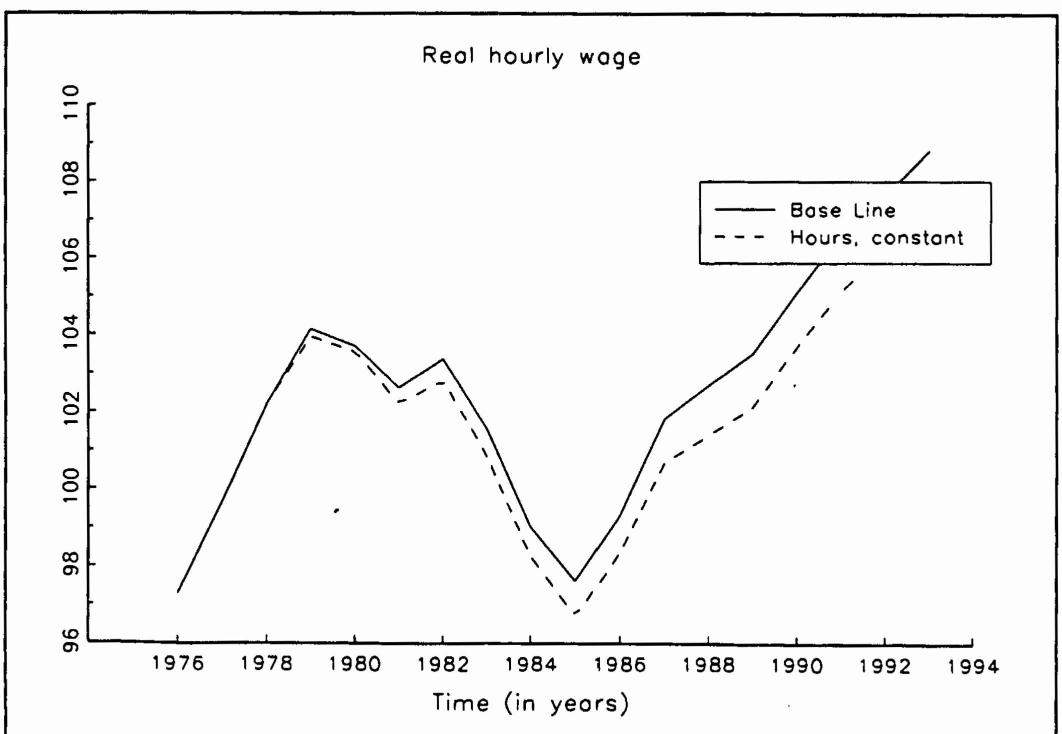


Figure 4.11d: Simulation results for the Netherlands based on estimation results of model 4.1: ***Weekly hours of work***

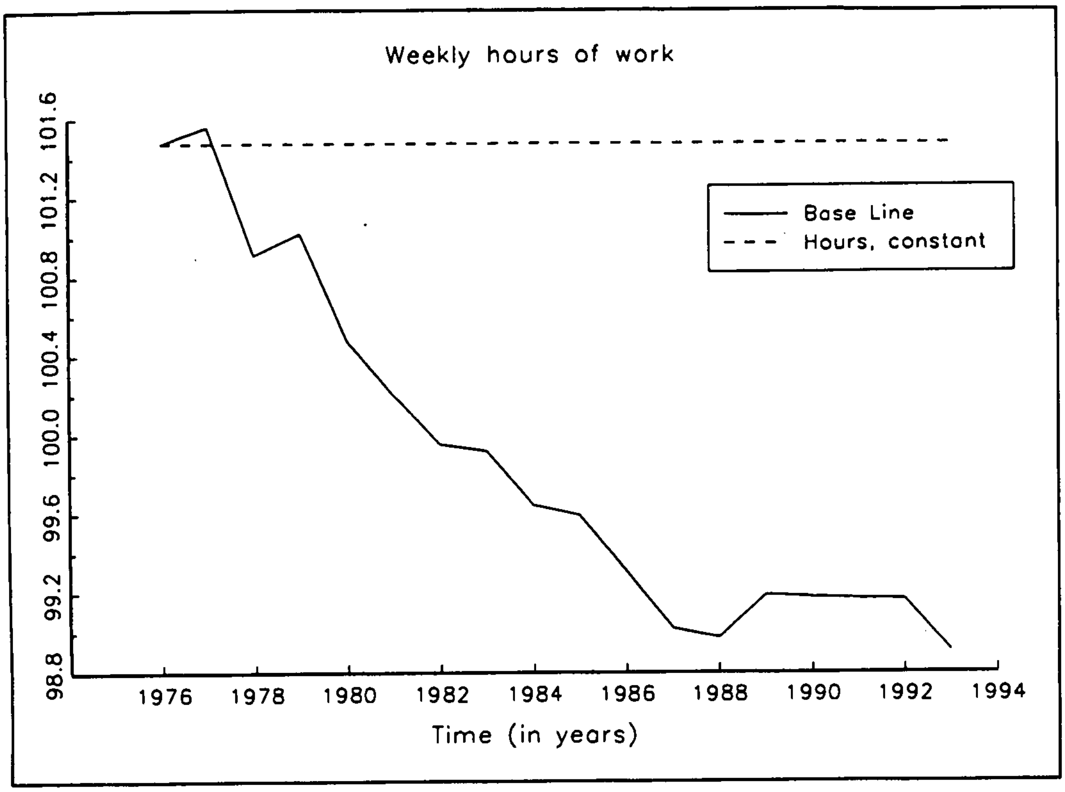


Figure 4.12a: Simulation results after a reduction of 5% in the hours of work per week in 1980: ***Employment***

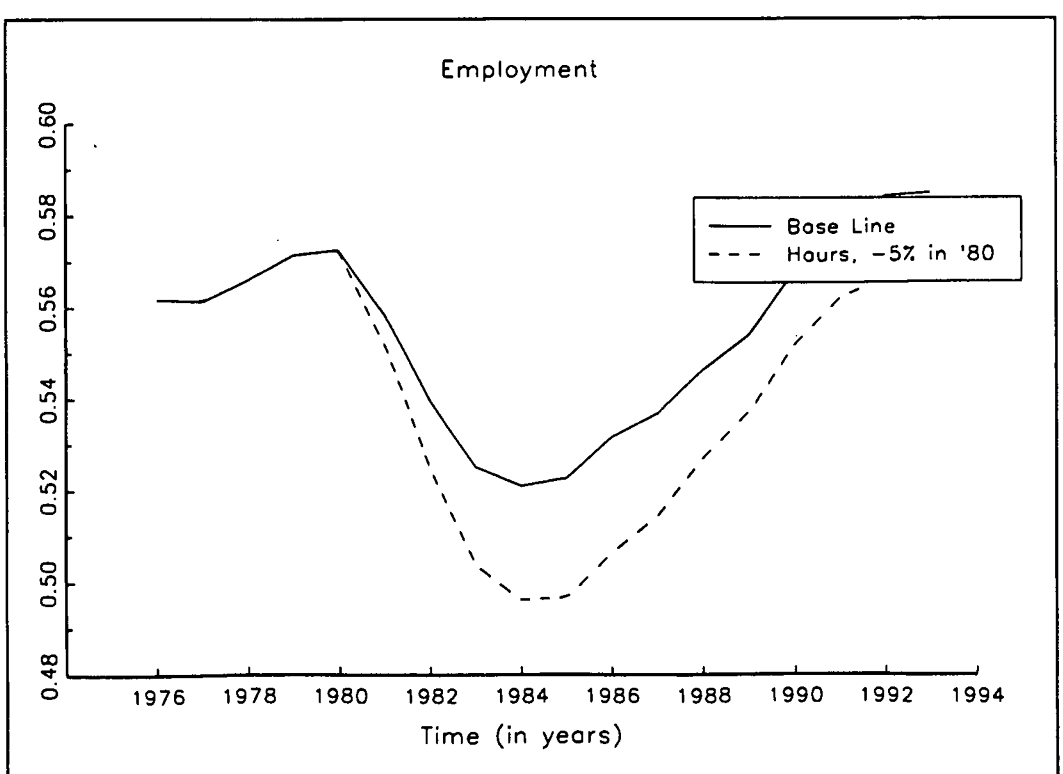


Figure 4.12b: Simulation results after a reduction of 5% in the hours of work per week in 1980: *Unemployment*

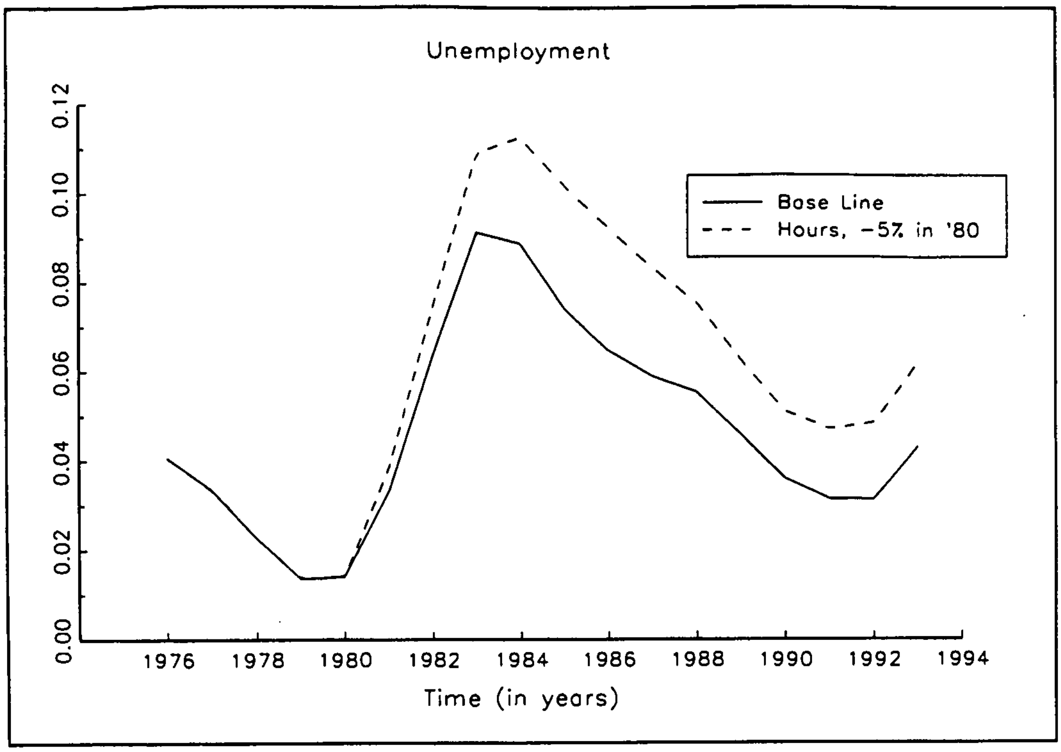


Figure 4.12c: Simulation results after a reduction of 5% in the hours of work per week in 1980: *Real hourly wage*

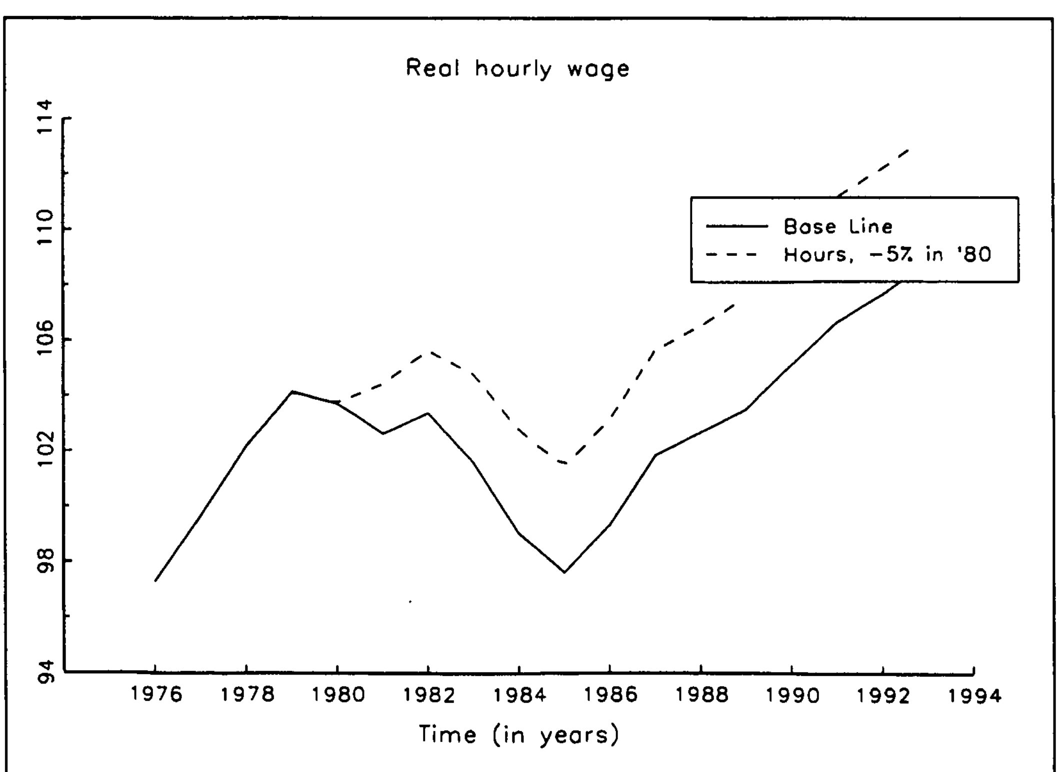
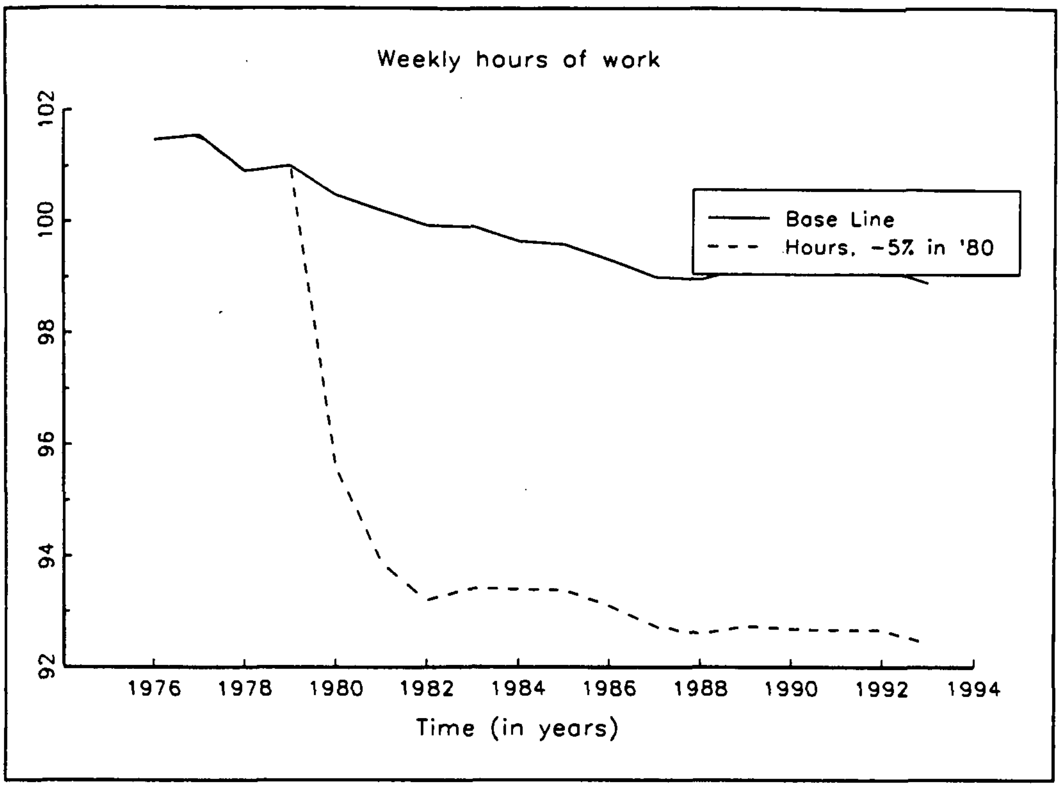


Figure 4.12d: Simulation results after a reduction of 5% in the hours of work per week in 1980: ***Weekly hours of work***



4.6 Concluding remarks

We have considered both the theoretical and the empirical case for worksharing as a policy to reduce unemployment or promote employment. The results from the literature are by and large rather pessimistic as to the efficacy of worksharing as a means to reduce unemployment. The most favorable conclusion is usually that its effects are ambiguous, whereas several other papers conclude that worksharing simply will not work or have severe negative side-effects.

Our empirical analysis does not provide any ground for the proposition that worksharing would reduce unemployment. On the contrary, it is rather more likely that it aggravates unemployment problems, at least in the short run. In the long run no significant effects of worksharing on employment can be found.

All this does not preclude that one would prefer earlier retirement or shorter hours as a means of consuming increased income in the form of additional leisure. To allow for such possibilities at an individual level may be welfare enhancing, just as it may be welfare enhancing to create possibilities for people to work longer hours and earn more, if they wish to do so. Also other arguments have been advanced in favor of worksharing, for instance that it would help the emancipation of women. These other arguments in favor of worksharing may be judged on their own merit and may form compelling reasons to work shorter hours or to retire earlier.

But if one wants to increase employment, other measures are probably much more effective than worksharing.

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APPENDIX A

Table A1: Estimation results of model 4.1. The estimation results are based on 216 observations. Standard errors are in parentheses

Equation	Employment	Wages	Hours	GNP	Labor Supply	Inflation rate
E_{t-1}	1.25** (0.43)	0.72 (0.89)	0.22 (0.53)	1.72 (1.18)	0.07 (0.23)	-1.25* (0.73)
E_{t-2}	-0.44* (0.26)	0.24 (0.51)	0.05 (0.25)	-1.21* (0.68)	0.05 (0.12)	0.30 (0.42)
E_{t-3}	-0.29 (0.18)	-0.71* (0.37)	-0.01 (0.14)	-0.10 (0.42)	-0.17 (0.11)	-0.08 (0.30)
W_{t-1}	-0.01 (0.10)	0.57** (0.20)	-0.11 (0.09)	-0.12 (0.20)	0.0003 (0.06)	0.17 (0.16)
W_{t-2}	0.03 (0.05)	-0.05 (0.14)	0.06 * (0.04)	0.14 (0.1)	0.01 (0.03)	-0.005 (0.085)
W_{t-3}	-0.01 (0.05)	-0.19** (0.08)	0.002 (0.03)	-0.06 (0.11)	0.03 (0.03)	0.06 (0.07)
H_{t-1}	0.25 (0.24)	-0.35 (0.60)	0.31 (0.25)	-0.40 (0.64)	0.14 (0.14)	0.56 (0.44)
H_{t-2}	0.04 (0.10)	0.02 (0.23)	-0.02 (0.08)	0.12 (0.25)	0.09 (0.07)	0.12 (0.15)
H_{t-3}	-0.10 (0.10)	-0.17 (0.17)	-0.03 (0.10)	-0.01 (0.22)	-0.09 (0.06)	0.10 (0.15)
Y_{t-1}	0.06 (0.16)	-0.46 (0.31)	-0.05 (0.15)	0.41 (0.38)	0.03 (0.10)	0.17 (0.25)
Y_{t-2}	-0.13** (0.06)	-0.14 (0.13)	-0.04 (0.05)	-0.10 (0.14)	-0.06 (0.04)	0.08 (0.10)
Y_{t-3}	0.10* (0.05)	0.24** (0.11)	-0.02 (0.05)	0.05 (0.12)	0.05 (0.03)	0.11 (0.08)
L_{t-1}	-0.54 (0.59)	0.97 (1.19)	-0.63 (0.61)	-2.33 (1.52)	0.49 (0.38)	2.96* (1.15)
L_{t-2}	0.53 (0.32)	0.01 (0.65)	-0.08 (0.28)	1.22 (0.75)	0.05 (0.18)	-0.52 (0.52)
L_{t-3}	0.17 (0.31)	1.06* (0.55)	0.04 (0.22)	0.27 (0.73)	0.07 (0.21)	0.30 (0.46)
P_{t-1}	-0.01 (0.03)	-0.08 (0.07)	-0.003 (0.03)	0.03 (0.08)	-0.01 (0.02)	-0.06 (0.05)
P_{t-2}	0.06 (0.07)	-0.19 (0.17)	0.006 (0.06)	0.23 (0.18)	0.004 (0.05)	-0.18 (0.13)
P_{t-3}	0.02 (0.05)	0.02 (0.12)	-0.06* (0.03)	0.001 (0.12)	-0.004 (0.03)	-0.10 (0.09)
S_t	0.03 (0.03)	0.05 (0.07)	-0.02 (0.02)	-1.01 (0.07)	0.08** (0.02)	0.05 (0.04)
S_{t-1}	0.02 (0.16)	-0.54 (0.35)	-0.001 (0.14)	0.43 (0.35)	-0.009 (0.11)	0.10 (0.25)
S_{t-2}	-0.14 (0.06)	-0.23 (0.17)	-0.15** (0.05)	-0.31 (0.13)	-0.08* (0.04)	0.16 (0.10)
S_{t-3}	0.16 (0.07)	-0.03 (0.14)	0.03 (0.05)	-0.09 (0.17)	0.10** (0.04)	0.22 (0.11)
V_t	0.24 (0.18)	0.80 (0.51)	0.16 (0.26)	0.39 (0.48)	1.00** (0.13)	-0.13 (0.35)
V_{t-1}	0.22 (0.61)	1.33 (1.23)	0.38 (0.58)	1.62 (1.54)	-0.61 (0.43)	-2.84** (1.11)
V_{t-2}	-0.73 (0.44)	-1.22 (1.03)	-0.16 (0.40)	-1.37 (0.94)	-0.12 (0.28)	0.78 (0.76)
V_{t-3}	0.30 (0.48)	-1.35* (0.71)	0.05 (0.27)	-0.16 (0.80)	0.27 (0.08	0.52 (0.61
CONS.	-0.0001 (0.004	0.02** (0.01)	0.003 (0.004)	0.02* (0.01)	-0.0003 (0.003)	-0.02 (0.01)

* significant at the 10% level
** significant at the 5% level

Table A2: Estimation results of model 4.1 where we include part-time employment in the system of equations. The estimation results are based on 216 observations. Standard errors are in parentheses.

Equation	Employment	Wages	Hours	Part-time	GNP	Labor supply	Inflation rate
E_{t-1}	1.04*	0.72	0.53	0.39	1.47	-0.24	-1.16
	(0.53	(1.04)	(0.60)	(1.82)	(1.34)	(0.28)	(0.81)
E_{t-2}	-0.21	0.25	-0.06	-0.32	-0.99	0.23	0.43
	(0.31	(0.62)	(0.27)	(0.81)	(0.74)	(0.16)	(0.47)
E_{t-3}	-0.34	-0.51	-0.08	0.29	-0.10	-0.13	-0.03
	(0.16	(0.40)	(0.15)	(0.39)	(0.21)	(0.09)	(0.27)
W_{t-1}	-0.02	0.53*	-0.09	-0.01	-0.16	-0.03	0.12
	(0.09)	(0.27)	(0.11)	(0.23)	(0.21)	(0.05)	(0.18)
W_{t-2}	-0.03	0.18	0.07	-0.18	0.12	-0.05	-0.10
	(0.07)	(0.16)	(0.05)	(0.14)	(0.14)	(0.04)	(0.12)
W_{t-3}	0.05	-0.26*	-0.003	0.004	-0.04	0.05	0.07
	(0.06)	(0.15)	(0.05)	(0.15)	(0.14)	(0.05)	(0.09)
H_{t-1}	0.35	-0.07	0.51	-0.77	0.35	0.14	0.45
	(0.26)	(0.62)	(0.34)	(0.91)	(0.60)	(0.15)	(0.45)
H_{t-2}	-0.16	0.37	-0.11	0.27	-0.39	-0.003	0.13
	(0.15)	(0.32)	(0.14)	(0.41)	(0.40)	(0.08)	(0.23)
H_{t-3}	-0.13	0.04	-0.10	0.57*	-0.23	-0.05	0.19
	(0.10)	(0.20)	(0.11)	(0.33)	(0.28)	(0.05)	(0.16)
Y_{t-1}	0.11	-0.40	-0.09	-0.40	0.64	0.05	0.10
	(0.17)	(0.34)	(0.20)	(0.47)	(0.39)	(0.09)	(0.25)
Y_{t-2}	-0.14	-0.22	-0.08	0.19	-0.22	-0.013	0.09
	(0.10)	(0.19)	(0.09)	(0.27)	(0.23)	(0.06)	(0.14)
Y_{t-3}	0.06	0.19	0.03	-0.08	-0.03	-0.004	0.04
	(0.07)	(0.16)	(0.08)	(0.20)	(0.18)	(0.04)	(0.12)
L_{t-1}	-0.30	-1.54	-0.94	-0.039	-1.87	0.75	2.35**
	(0.62)	(1.30)	(0.72)	(1.92)	(1.62)	(0.36)	(1.02)
L_{t-2}	0.49	0.16	0.09	0.02	1.66**	-0.06	-0.30
	(0.31)	(0.61)	(0.24)	(0.84)	(0.75)	(0.17)	(0.47)
L_{t-3}	0.15	0.78	-0.03	0.25	-0.33	0.13	0.30
	(0.33)	(0.62)	(0.31)	(0.94)	(0.87)	(0.20)	(0.46)
P_{t-1}	-0.04	-0.01	-0.0004	0.001	0.07	-0.05**	-0.15**
	(0.04)	(0.09)	(0.04)	(0.12)	(0.11)	(0.02)	(0.07)
P_{t-2}	-0.05	-0.01	-0.016	-0.05	0.27	-0.10**	-0.30*
	(0.08)	(0.24)	(0.08)	(0.19)	(0.21)	(0.05)	(0.17)
P_{t-3}	0.08	0.11	-0.006	-0.13	-0.01	-0.001	-0.09
	(0.06)	(0.21)	(0.06)	(0.15)	(0.16)	(0.03)	(0.12)
S_t	0.05	0.04	0.02	-0.08	-0.99**	0.10**	0.08
	(0.04)	(0.10)	(0.04)	(0.09)	(0.09)	(0.02)	(0.06)
S_{t-1}	0.03	-0.36	-0.03	-0.80**	0.59*	-0.02	0.06
	(0.15)	(0.32)	(0.17)	(0.40)	(0.32)	(0.08)	(0.21)
S_{t-2}	-0.21**	-0.31	-0.23**	0.62**	-0.60**	-0.06	0.16
	(0.09)	(0.21)	(0.08)	(0.24)	(0.20)	(0.06)	(0.15)
S_{t-3}	0.16**	-0.01	0.07	-0.33*	0.09	0.07	0.11
	(0.08)	(0.16)	(0.07)	(0.20)	(0.18)	(0.05)	(0.12)
V_t	0.29	0.35	0.23	-0.24	0.41	1.05	-0.01
	(0.20)	(0.48)	(0.31)	(0.79)	(0.38)	(0.11)	(0.29)
V_{t-1}	0.02	1.43	0.66	0.01	1.00	-0.79	-1.82*
	(0.59)	(1.14)	(0.64)	(1.75)	(1.56)	(0.40)	(0.94)
V_{t-2}	-0.72*	-0.74	-0.36	-1.58	-1.23	-0.09	0.46
	(0.39)	(0.84)	(0.34)	(1.28)	(0.95)	(0.24)	(0.64)
V_{t-3}	0.05	-0.50	-0.06	2.37**	-0.68	0.20	0.08
	(0.48)	(0.75)	(0.36)	(1.00)	(0.84)	(0.41)	(0.52)
D_{t-1}	-0.09	0.0004	-0.07	0.88**	-0.19	-0.05	0.03
	(0.08)	(0.18)	(0.09)	(0.22)	(0.18)	(0.05)	(0.12)
D_{t-2}	0.02	-0.01	-0.04	-0.12	0.06	0.02	-0.02
	(0.03)	(0.07)	(0.03)	(0.07)	(0.06)	(0.01)	(0.04)

Equation	Employment	Wages	Hours	Part-time	GNP	Labor supply	Inflation rate
D_{t-3}	0.02 (0.02)	0.02 (0.05)	0.06 (0.03)	0.07 (0.08)	0.02 (0.06)	0.01 (0.02)	0.01 (0.03)
CONS.	0.003 (0.005)	0.018 (0.009)	0.006 (0.006)	0.01 (0.01)	0.022** (0.01)	0.002 (0.003)	-0.01 (0.01)

* significant at the 10% level
** significant at the 5% level

Table A3: Estimation results of model 4.1 using the unemployment rate instead of the employment rate. The estimation results are based on 216 observations. Standard errors are in parentheses.

Equation	Unemployment	Wages	Hours	GNP	Labor supply	Inflation rate
U_{t-1}	0.25** (0.12)	-0.002 (0.023)	0.02* (0.01)	0.02 (0.02)	0.001 (0.006)	0.03** (0.01)
U_{t-2}	0.23** (0.08)	0.01 (0.02)	-0.001 (0.001)	-0.03** (0.01)	-0.01 (0.01)	-0.01 (0.01)
U_{t-3}	0.05 (0.10)	0.02 (0.02)	0.01 (0.01)	0.04** (0.01)	0.002 (0.004)	-0.003 (0.008)
W_{t-1}	0.77 (1.08)	0.55** (0.20)	-0.13* (0.07)	-0.11 (0.20)	-0.01 (0.05)	0.29 (0.15)
W_{t-2}	0.30 (0.56)	-0.06 (0.13)	0.05 (0.04)	0.05 (0.10)	0.005 (0.03)	-0.04 (0.08)
W_{t-3}	-0.09 (0.14)	-0.24** (0.10)	-0.01 (0.03)	0.01 (0.07)	0.04 (0.03)	0.07 (0.06)
H_{t-1}	1.71 (3.07)	-0.60 (0.60)	0.21 (0.23)	-0.47 (0.59)	0.11 (0.13)	0.57* (0.34)
H_{t-2}	-0.14 (1.47)	0.10 (0.23)	0.03 (0.08)	-0.01 (0.18)	0.08 (0.07)	0.07 (0.14)
H_{t-3}	0.63 (1.01)	-0.20 (0.17)	-0.02 (0.10)	-0.01 (0.18)	-0.10* (0.06)	0.12 (0.16)
Y_{t-1}	-4.13** (1.98)	-0.20 (0.29)	0.12 (0.10)	0.69** (0.28)	0.06 (0.08)	0.06 (0.16)
Y_{t-2}	1.68** (0.64)	-0.07 (0.11)	-0.01 (0.04)	-0.15 (0.12)	-0.07 (0.04)	-0.01 (0.08)
Y_{t-3}	0.08 (0.62)	0.30** (0.11)	-0.004 (0.04)	0.07 (0.11)	0.03 (0.03)	0.06 (0.06)
L_{t-1}	-0.99 (4.24)	0.27 (0.70)	-0.40 (0.27)	-0.24 (0.87)	0.53** (0.26)	1,67* (0.86)
L_{t-2}	2.37 (2.30)	0.13 (0.42)	0.01 (0.14)	-0.23 (0.57)	0.04 (0.13)	-0.21 (0.36)
L_{t-3}	-0.36 (2.62)	0.27 (0.37)	0.02 (0.12)	0.38 (0.48)	-0.12 (0.17)	0.26 (0.25)
P_{t-1}	0.28 (0.31)	-0.09 (0.06)	-0.02 (0.02)	-0.03 (0.07)	-0.01 (0.02)	-0.04 (0.05)
P_{t-2}	0.04 (0.81)	-0.14 (0.17)	0.03 (0.05)	0.05 (0.15)	-0.01 (0.04)	-0.22** (0.10)
P_{t-3}	0.12 (0.55)	-0.02 (0.13)	-0.06* (0.03)	0.05 (0.10)	-0.01 (0.03)	-0.13 (0.08)
S_t	0.93 (0.32)	0.05 (0.07)	-0.02 (0.03)	-1.02** (0.06)	0.08** (0.02)	0.05 (0.04)
S_{t-1}	-3.72 (2.00)	-0.33 (0.32)	0.15 (0.09)	0.61** (0.28)	0.01 (0.08)	0.02 (0.17)
S_{t-2}	1.16 (0.64)	-0.15 (0.13)	-0.13** (0.04)	-0.30** (0.13)	-0.08 (0.04)	0.10 (0.07)
S_{t-3}	-0.35 (0.84)	0.07 (0.14)	0.05 (0.04)	-0.03 (0.15)	0.09** (0.04)	0.15* (0.09)
V_t	-3.19 (2.29)	0.68 (0.43)	0.004 (0.20)	0.18 (0.49)	0.98** (0.12)	0.11 (0.34)
V_{t-1}	0.22 (4.88)	0.12 (0.87)	0.10 (0.32)	-0.01 (0.95)	-0.57** (0.31)	-1.60* (0.85)
V_{t-2}	-2.29 (3.34)	-1.14 (0.75)	-0.19 (0.23)	0.11 (0.72)	-0.05 (0.22)	0.23 (0.48)
V_{t-3}	1.11 (3.38)	-0.37 (0.66)	0.12 (0.26)	-0.24 (0.59)	0.43 (0.39)	0.39 (0.52)
CONS.	0.06 (0.04)	0.007 (0.007)	-0.002 (0.002)	0.012* (0.007)	-0.0001 (0.002)	-0.014 (0.005)

* significant at the 10% level
** significant at the 5% level