

## ON THE CAUSES OF HYSTERESIS IN LONG-TERM UNEMPLOYMENT IN THE NETHERLANDS

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### I. INTRODUCTION

The labour market in the Netherlands in the eighties is characterized by a high and persistent level of unemployment. The most problematic aspect of this unemployment performance is its duration structure, unemployment over one year being more than 50 percent of total unemployment. This implies high social costs since the negative unemployment experience is unevenly distributed and concentrated within a small group of unemployed. Moreover, this situation may easily result in a lost generation of workers, who remain unemployed. This is confirmed by statistical tests which show that the current rate of long-term unemployment is strongly correlated with the lagged rate of long-term unemployment (Graafland and Huizinga, 1988). This is illustrated in Figure 1. Upward jumps in long-term unemployment in 1974-75 and 1981-84 appeared to have had persistent effects on the level of long-term unemployment.

The integrated character of long-term unemployment indicates hysteresis in long-term unemployment. The central idea of the hysteresis theory is that the level of equilibrium unemployment depends on the history of actual unemployment (Blanchard and Summers, 1986, 1987; Cross, 1987a; Graafland, 1988, 1989). This can be explained by two underlying theories, the duration theory and the insider-outsider theory. The duration theory is concerned with negative effects of unemployment duration on labour demand and the labour supply of the unemployed. If unemployment duration impairs the human capital of unemployed, their employability will be reduced. The duration effect may be reinforced by the tendency of employers to stigmatize long-term unemployed as low quality workers (Cross, 1987b; Hughes and Hutchinson, 1988; OECD, 1987). In addition, long-term unemployment may also reduce effective labour supply, because long unemployment duration will discourage job search on the official labour market. As a result of these effects a recession, that lasts for some years and

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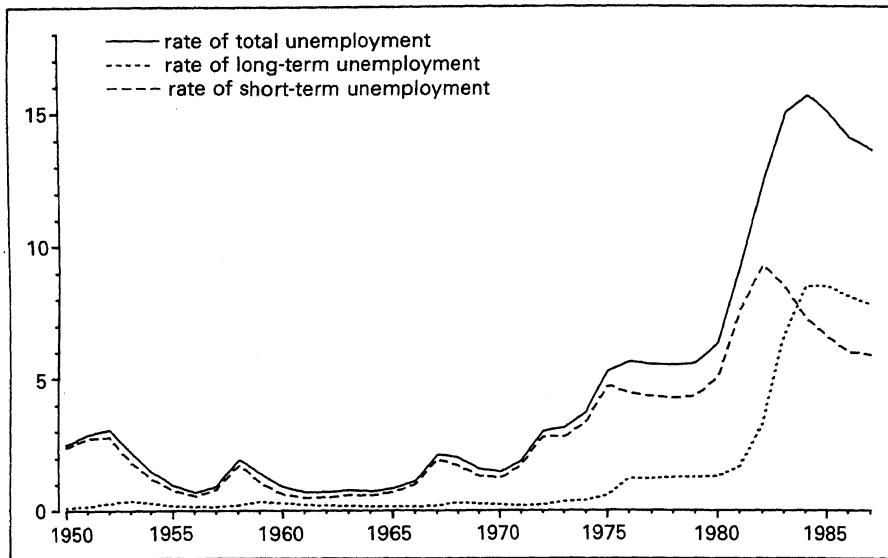


Fig. 1. Long-term unemployment in the Netherlands<sup>a</sup>

<sup>a</sup>As registered by the labour offices.

induces a rise of long-term unemployment, will cause a permanent upward shift of the Beveridge curve and raise the equilibrium rate of unemployment (Franz, 1987).

If duration effects worsen the employability of the long-term unemployed, then they will also lose their influence on wage formation. This is stressed by the insider-outsider theory. This theory argues that hysteresis in unemployment results if incumbent workers, the so-called insiders, have the market power to set wages independently of the unemployment situation (Carruth and Oswald, 1987; Solow, 1985; Lindbeck and Snower, 1986, 1987, 1988). Insiders have this market power because of labour turnover costs, which make it costly for the firm to replace incumbent workers by unemployed outsiders. Hence if hiring of long-term unemployed demands high training costs as a result of duration effects, wage formation will be independent of long-term unemployment (Graafland, 1990). This may be another source of hysteresis in long-term unemployment. A temporary recession, which increases long-term unemployment, will permanently raise the wage level and cause a rise of equilibrium unemployment.

The purpose of this paper is to investigate the empirical relevance of the insider-outsider and duration theories in explaining hysteresis in long-term unemployment in the Netherlands. Section 2 presents a small macro labour market model, which consists of four equations describing wages, employment, long-term unemployment and vacancies. Section 3 presents the estimation results. In Section 4 the estimated model is used for simulation to analyse the quantitative influence of hysteresis in long-term unemployment.

## II. THE MODEL

The model we consider is specified as:

$$v/l = f((us + \gamma ul)/ls, rs, rl) \quad (1)$$

$$w = f(p, h, tp, us/ls, rs, ul/ls, rl, v/l) \quad (2)$$

$$ld = f(y, w/p, t) \quad (3)$$

$$ul = f(us/v, rs) us_{-1} + f(us/v, rl, \Delta ul/ls) ul_{-1} \quad (4)$$

$$l = ld - v \quad (5)$$

$$us = ls - l - ul \quad (6)$$

*Endogenous variables:*

- v*: number of vacancies
- w*: real wage of enterprises (deflated by consumer prices)
- ld*: labour demand of enterprises (employment of enterprises plus vacancies)
- ul*: long-term unemployment (over one year)
- l*: employment of enterprises
- us*: short-term unemployment

*Exogenous variables:*

- p*: ratio of value added prices of enterprises to consumer prices
- h*: labour productivity of enterprises
- tp*: rate of income taxes and social premiums (as a fraction of wage costs)
- ls*: labour force
- rs*: replacement ratio of short-term unemployed
- rl*: replacement ratio of long-term unemployed
- y*: real value added of enterprises
- t*: time trend

Equation 1 is the *U-V* equation, which can be derived from the matching function relating the number of matchings per period to the number of vacancies and effective jobseekers, and some proper steady state conditions (see Appendix 1). If the number of unemployed workers rises, the employer will more rapidly find a suited candidate for an existing vacancy and the number of matchings increases, causing a fall of the steady state level of the vacancy rate. In order to test for the relevance of duration effects, we distinguish between short-term and long-term unemployment. If the long-term unemployed do not search actively for a job or if they are stigmatized by employers, the number of matchings will be independent of long-term unemployment ( $\gamma = 0$ ). In that case, a shift from short-term to long-term unemployment at a given level of unemployment will reduce the number of suited candidates and raise the steady state level of the vacancy rate. The vacancy rate is further assumed to be positively related to the replacement ratio of

long-term ( $rl$ ) and short-term unemployed ( $rs$ ), since higher benefits may also reduce the search intensity and the acceptance of jobs by the unemployed (Budd *et al.*, 1987). Finally, note that no mismatch variable is included because we lacked a proper time series for this variable.

The wage equation (2) can be derived from a right-to-manage wage bargaining model between an employers' organization and a union, for a representative industry (Nickell and Andrews, 1983; Graafland, 1990). The ratio of value added prices to consumer prices ( $p$ ) and labour productivity ( $h$ ) have a positive influence on wages since they strengthen the ability of firms to pay higher wages and employ more workers. The sign of the rate of income taxes and social premiums ( $tp$ ) is ambiguous. On the one hand, the tax rate influences wages positively because of income compensation effects. On the other hand, higher income tax rates reduce the marginal utility of wage increments. This shifts the union's wage-employment trade-off in favour of employment and lower wage claims. The other variables concern the threat point of the union. This threat point is related to the reservation wage of the workers it represents. The reservation wage of an individual worker is a weighted average of wages in other industries and unemployment benefits. Workers, who are not employed in the industry in the next period, have some probability of finding a job in another industry and receiving an alternative wage. Otherwise they will be unemployed, receiving unemployment benefits, which equal the replacement ratio times the macro wage. The replacement ratio differs for long-term and short-term unemployed. In the Netherlands the unemployment benefit depends on the unemployment duration of a worker. Employed workers who become short-term unemployed in the next period, will get unemployment benefits from the social security fund, whereas long-term unemployed, who remain unemployed in the next period, will get social assistance from the government, which is considerably lower. The replacement ratios of short-term and long-term unemployed will generally have a positive influence on the wage outcome because they raise the fall back position of the workers. Only if unions do not care at all about the interests of the long-term unemployed will the replacement ratio of the long-term unemployed not affect wages.

The probability of finding a job in another industry depends negatively on the unemployment rate. Following Moghadam and Wren-Lewis (1989) we test whether this probability depends more on the rate of short-term unemployment than on the rate of long-term unemployment. If the long-term unemployed are hardly employable because their skills have eroded or they are stigmatized by employers or they no longer search for a job due to discouragement, employed workers or short-term unemployed will experience no competition from long-term unemployed when searching for another job. Then only a rise of the rate of short-term unemployment will reduce the fall back position of the employed workers or short-term unemployed workers and so wages may be independent of the rate of long-term unemployment. Finally, the vacancy rate will have a positive influence

on wages, because it increases the probability of finding a job in another industry.

Equation 3 is a standard employment equation, relating the demand for labour to value added ( $y$ ), the ratio of wage costs to value added prices ( $w/p$ ) and an autonomous rate of labour saving technological progress ( $t$ ).

Equation 4 describes the incidence of long-term unemployment. The first term models the inflow of short-term unemployed into the pool of long-term unemployment. The inflow rate is assumed to be positively related to the excess supply of short-term unemployed ( $us/v$ ) and the replacement ratio of short-term unemployed ( $rs$ ). The second term describes the number of past long-term unemployed, who remain unemployed. The outflow rate is assumed to be negatively related to the excess supply of short-term unemployed and the replacement ratio of long-term unemployed ( $rl$ ). The outflow may also change as a result of past movements in long-term unemployment. In the case of a decline in long-term unemployment in the previous period, the current outflow rate will be relatively small because workers with a relative short unemployment duration, who are better qualified, will have left the unemployment pool first.<sup>1</sup> In the case of a rise in long-term unemployment in the previous period the effect on the outflow rate is ambiguous. If the rise is due to an increase in the inflow into long-term unemployment, as in 1982 and 1983, the effect will be positive. On the other hand, if the rise is due to an increase in long-term unemployment over two years duration, as in 1984, the effect may be negative. Previous upward and downward movements will therefore have asymmetric effects on the current outflow, so we will test separately for them.

Hysteresis in long-term unemployment can be explained by the model either through duration effects in the  $U-V$  equation or through insider-outsider effects in the wage equation or a combination of both. We first comment on the situation in which long-term unemployment has a smaller influence on the vacancy rate than short-term unemployment, whereas their influence on wages is equal. Then a shift from short-term to long-term unemployment as a result of a temporary recession will permanently increase the vacancy rate (equation 1). Hence employment falls (equation 5) and the equilibrium rate of unemployment rises. Figure 2a presents a stylized graphical illustration of hysteresis in long-term unemployment as a

<sup>1</sup> This effect is indicated by the divergence in the development of unemployment with duration over two years ( $t > 2$ ) and unemployment with duration between one and two years ( $1 < t < 2$ ):

Year	1981	1982	1983	1984	1985	1986	1987
	× thousand of persons						
$ul(1 < t < 2)$	15	71	180	186	157	136	121
$ul(t > 2)$	71	98	172	272	300	304	303
$ul$	86	169	352	458	457	440	424

Because we lacked data of  $ul(t > 2)$  before 1980, we could not distinguish between  $ul(1 < t < 2)$  and  $ul(t > 2)$  in the model.

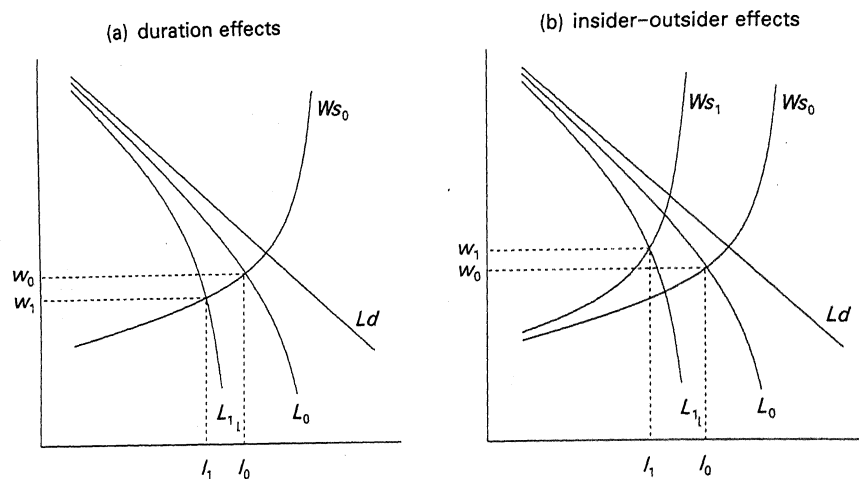


Fig. 2. Causes of hysteresis in long-term unemployment

result of duration effects.  $Ld$  denotes the labour demand curve,  $L$  the employment curve and  $Ws$  the wage equation. The wage equation is upward sloping, because wages are negatively related to unemployment. The employment curve lies to the left of the labour demand curve because some jobs remain unfilled. If unemployment is high, the number of vacancies will be low and so the employment curve will lie near the labour demand curve. If unemployment falls, the number of vacancies will increase and so will the discrepancy between the labour demand curve and employment curve.

Suppose now that the labour demand curve shifts downwards for some years, causing a shift from short-term unemployment to long-term unemployment, and that afterwards the labour demand curve shifts back to its initial position. If the long-term unemployed are not effective labour supply, the switch from short-term to long-term unemployment will shift the employment curve to the left because the number of vacancies will rise. Hence employment will be permanently reduced. After some time also the wage curve may shift to the left as a result of the rise of the vacancy rate. This will reduce labour demand and partly mitigate the rise of the vacancy rate.

Hysteresis in unemployment will be enhanced if duration effects on the labour market position of unemployed induce a correlation between outsider status in wage formation and long-term unemployment. If long-term unemployment has a smaller negative influence on wages than short-term unemployment, a shift from short-term to long-term unemployment will then also raise the wage rate (equation 2) and reduce labour demand. A stylized graphical illustration is given by Figure 2b. The rise of long-term unemployment during the recession shifts the wage curve to the left. This will induce an additional reduction of equilibrium employment and vacancies, and increase the equilibrium rate of unemployment.

## III. ESTIMATION RESULTS

Table 1 presents macro estimation results of linearized specifications of equations (1)–(3). The estimation result for the long-term unemployment equation (4) is reported in Table 2. The data are described in Appendix 2. Since data for replacement ratios are only available from 1965 onwards, the estimation period is set to 1966–87. *t*-Values are reported between brackets.

Column 1 of Table 1 presents the results for the vacancy rate equation. Because of simultaneity between the vacancy rate and the rate of short-term unemployment, we used lagged values of the rate of short-term unemployment as instrumental variables. The vacancy rate is found to be negatively related to the rate of short-term unemployment. The long-term elasticity is  $-0.7$ . The coefficient of the rate of long-term unemployment ( $\gamma$ ) was found to be incorrectly signed and insignificant ( $-0.22$  with a *t*-statistic of 1.39). Therefore we dropped the rate of long-term unemployment as an explanatory variable. Also the replacement ratios of short-term and long-term

TABLE I  
*Estimation Results of Vacancy Rate, Wage and Labour Demand Equation*

	(1) <i>log(v/l)</i>	(2) <i>log w</i>	(3) <i>log ld</i>
<i>log(us/l<sub>s</sub>)</i>	-1.07 (5.98)	<i>log p</i> 0.74 (7.13)	<i>log y</i> 0.39 (-)
<i>log(us/l<sub>s</sub>)<sub>-1</sub></i>	0.77 (3.77)	<i>log h<sub>-1/2</sub></i> 0.71 (7.35)	<i>log(w/p)</i> -0.26 (5.67)
<i>log(v/l)<sub>-1</sub></i>	0.93 (8.24)	<i>log(1-tp)</i> -0.20 (1.39)	<i>t*100</i> -0.41 (2.87)
<i>log(v/l)<sub>-2</sub></i>	-0.39 (3.60)	<i>(us/l<sub>s</sub>)<sub>-1</sub></i> -0.45 (1.02)	<i>log l<sub>-1</sub></i> 1.23 (6.81)
<i>c</i>	-2.90 (3.58)	<i>log rs<sub>-1</sub></i> 0.10 (0.86)	<i>log l<sub>-2</sub></i> -0.62 (4.22)
		<i>(ul/l<sub>s</sub>)<sub>-1</sub></i> -0.96 (5.44)	<i>c</i> -0.47 (3.44)
		<i>log rl<sub>-1</sub></i> 0.13 (1.65)	
		<i>log w<sub>-1</sub></i> 0.30 (2.32)	
		<i>c</i> -1.30 (2.32)	
<i>R</i> <sup>2</sup>	0.947	0.999	0.976
SE	0.123	0.006	0.009
DW	2.083	2.132	1.850
Method of estimation	2 SLS	2 SLS	2 SLS

unemployed appeared to have no significance and plausible influence on the vacancy rate and were dropped. The estimation result points to the relevance of state-dependence. It is noted, however, that alternative interpretations are also possible, because no proper mismatch variable is included. Since a rise in structural imbalances will generally be attended by falling exit rates and a rising ratio of long-term to total unemployment the small influence of long-term unemployment on the vacancy rate may stand for heterogeneity instead of duration effects. However, it can be doubted whether this alternative causal channel can fully account for the absence of any influence of long-term unemployment in the  $U-V$  equation. First, other researchers who include proxies for mismatch as explanatory variables still find a relatively small influence of long-term unemployment in the  $U-V$  equation (Mulder and Van Schaik, 1989). Second, there is also some evidence from microeconomic research for the Netherlands, that state-dependence is empirically relevant if heterogeneity is explicitly tested for (Groot, 1990).

The second column of Table 1 presents the estimation result of the wage equation. Because of simultaneity between real wages and the ratio of producer prices to consumer prices and labour productivity, the wage equation is estimated with 2 SLS, using current and lagged import prices as instrumental variables for the current ratio of producer to consumer prices and labour productivity. All parameters are correctly signed and have plausible values. Only the vacancy rate appeared to have no plausible influence on wages and was dropped. Real wages appear to be strongly influenced by the ratio of value added prices to consumer prices ( $p$ ) and labour productivity ( $h$ ). The rate of income taxes and social premiums has a positive influence on wages, which indicates that the income compensation effect dominates the effect of a shift of the wage-employment trade-off in favour of employment. Short-term unemployment has a negative but insignificant influence on wages.<sup>2</sup> The replacement ratio of short-term unemployed is correctly signed, but can easily be dropped without worsening the fit. Also the replacement ratio of long-term unemployed has a positive influence on wages, although not significant. This indicates that unions care about the utility of long-term unemployed. Most importantly, the wage level appears to be significantly negatively influenced by the rate of long-term unemployment. This result is surprising, since the  $u-v$  analysis indicates that long-term unemployed are less employable than short-term unemployed. Hence one would expect long-term unemployment to have a smaller influence on wages than short-term unemployment. How can this be explained? There may be two answers, which both have some relevance. First, it is noted that the estimation result of the  $U-V$  equation does not necessarily imply that long-term unemployed workers are not hired at all, but only that they do not reduce the aver-

<sup>2</sup> We also tested for a loglinear influence of long-term and short-term unemployment on wages but a linear influence proved to produce better estimation results.



age duration of vacancies. Suppose, for example, that there are two kinds of jobs, one which can be filled quickly by unqualified workers, and one which can only be filled by qualified workers. If employers refrain from hiring long-term unemployed workers for the latter kind of jobs, then a rise of long-term unemployment will not reduce the number of vacancies. However, in that case, long-term unemployment will still reduce the probability of finding a job of the first kind and have a negative effect on the wage level. The relevance of this explanation is confirmed by empirical information on outflow rates in the Netherlands, which show that there have still been a lot of long-term unemployed workers who have left the unemployment pool by finding a job. Second, although unions may have been unaware of the fact that long-term unemployed workers are less employable than short-term unemployed workers, they may have been more prepared to accept wage reductions in the light of high long-term unemployment, because long-term unemployed workers receive lower unemployment benefits than short-term unemployed workers. Indeed, information about collective agreements show that, in some cases, unions have been willing to accept wage cuts in return for special training programmes for long-term unemployed. Newspaper information indicates, however, that these programmes have generally not been effective in increasing the match between vacancies and long-term unemployed workers because employers were reluctant to carry out the central agreements at the individual firm level, whereas in some other cases only a few long-term unemployed were prepared to participate in special training programmes.

The third column of Table 1 presents estimation results of the labour demand equation. Again 2 SLS is used with lagged regressors and current and lagged import prices as instrumental variables because of simultaneity between labour demand, value added and real wages. The long-term coefficient of value added is restricted to 1 (constant returns to scale).<sup>3</sup> The ratio of wage costs to value added prices appears to have a significant negative influence on labour demand. The long-term real wage elasticity of labour demand is  $-0.66$ . The autonomous rate of technological progress amounts to 3.1 percent per year, which is similar to estimates of other research (Van den Berg *et al.*, 1988). Finally we comment on the specification of the lagged dependent variable. From the theoretical notion of adjustment costs, lagged employment rather than lagged labour demand should be the relevant variable. This was indeed confirmed by the estimation results. If lagged labour demand and the lagged vacancy rate were used as regressors, opposite coefficients were found with almost equal magnitude. Therefore we use lagged employment as the explanatory variable. It is noted that this specification of the lagged dependent variable enhances the relevance of duration effects, since it implies that the vacancy rate has a strong negative influence

<sup>3</sup> The estimation result worsened if capital was used as explanatory variable instead of output. Since both output and capital are exogenous in our model, we therefore prefer to use output as the explanatory variable in the labour demand equation.

TABLE 2  
*The Long-term Unemployment Equation*

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$ul$	$= [0.05 + 265.94 (us/l)_{-1} ** 2.78] * us_{-1}$			
	(3.26) (1.09) (7.12)			
	$+ [0.74 + 124.02 (us/l)_{-1} ** 2.78 - 17.09 \min(0, \Delta(us/l)_{-1})] * ul_{-1}$			
	(16.76) (1.12) (-) (3.67)			
$R^2 = 0.999$	$SE = 0.005$	$DW = 2.443$	method of estimation: OLS	

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on employment.<sup>4</sup> A shift from short-term to long-term unemployment, which raises the number of vacancies, will not only reduce employment directly (equation 5), but also hamper future employment growth because the lower employment level induces a reduction of labour demand afterwards because of adjustment costs.

Table 2 reports the estimation result of the long-term unemployment equation. The replacement ratio and the vacancy rate appeared not to be empirically relevant for the inflow and outflow of long-term unemployed and were dropped. The inflow of short-term unemployed into long-term unemployment is positively influenced by the rate of short-term unemployment. The outflow rate depends also on the rate of short-term unemployment, although less than the inflow rate. In addition the outflow rate appears to be significantly depressed by previous falls in the rate of long-term unemployment. No upward effect was found from previous rises in the rate of long-term unemployment.

#### IV. EMPIRICAL RELEVANCE OF DURATION EFFECTS

The estimation results in Section III confirm the relevance of the hysteresis phenomenon for the Netherlands. Although long-term unemployment has a significant influence on wages, it exerts no downward pressure on vacancies. This indicates duration effects. In this section the implications of these duration effects are further investigated by simulating the model estimated in Section III.

Before presenting the simulation results, we stress the tentative character of this exercise. For a full analysis of the implications of duration effects a more complete model would be needed, which describes the links between various labour market developments and the exogenous variables in our model, particularly value added, labour productivity and the labour force.

<sup>4</sup> Using equation (5)  $\log l^d$  can be proxied by:  $\log l^d = \log l(1 + v/l) = \log l + \log(1 + v/l) \approx \log l + v/l$ . Substitution in the estimated labour demand equation gives:  $\log l - 1.23 \log l_{-1} + 0.62 \log l_{-2} = -v/l + 0.39 \log y - 0.26 \log w/p - 0.004 t - 0.47$ . The long-term coefficient of the vacancy rate is  $-1/(1 - 1.23 + 0.62) \approx -2.5$ .

TABLE 3  
*Simulation Results of Absence of Duration Effects*

	<i>Actual values</i>			<i>Simulation values without duration effects<sup>a</sup></i>		
	73-77	78-82	83-87	73-77	78-82	83-87
<i>Percentage changes</i>						
Private employment	-0.9	-1.0	0.5	-0.8	-1.1	0.9
Real wage rate	5.4	1.7	0.3	5.4	1.7	0.5
<i>Levels</i>						
Long-term unemployment rate	1.2	3.2	7.8	1.1	3.1	6.2
Total unemployment rate	5.5	12.4	13.6	5.1	12.4	12.2
Vacancy-rate	1.4	0.5	1.6	1.1	0.4	1.0

<sup>a</sup>By introducing negative effects of long-term unemployment on vacancies equal to the estimated effect of short-term unemployment in the  $U-V$  equation and dropping the asymmetry-effect on the outflow rate in the long-term unemployment equation.

Table 3 compares the actual labour market developments with simulated values if duration effects had not occurred. The simulation has been obtained by setting the parameters of current and lagged rates of long-term unemployment equal to the estimated coefficients of the rate of short-term unemployment in the  $U-V$  equation. In addition the downward effect of previous falls in the rate of long-term unemployment on the outflow rate in the long-term unemployment equation has been dropped. For the period 1972-82, in which the short-term unemployment rate rose from 2.8 percent to its highest level of 9.2 percent, the absence of duration effects would have had only minor consequences for the development of total unemployment. Long-term unemployment would only have been 8,000 manyears lower in 1982. Duration effects became, however, quantitatively important after 1982. If duration effects had not occurred, the rise of the vacancy rate would have been much smaller in the last five years. As a result employment would have grown more rapidly, causing a cumulated reduction of the total unemployment rate of 1.5 percent in 1987. Moreover, especially the long-term unemployed would have benefitted, long-term unemployment being about 20 percent lower than actual long-term unemployment in 1987. This is illustrated in Figure 3. While actual long-term unemployment was almost constant during the last three years, long-term unemployment would have fallen substantially if duration effects had not occurred.

Note that the simulated duration effects on long-term unemployment must be interpreted as maximum estimates since it is implicitly assumed that the small influence of long-term unemployment in the vacancy rate equation is caused by duration effects only. In as far as the small influence of long-term

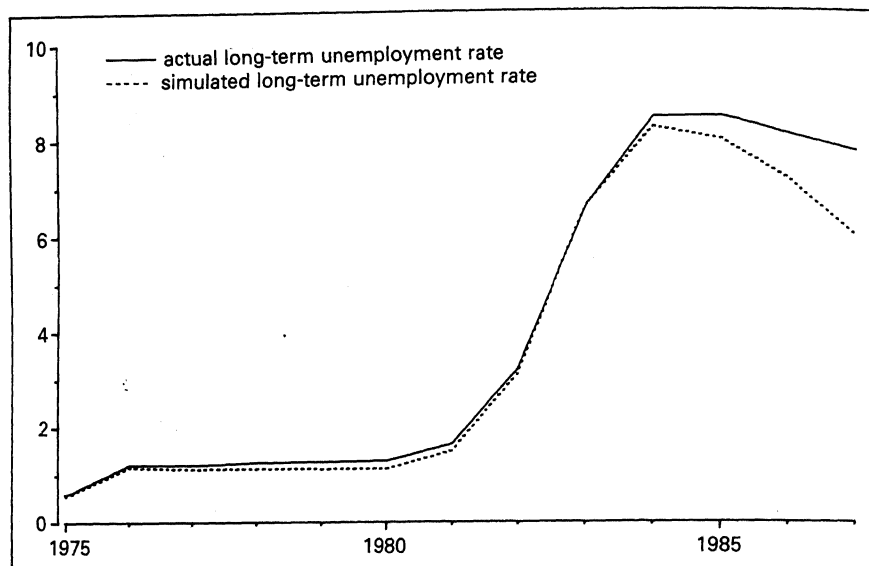


Fig. 3. Duration effects on long-term unemployment

unemployment on vacancies is caused by heterogeneity, low qualified people being disproportionately represented among the long-term unemployed, rather than by negative effects of unemployment duration on the labour market position of unemployed (state-dependence), the relevance of duration-effects would have been smaller.

#### V. CONCLUSION

The labour market in the Netherlands in the eighties is characterized by a high and structural level of long-term unemployment. This may be explained by the hysteresis theory. Hysteresis in long-term unemployment can be caused by insider-outsider effects in wage formation or duration effects on labour demand or labour supply. This paper investigates the empirical relevance of both effects by estimating a small macro labour market model, which consists of a wage equation, labour demand equation,  $U-V$  equation and an equation for long-term unemployment.

Estimation results of the wage equation show no indication that outsider status in wage formation is related to the unemployment duration of a worker. Long-term unemployment is not found to have a weaker effect on wages than short-term unemployment. Estimation results of the  $U-V$  curve show, however, that duration effects are relevant for the Dutch labour market. Long-term unemployment appears to have had no influence at all on the number of vacancies. Therefore long-term unemployment has not tempered the rise of the vacancy rate during the last five years. Moreover,

estimation results of the labour demand equation imply that a rise of the vacancy rate frustrates employment growth, further enforcing the duration effects. The estimation result of the long-term unemployment equation indicates that the outflow from long-term unemployment declines, if long-term unemployment has fallen in previous periods.

The estimated model is used to analyse the quantitative relevance of duration effects. Until 1982, duration effects appear to have had only minor consequences for the development of unemployment. However, after 1982 the duration effect has curbed employment growth considerably. If duration effects had not occurred, long-term unemployment would have been substantially lower in 1987.

The consequences of duration effects may become even more important in the coming years. Strong economic growth may above all reduce short-term unemployment and cause a further rise in the vacancy rate.

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#### APPENDIX 1 THEORETICAL DERIVATION OF $U-V$ EQUATION

Suppose that the number of successful matchings between unemployed workers who are seeking a job and employers who want to fill vacancies can be described by a Cobb-Douglas matching function:

$$m = v^{\alpha}(\beta us + \gamma ul)^{1-\alpha} / x \quad (\text{A1})$$

where  $m$  denotes the number of matchings per period,  $v$  the number of vacancies,  $us$  short-term unemployment,  $ul$  long-term unemployment and  $x$  a mismatch variable, which measures differences in characteristics between the vacancies and unemployment in terms of skill, work experience and location. Not all unemployed workers are effective job seekers. The proportion of effective job seekers may differ for short-term ( $\beta$ ) and long-term unemployed workers ( $\gamma$ ) because of duration effects.

Following Jackman *et al.* (1989) the number of matchings can be defined as the change in employment plus the outflow from employment:

$$m = ql + \Delta l \quad (\text{A2})$$

where  $q$  denotes the separation rate and  $l$  employment. The  $U-V$  curve is defined as the locus of points where the employment rate is constant.

Assuming that the separation rate and labour supply growth are constant, the  $U-V$  equation can then be expressed as:

$$\log(v/l) \cong (1 - 1/\alpha) \log((us + (\gamma/\beta) ul)/ls) + (1 - 1/\alpha) \log \beta \\ + (1/\alpha) \log x + (1/\alpha) \log(q + g) \quad (\text{A3})$$

where  $g$  is the growth rate of labour supply. If long-term unemployed workers are stigmatized or do not search for jobs,  $\gamma$  will be zero and the vacancy rate will only be negatively related to the rate of short-term unemployment. Furthermore it is assumed that  $\beta$  is negatively related to the replacement ratio of short-term and long-term unemployed, since higher benefits may also reduce the search intensity and the acceptance of jobs by unemployed.

#### APPENDIX 2 DATA AND SOURCES

For the construction of the data, the following model was used:

$$l = ls - lg - lk - u$$

$$y = yb - yk$$

$$h = y/l$$

$$w = (wb - wk)/(l - lz)$$

$$tp = (1.2 sll + slw + 0.65 tl - 2.2 auk)/wb$$

where:

- $ls$ : labour force
- $lg$ : government employment (labour years)
- $lk$ : employment in the medical sector and other non-market services (labour years)
- $u$ : unemployment, including unemployed with age over 57.5 years with no registration duty
- $yb$ : value added of enterprises excluding mining and quarrying and exploitation of real estate (constant prices)
- $yk$ : value added of the medical sector and other non-market services (constant prices)
- $wb$ : wage sum of enterprises, including social premiums
- $wk$ : wage sum of the medical sector and other non-market services, including social premiums
- $lz$ : self-employed (labour years)
- $sll$ : social premiums, paid by employees
- $slw$ : social premiums, paid by employers
- $tl$ : direct taxes on wage income
- $auk$ : children's allowance received by employees
- $ul$ : long-term unemployment, including unemployed with age over 57.5 years with no registration duty

*us*: short-term unemployment  
*v*: vacancies

Other series used:

*pc*: consumer price  
*pm*: import price of consumer goods  
*pop*: population of 15-64 years old  
*rs*: net unemployment benefit of short-term unemployed as a percentage of net average wage  
*rl*: net government assistance of long-term unemployed as a percentage of net average wage

Most series are taken from internal sources of the Central Planning Bureau. For the number of vacancies we used data of the Ministry of Social Affairs for the period 1960-80 and data of the Central Bureau of Statistics for 1981-87. For the replacement ratio of short-term and long-term unemployed data were used from an internal paper by F. Krapels of the Ministry of Economic Affairs. For the unemployment series we used unemployment series as registered by the labour offices. During the eighties these figures have increasingly been affected by statistical errors. However, alternative series are only available from the beginning of the eighties.