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Unemployment and the growth in the number of recipients of disability benefits in Norway

by

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Abstract

The paper contains an analysis of factors behind the increases in the number of disability recipients in Norway. Entry rate functions for disability benefit are estimated using grouped time series data for entry rates by sex and age. It is found that an equation containing the level of unemployment, replacement ratios (after tax) and for women, labour participation rates, have a number of desirable properties. The estimated equations are then integrated in a model of entry into and exit from disability, and this model is used to decompose the increase in the number of disability recipients in the 1980s. The increase in unemployment above 1980 levels explains about one half of the actual increase in recipients, whereas increased female labour participation and replacement ratios for men and women together explain the other half.

1. Introduction

The number of recipients of disability benefits has increased significantly in many western countries over a number of years, coinciding with lower labour force participation rates. Genererally the number of recipients has risen much more rapidly than expected when these programs were legislated. In many countries the consequences have been increases in government expenditure which again have induced tax increases, cuts in other government spendning and/or been a factor behind increasing budget deficits.

Disability benefits is determined in interrelationship between the rules of the disability benefit programme and the labour market. One main concern has been that increased generosity and availability of disability benefit has been a main factor behind the increased number of disability recipients. To what extent this appears to be the case is still debated. Parsons (1980, 1991A and 1991B) argue that the disincentive effects of increased benefit levels in the US disability benefit programme has been the main factor behind the decline in labour force participation rates of older men in the USA. Bound (1989, 1991) and Havemann et. al. (1991) on the other hand argue that the replacement ratio in the disability benefit programme has only been a minor factor behind the increased number of disability recipients and lower participation rates. Aarts and de Jong (1992) conclude in a major investigation of the Dutch disability insurance programme that incentive effects due to high replacement ratios and lax practices by the social security system have been important factors behind the very rapid increase in disability benefit recipients.

An alternative or supplementary perspective has been to see the decline in labour force participation and the rise in disability benefit rates as a response to problems in the labour market. In most countries unemployment in the 70's and especially in the 80's have been much higher than in the 50-'s and 60's. One hypothesis has been that this has exerted a pressure on various government benefit programmes. Actually which programme will of course be dependent of country-specific institutional arrangements, but similar programs are present in most western countries, under some different names and specific rules, though. For the UK, Piachaud (1990) finds that a substantial proportion of the overall increase in disability and decline in labour force participation from 1971 to 1981 is attributable to the general rise in unemployment. Disney and Webb (1990) also emphasise the effect of increases in the aggregate unemployment as a factor behind changes (i.e. increases) in a number of transfers, including disability benefits, in the UK.

For Norway, Westin et. al. (1989) and Westin (1990) has shown a strong overrepresentation in disability benefit by employees being subject to plant closures, compared to control groups. Similar results have been obtained by Teigen (1983).

The conclusions on the issues adressed in this research have important policy implications. With a high degree of responsiveness wrt. the replacement ratio, a lower level of transfer rates will induce fewer persons to enter disability benefit. This will have a positive effect on government sector balances, which is a major concern for policy makers in almost all western countries. Also the (possible) degree of cyclical response of disability benefits is of major importance, and should be taken into account in policy analysis. The reported research indicates that there are significant effects, at least on the micro- or individual level, from the labour market situation to the number of disability benefit recipients. The interlinkages to the macroeconomic analysis is however not quite straightforward from this research, inter alia because a number of labour market indicators are often used, as well as individual data such as earlier employment history. There is thus a need for an analysis which has an aggregate macroeconomic connection, but which incorporates enough micro information. Creedy and Disney (1989) report some simple time series equations suitable for incorporating into a macroeceonomic framework. Their results with respect to the replacement ratio are more ambiguous, however.

This article is an attempt to connect the working of the disability benefit system into a macro-economic model for Norway - the MODAG model of the Central Bureau of Statistics (CBS), cf. Cappelen (1992). Contrary to most other research on disability I utilise only time series data. This obviously limits which factors can be incorporated, but it enables us to take into account the longer term movements in the explanatory variables. An important feature with this analysis, is that the dependent variable is entry into disability, not the actual number of disability recipients. This is an important point, which I shall return to below.

The paper is organized as follows. In section 2 I will give an outline of the institutional setting of the Norwegian system of disability benefits, and the important rules in the system. The model for entry rates specified by sex and age is set up in section 3, whereas data are described in section 4. The estimation results are described and evaluated in section 5. In section 6 I set up a model linking together the estimated equations for entry into disability benefit, ageing of the disabled population and exit (death and retirement) from disability benefit in order to make a historical decomposition of the changes of the number of recipients in the 1980s.

2. Theoretical background and institutional setting of the Disability Benefit programme in Norway

The disability benefit programme in Norway has its origins in the introduction of the overall National Insurance (NI) system in 1967, but has a longer history as a pension with smaller coverage and payment levels. The disability benefit programme in the National Insurance was thought of as a benefit to those who were physically or mentally disabled, unable to perform work in the ordinary labour market. Projections of the number of recipients made in 1967 have nevertheless showed that the programme has been much more attractive than believed by the government at the time of the introduction. The number of recipients in 1990 was in the Government Long term programme released in 1974 forecasted to be between 114 000 and 139 000 persons, but the actual outcome was 234 000 persons. An updated description of the disability benefit programme, and research related to it, is given in NOU (1990). An overview of the Norwegian National Insurance is given by Hatland (1986).

There are certain medical conditions to be met in order to obtain disability benefit. One must obtain a report from a physician, to apply for disability benefit. This application is decided upon by the lower level in the NI system. There are also certain appeal possibilities for rejected applicants. The amount of assessment by the NI authorities is large. The law states that the non-ability to work must be caused by illness or injury. It is also possible to obtain a partial disability status, implying a benefit payment of a fraction of full disability benefit. One has to be decleared at least 50 % disabled to obtain any benefit. The disability benefit is not fully labour market-related as in many other countries, in the sence that it requires previous employment to become a transfer recipient. Consequently, the programme has attracted women as well as men, and today the majority of the recipients are women.

When allowed benefit, there has been no time limitations with respect to duration. In practice, the only way out of disability benefit has turned out to be death or transition to retirement pension, disability thus becoming nearly fully an absorbing state. This has important implications for modelling. It neccessitates modelling entry and exit separately, to capture the (potential) effects of economic factors such as the labour market situation and replacement ratio. This is probably particularly important in Norway, where exit back to the labour force has been almost non-existent, but it is likely to have great relevance in other systems too, if exit rates from similar benefit systems are small and/or non-responsive to variations in the labour market situations. This appears to be the case for UK, cf. Disney and Webb (1990)'s reporting that expenditures on invalidity benefits did not fall although unemployment fell in 1988/89.

There is a payment floor which accrues to all recipients, even if they have no past labour earnings (minimum pension). There is also a supplementary benefit component which is related to past earnings in a rather complex way. The supplementary benefit is also related to the year disability occurs, as pension rights are being more favourable as time passes since the introduction of NI in 1967. The system is "mature" only in 2007, as a newly retired person that year will have earned the maximum years of pension rights. This property of the benefit system enables us to calculate time-varying replacement ratios for the different demographic groups.

During the period considered, there has been a number of legislative changes in the benefit system. The most important is the lowering of the retirement age i 1973, to 67 years. Consequently we only consider persons younger than 67 years. There have also been some liberalisations considering alcoholism and drug abuse as valid medical diagnoses to obtain benefit. The latter applies only to a minor share of the applicants, and is thus disregarded in the analysis. The latest years some restrictive legislative measures have been taken to contain expenditures. The effects are probably small, at least in the period we are considering, but as we have no explicit variable capturing legislative and administrative changes, such effects may induce some bias in the analysis.

As mentioned, the degree of assessment of the physicians and the NI administration in general is significant. A great deal of focus in Norwegian research on disability benefits has thus been on the physicians role as a guardsman in this programme, and it has been argued that a factor behind the increase in disability recipients is that physicians have turned slippery in recommending disability benefit. It has also been claimed that reduced stigma effects in the population against applying for benefit has contributed. Hard to quantify, no firm empirical support for these hypotheses have been found, however.

I will not put forward any explicit derivation of the behaviour of an utility-maximizing individual facing the choice of continued work or applying for disability benefit. I will limit myself to outline the structure of incentives. For an individual, income if continued work will be:

$$W \cdot (1-t_W)$$

Excpected income if obtaining disability benefit is:

$$DB \cdot (1-t_d)$$

where

W: Average wage rate per year

t_w: Average tax rate wage-earners

DB: Average disability benefit

t_d: Average tax rate disability benefit recipients

Tax rates for wage-earners and disability recipients differ due to two effects. Firstly, average tax rates will be lower for recipients due to lower pre-tax incomes combined with a progressive income tax system. Furthermore, the tax Norwegian rules imply lower average tax rates for a given pre-tax income for pension and benefit recipients than for wage earners.

The labour market situation enters the decision directly, via layoffs in the corporate sector. In cases of plant closure, it has been very difficult, especially for older employees, to obtain other work, and they have often ended up as disability benefit recipients, see e.g. Dahl and Colbjørnsen (1991). Other mechanisms may however take place in close interrelationship with the benefit system. When firms lay off workers, they have had a tendency to do this in a way that sends the older employees into long term illness (also paid by NI), and after a year it has been common practice that the individual is granted disability benefit. This is far more beneficial for the individual than going via the pool of persons receiving unemployment benefit. The replacement ratio is 100 % in illness allowance, but at most 62,4 % (pre-tax) in unemployment benefit. Thus in a recession a large number of persons don't even become unemployed, they enter disability pension in a much more direct way. It is possible that the increased replacement ratio in disability benefit makes this mechanism work easier than before, when replacement ratios in disability benefit were generally lower. One might thus expect the effect of unemployment to be dependent upon the level of the replacement ratio. In this analysis, however, we have assumed constant elasticities of the explanatory variables, due to few degrees of freedom.

To conclude, the use of aggregate labour market variables, such as aggregate unemployment, proxies a number of effects, not neccessarily found on the individual level. It also facilitates linking analysis and forecasts of entry into disability to macroeceonomic analysis.

Although there is a strong precedence towards using seniority criteria in layoff situations, the benefit system makes it easier come to agreements of deviating from these principles. This results in firms laying off elderly workers, under the implicit assumptions that they obtain disability benefits.

In a number of Norwegian analyses, e.g. Kjeldstad (1990), focus has been on the particularly rapid increase in entry into disability benefit for women, especially in the middle age groups. Though no firm conlusions have been reached, the increased labour force participation combined with "double-work" have been mentioned as factors. As wages are usually lower for women than for men, replacement ratios have been higher inducing higher entry into disability. The data used in this analysis does not suppurt the latter view, however. In this analysis we have utilized labour force participation rates for different age groups for women as a potential variable explaining the increase in female disability entry.

Analyses have shown that disability is quite strongly dependent on marital status, as in e.g. Fredriksen (1992). Married persons have had much less propensity to be disability recipients than non-married. Whether this reflects self-selection or positive effects of being married is not clear, however. Also type of work has also been important at the micro-level, blue collar workers having higher incidence of disability. Similar results have been found for sub-groups of sectors (manufacturing, primary sectors etc.). This probably indicates that work-related injuries and illnesses vary a great deal, see e.g. Abrahamsen (1988). Fredriksen also reports very significant effects of education, which may partly capture effects of differences between blue-collar and white-collar work.

3. Estimation of entry functions into disability benefit

In order to take account of pure medical reasons to disability, I have considered entry rates for age-specific groups. I also have distinguished between men and women, partly due to the fact that the age variations in entry rates differ somewhat between sexes, but also because the transfer levels pr. recipient is much lower for women than for men. This affects replacement ratios, but is also important when using the full model to simulate government expenditures on disabilitiy benefit.

The model is formulated on logarithmic form. An alternative formulation would obviously have been a logit-formulation, which is often considered suitable for modelling ratios varying between

0 and 1. Logit formulation has the advantage of never predicting values grater than unity. In this case this is not likely to be a restrictive assumption, as the historical values for entry rates have been close to 0. The largest value in the sample, the one for men 65-66 years, was slightly higher than 0,1 in 1990. On the other hand, a disadvantage with the logit functional form in this case is that the elasticities will be less for the groups with the higher entry rates. This does not seem to be a sensible restriction to impose on the model. Preliminary estimations indicated insignificant differences in fit between the two functional forms.

The age groups are 16-39, 40-49, 50-59, 60-64 and 65-66 years. The retirement age in Norway is 67 years. We thus look upon 10 demographic groups. The equation for each group is formulated as an error correction model:

$$\Delta\log(ER_i)=a_{0i}+\sum_j a_{ji}\Delta\log(X_j)+b_i\log(ER_i)_{-1}+\sum_j c_{ji}\log(X_j)_{-1}+U_i \qquad (1)$$

where

ER_i	Entry rate into disability benefit, group i
X_j	Right hand side variable j
a_{ji}, b_{ji}, c_{ji}	Coefficients
U_i	Error term with white noise properties

Instead of estimating the 10 equations separately, I have grouped the data, to obtain more degrees of freedom.

To estimate the model for all groups together implies the following formulation:

$$\Delta\log(ER_i) = a_{0i} + \sum_j a_j \Delta\log(X_j) + b_i \log(ER_i)_{-1} + \sum_j c_j \log(X_j)_{-1} + U_i \qquad (2)$$

In eq. 1 all coefficients are different by group while in eq. 2 we only have included group-specific constant terms whereas the coefficients on all right hand side variables (including lagged endogenous variables) are identical for all groups. Such restrictions should be subject to testing, which is described later.

In principle one might have constructed a test-tree where one starts with the general model and perform all possible tests of coefficient-restrictions to use ordinary F-tests to see if data accepts a less general model. I have not done that, mainly because a very large number of tests would have to be made, at the same time as the probability for a unique result would have been small. It is also well-known that use of classical statistical theory has inherent interpretation problems, inter alia connected to the level of significance of the whole test procedure.

If all the tests were independent tests, one should in each sub-test choose a significance level of ε/n, where ε is the significance level of the whole procedure and n is the number of tests performed. Thus it is clear that the significance level in each tests would have to be very low, making it impossible to accept specific hypotheses. Moreover, such a procedure only establishes an upper limit because in practice the sub-tests will not be independent. Nevertheless I have performed a number of standard F-tests to test the equations I ended up with against some more general alternatives, and also against some more specific models, which were rejected. This is reported in table 3 in section 5.

I have also made a further correction to the model. If the model in eq. (2) is valid on the individual level, using grouped data as in this case, will give non-constant variance in the error terms. Assuming constant variance on the individual level, a transformation of the equation as e.g. described in Johnston (1990), pp. 293-298 will give equation 9 below.

Let the model at the individual level be:

$$Y_j=\alpha+\beta X_j+u_j \quad j=1,\ldots,n \tag{3}$$

where Y_j is the entry probability for individual j and n is the total numbers of individuals.

In this case we only observe m (in this case 10) groups, each containing n_i individuals. Our model thus becomes

$$\overline{Y}_i=\alpha+\beta\overline{X}_i+\overline{u}_i \tag{4}$$

where $\overline{X}_i$, $\overline{Y}_i$ *og* $\overline{u}_i$ are group averages.

When $var(u_i) = \sigma^2$, then

$$var(\overline{u}_i)=\sigma^2/n_i \quad i=1,\ldots,m \tag{5}$$

This means that the variance of the error terms will be smaller in larger groups than in smaller groups. A transformation of eq. 4 above by multiplying by $\sqrt{n_i}$ for each group, will give

$$\sqrt{n_i}\, Y_i = \alpha \sqrt{n_i} + \beta \sqrt{n_i} X_i + \mu_i \tag{6}$$

where

$$\mu_i = \sqrt{n_i}\, \overline{u_i} \tag{7}$$

Then

$$var(\mu_i) = n_i\, var(\overline{u_i}) = \sigma^2 \tag{8}$$

The point here is that each group is given weights equal to the square root of the number of micro-units in each group. Though the various groups' relative size differ somewhat over time, I have used mid-sample (1980)-values to obtain fixed weights.

The equation being estimated is thus

$$\sqrt{n_i}\Delta\log(ER_i) = a_{0i} + \sum_j a_j \sqrt{n_i}\, \Delta\log(X_j) + b_i \sqrt{n_i}\, \log(ER_i)_{-1} + \sum_j c_j \sqrt{n_i}\, \log(X_j)_{-1} + U_i \tag{9}$$

In selecting the best model and which variables to include, one must consider a number of points. In addition to good fit, stability of the estimated coefficients is desirable. A simple test of this is using CHOW F-tests of paramter constancy. If overall fit is low, however, CHOW-tests are not very powerful in detecting unstability. Furthermore the CHOW-test is a joint test of constant variance and of constant parameters. In this case I have used recursive estimates of the coefficients to evaluate parameter stability. The method of Bårdsen (1989) has been used to calculate standard errors of the long run coefficients in the error conection model (9).

4. Data

The number of disability recipients rose from 4.3 per cent of the population 16-66 years in 1970, increasing to 8.6 per cent in 1991. Disability rates have risen more for women than for men. In the older age groups just below retirement age disability rates are now close to 50 per cent. Entry rates for women are generally higher than the ones for men for the younger age groups, whereas they are lower for the two older ones. The relative increase in entry rates over the years 1970-1990 have been higher for women than for men, for all age groups.

Table 1. Entry rates[1)] to disability benefit. Rate in 1991 and percentage change 1970-1991. Per cent

Age group	Men		Women	
	Change in % 1970-91	Rate 1991	Change in % 1970-91	Rate 1991
16-39	42	0.2	38	0.2
40-49	18	0.6	75	1.0
50-59	3	2.2	50	2,7
60-64	36	6.4	68	4,8
65-66	35	10.0	69	6.0

1) As a share of non-disabled population.

In the 1980's unemployment had one temporary jump in 1983-84 and rose sharply from 1988 on. There was a slight increase in disability entry in the first part of the 1980's, but only a moderate decline around 1985/86 as unemployment soared. And entry increased again sharply in 1987, while unemployment only started to rise in 1988-1989. From 1990 to 1991 entry rates declined again, though unemployment was still high. The visible correlation from looking at the data thus does not seem very direct.

Figure 1. Entry into disability benefit. Per cent of non-disabled population 16-66 years, men and women. Unemployment rate. Per cent (left axis)

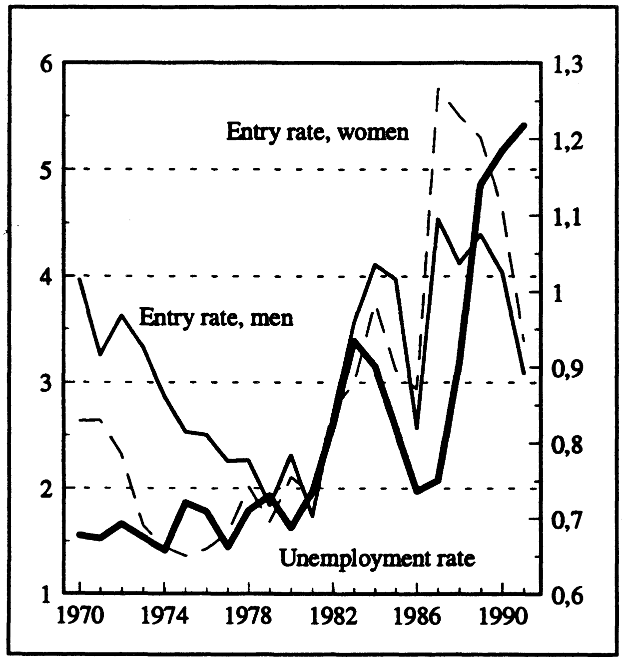
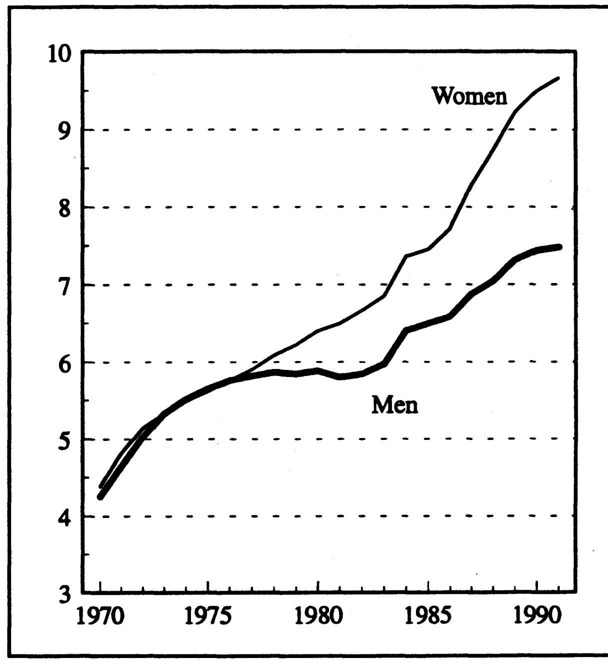


Figure 2. Disability recipients. Per cent of population 16-66 years



The replacement ratios for entrants into disability benefit have somewhat different trends and levels depending which group we consider. For the older male groups replacement ratios in the late 70's, and being roughly constant thereafter. The younger male groups' replacement ratios have been roughly constant in the period we are considering. For women there is a more uniform picture of increasing replacement ratios since the mid 70's, also changing little in the 80's. A noticable factor behind slower growth in female replacement ratios is the fact that female wages have risen considerably more than wages for men. Data sources and procedures for construction of data are described in the appendices and in Bowitz (1992).

Table 2. Replacement ratios (after tax) for an entrant into disability benefit. Per cent of annual wages

Age group	Men		Women	
	Change in % 1970-91	Rate 1991	Change in % 1970-91	Rate 1991
16-39	-8	62	8	56
40-49	0	68	19	59
50-59	6	62	10	53
60-64	31	59	16	51
65-66	49	59	19	50

5. Estimation results

It turned out that the results using total unemployment as labour market variable were at least as good as using any other measure of unemployment. I therefore proceeded by using total unemployment as the labour market variable. Both unemployment, replacement ratio and female participation were significant as long run coefficients. In first differences only unemployment were significant, with a negative sign. But the interim multipliers of unemployment are positive, though small, the first 2-3 years, in all equations.

The equations contain restrictions both wrt. the short run and long run coefficients. The coefficients for changes in unemployment are different between men and women, in some cases; data rejected further restrictions. In all equations in table 3 there are restrictions imposed on the long run coefficients. In all equations the long run elasticities are restricted to be the same for all age groups, but in equations 2 and 3 there are different elasticities for men and women of unemployment and/or replacement ratio. The differences in long run elasticities between men and women were small, so equality restrictions could be imposed (equation1). The results imply that changes in the economic factors take time to affect entry rates into disability benefit. Especially the effects of changes in unemployment on entry rates are very small the first years, but there rise quite sharply. The effects of changes in e.g. unemployment on entry and the number of transfer recipients can only be evaluated in a model describing entry, aging of the disabled population and exit from disability benefit. The effects measured in persons will also depend on the level of unemployment in the reference scenario. A first order impression of the effects may be obained by looking at the calculated long run elasticities using the actual figures for unemployment and disability entry in 1991. Then unemployment was 5,4 per cent or 116 000 persons, and gross entry into disability benefit was 25 000 persons. An increase in unemployment of say 20 000 persons would have a long run partial effect of disability entry of 2 500 - 3 000 per year (ignoring the fact that increased disability reduces the popultaion at risk). Both replacement ratios and female labour participation also were significant on level form, but not in first differences. The long run elasticities for these variables did not differ much between men and women, either. The elasticity of the replacement ratio was some above one while the elasticity of female participation was only slightly smaller. With equal coefficients for men and women for unemployment and replacement ratio in equation 2 in table 3, increased labour participation is the main factor behind the sharper rise in female entry rates into disability benefit.

In section 6 the estimated entry equations are used in a historical decomposition of the changes in the number of transfer recipients in Norway.

Table 3. Estimated equations for entry rates into disability benefit. Method: OLS. Estimation period 1974-1990. t-statistics in parentheses

		(1)	(2)	(3)
ΔUR_{-1}	M	-0.23 (2.9)	-0.22 (2.9)	-0.23 (2.9)
	W	-0.35 (5.0)	-0.36 (4.5)	-0.36 (4.5)
ΔUR_{-2}	M	-0.19 (2.8)	-0.19 (2.7)	-0.19 (2.6)
	W	-0.33 (4.8)	-0.34 (4.0)	-0.35 (4.0)
ΔUR_{-3}	M	-0.43* (7.22)	-0.43* (7.1)	-0.43* (7.0)
	W	-0.43 (7.22)	-0.43* (7.1)	-0.43* (7.0)
PR_{-1}	W	0.47 (3.4)	0.44 (2.6)	0.45 (2.3)
RR_{-1}	M	0.51* (3.1)	0.51* (3.1)	0.52 (2.6)
	W	0.51* (3.1)	0.51* (3.1)	0.49 (1.6)
ER_{-1}	....	-0.45 (6.6)	-0.45 (6.3)	-0.45 (6.2)
UR_{-1}	M	0.35* (5.0)	0.35 (3.1)	0.35 (4.7)
	W	0.35* (5.0)	0.37 (3.7)	0.37 (3.7)
ΔER_{-1}	....	-0.16 (2.2)		-0.15 (2.1)
n	....	180	180	180
k	....	20	21	22
$\hat{\sigma}$	....	0.14399	0.14442	0.14487
SSR	....	3.31744	3.3161	3.31599
DW	....	2.35	2.35	2.35
Long run elasticities, t-statistics according to Bårdsen (1989)				
PR	W	1.05 (3.4)	0.98 (2.4)	1.00 (2.1)
UR	M	0.79*(8.8)	0.78 (7.5)	0.78 (7.1)
	W	0.79*(8.8)	0.82 (5.6)	0.82 (5.5)
RR	M	1.14*(2.6)	1.13* (2.6)	1.16 (2.2)
	W	1.14*(2.6)	1.13* (2.6)	1.09 (1.0)

UR = Unemployment rate.
PR = Female participation rate.
RR = Replacement ratio.
n = Number of observations.

k = Number of coefficients.
$\hat{\sigma}$ = Standard error of regression.
SSR = Sum of squared residuals.
* = Restriction.

Table 4 shows a number of tests of the imposed restrictions.

Table 4. Tests on imposed restrictions of equation 1 in table 3

Restriction	F-statistic
Equal coeff. for ΔUR for men and women, against chosen eq. ...	F(2,160) =3.83
Chosen eq. against group-specific effects of ΔUR_{-j}, j=1,2,3	F(24,135) =0.21
Chosen eq. against age-specific eff. of UR_{-1} and RR_{-1}	F(8,160) =0.30
Chosen eq. against sex-specific eff. of UR_{-1} and RR_{-1}	F(2,158) =0.03
Chosen eq. against group-specific eff. of UR_{-1} and RR_{-1}	F(18,142) =0.43
Chosen eq. against group-specific effects of UR_{-1}	F(9,151) =0.45
Chosen eq. against group-specific effects of lagged endogenous variable	F(9,151) =0.83
Chosen eq. against sex-specific effects of UR_{-1}	F(1,159) =0.06
Chosen eq. against sex-specific effects of RR_{-1}	F(1,159) =0.01
Chosen eq. against age-specific effects of PR_{-1} and RR_{-1}	F(8,152) =0.56
Chosen eq. against age-specific effects of RR_{-1}	F(4,156) =0.94
Chosen eq. against very general equation	F(65,95) =0.41

We cannot reject equation 1 against more general models, but data says that we can not impose the restriction that all the first differences of log(unemployment) are equal for men and women.

As a part of the model evaluation I have studied recursive estimates of the various coefficients, and their standard deviations. The method of Bårdsen(1989) was used for obtaining standard errors for the long run coefficients. The recursive estimates for the replacement ratio increased during the 1980's, while the estimates for the participation ratio seems quite stable after 1983. The estimates of the long run elasticity of unemployment varies somewhat until 1987, but are very stable from then on.

Figure 3. Recursive estimates of the long term coefficient of unemployment. +/- 2 standard deviations

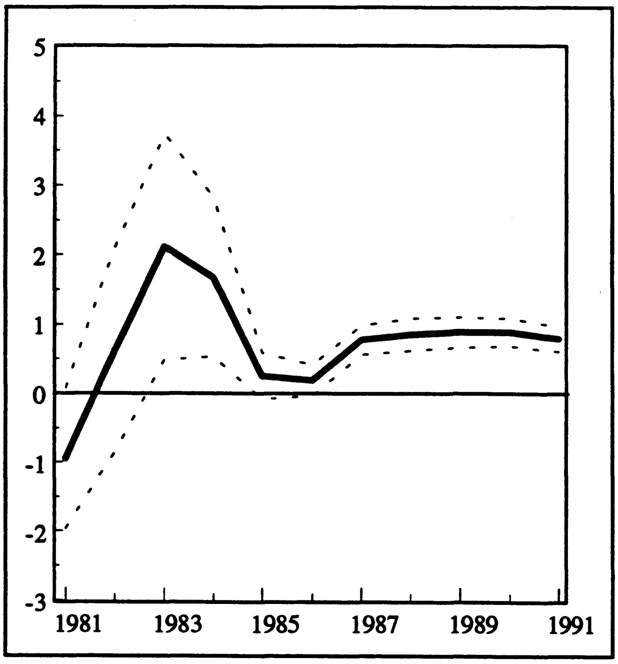


Figure 4. Recursive estimates of the long term coefficient of the replacement ratio. +/- 2 standard deviations

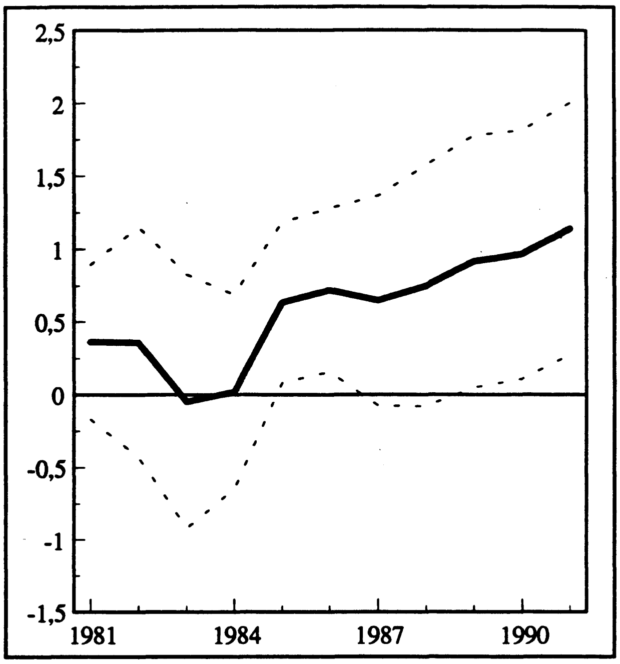
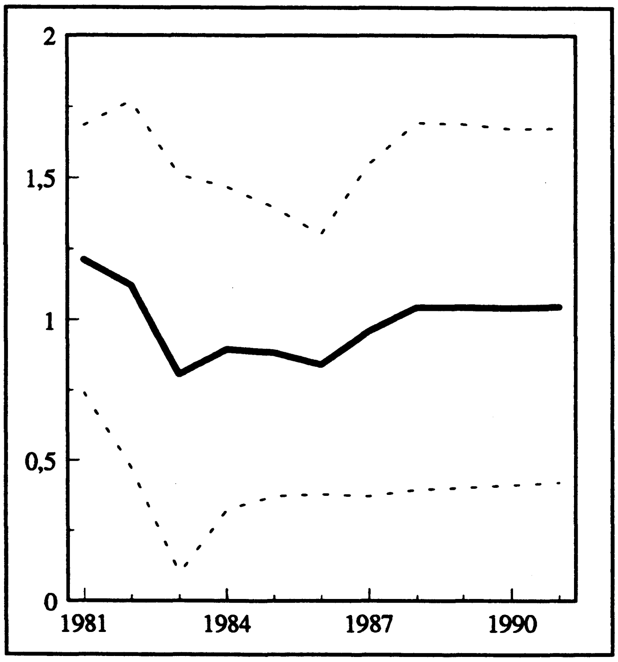


Figure 5. Recursive estimates of the long term coefficient of participation rate for women. +/- 2 standard deviations



Some variables, other than the ones mentioned in table 3, have been tried, but are not reported here due to lack of significance or stability. Eg. the coefficient of variation of regional unemployment was tried, but was insignificant. Likewise variables for the share of employment in subsectors of the economy was tried (primary sectors, manufacturing, services), for men and women respectively. Several analyses have indicated that disability is more frequent in some sectors, inter alia in manufacturing. But these variables only obtained wrong sign, and were dropped. In addition various measures of employment growth and sectoral composition of employment were tried. These variables were included in order to be able to account for the possibility that disability entry increases more in cases unemployment increases as a consequence of layoffs than if unemployment increases as a result of increased labour supply. But they were dropped in the final equation because of very unstable estimates. Marital status was not significant and had 'wrong' sign compared to what was expected from microdata-research, and was dropped.

Both total unemployment, unemployment for men and women respectively, and long term unemployment (more than 26 weeks) have been tried, but never gave better results than using total unemployment. In order to capture effects of the possibility that increased unemployment due to layoffs induces more people to enter disability than increased unemployment due to increased supply, I have constructed an indicator to capture this. The variable summed the absolute value of decreases in employment in all sectors in MODAG, relative to total labour supply. The results using this variable were not successful, however.

6. Explaining the growth of disability recipients in Norway

As in most other western countries the number of disability recipients in Norway has risen steadily the last 20 years. By combining the estimated relationships with a model describing aging and mortality of the disabled population, I have used the model to decompose changes in disability recipients on the different explanatory variables in my analysis. The model for determining the number of disability recipients is:

$$(1)\quad D_{ij,t} = D_{ij,t-1} + E_{ij,t} - C_{ij,t} - \alpha_j \cdot (D_{ij,t-1} + E_{ij,t} - C_{ij,t}) + \alpha_k \cdot (D_{ik,t-1} + E_{ik,t} - C_{ik,t})$$

$$(2)\quad C_{ij,t} = D_{ij,t} \cdot CR_{ij,t}$$

$$(3)\quad E_{ij,t} = ER_{ij,t} \cdot (N_{ij,t} - D_{ij,t})$$

where

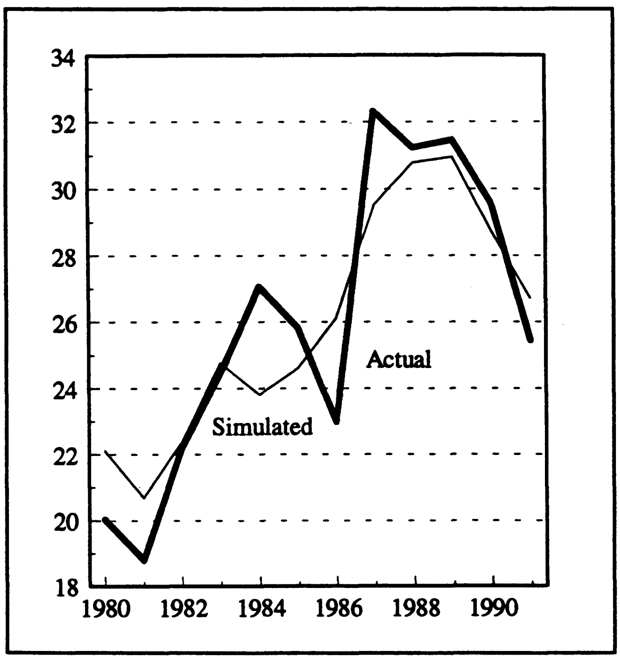
D_{ij},t	Number of disability recipients, sex i, age group j, end of year t.
E_{ij},t	Entry of disability recipients, sex i, age group j, year t.
C_{ij},t	Exit from disability benefit (mostly mortality), sex i, age group j, year t.
N_{ij},t	Population, age group j, end of year t.
$ER_{ij,t}$	Entry rate into disability benefit, rate of non-disabled population.

$CR_{ij,k}$ Exit rate for the disabled population, rate of disabled population.

α_j The share of the disabled population in one age group that are in the next older age group at the end of the next year. This variable is higher than $1/T_j$ where T_j is the number of years in the age groups because the disability rate is an increasing function of age within each age group.

Given population, entry and exit rates, the model simulates the number of disability recipients. Entry rates are determined by equation 1 in table 3. Figure 6 shows actual and simulated values of entry into disability benefit in a simulation 1980-91. The actual rise in disability in the period was 79 000 persons while the simulated increase was 72 000.

Figure 6. Entry into disability benefit. Actual and simulated values. 1 000 persons



I here use the model to decompose the increase in the number of recipients on the various explanatory variables. We must keep in mind that since the model is highly dynamic, the full effects of a change in an explanatory variable only occur many years after the change.

Table 5 below shows the results of the decomposition. The various exogenous variables in the entry rate equations were fixed at their 1980 levels and the corresponding changes in disability compared to the historical simulation were calculated. Because some of the explanatory variables changed little in the 80's, but increased sharply in the late 70's, I also made simulations where the exogenous variables were fixed at their 1975 levels. The model was also in this case simulated over the years 1980-91.

Table 5. Decomposition of changes in the number of disability recipients 1980-1991. Partial effects of increases in each factor. 1000 persons

Change in:	Effect:
1. Unemployment above 1980-level (1.6 %)	35
2. Female participation above 1980 level	6
3. Replacement ratio above 1980 level	-4
4. Female participation above 1975 level	17
5. Replacement ratio above 1975 level	16
Actual change	79
Simulated change	72

We see that among the explanatory variables only unemployment has a large contribution to increased disability from changes above the level in 1980. The increase in female participation in the 1980s has according to this analysis only contributed slightly to the increased frequency of disability. As replacement ratios have fallen in the 1980s, this has contributed to a decline in disability, cet. par. A large part of the increase is unexplained by the increases of the explanatory variables in the 1980s.

Actually, replacement rates increased significantly in the late 70's, and the effect of this is given in line 4 in table 5. Also the effects of incrased female participation becomes larger when we compare to the level in 1975. The composite effect of increased participation and replacement rates relative to 1975 level and unemployment relative to 1980 level (unemployment was a little higher in 1975 than in 1980) amounts to 69 thousand persons. Although the bulk of the explanation of increasing numbers of disability recipients still is attributable to increased unemployment, some 45 percent of the simulated increase of disability recipients in the 1980s can be attributed to higher replacement rates and female labour participation rates than in the mid-70's. A significant part of increased disability incidence in the 80's is thus due to what happened in the second part of the 70's according to this analysis.

7. Summary and conclusions

Using grouped time-series data for different demographic groups by sex and age, I have estimated entry functions into disability benefit in Norway. Though its well-known weaknesses, a time series approach makes it possible to assess the effects of the large variations (i.e. increases) in relevant variables such as unemployment, replacement rations and female labour participation that has occured the latest decade. But perhaps the main advantage of this approach is the fact that this analysis is easy to incorporate in a macroeconomic model. Taking account of the large dependence on the labour market of disability benefits, this makes policy evaluations using a macroeconomic model more realistic. As public worry about government finances persist or increase, taking account of effects like the ones adressed in this paper are of course of great importance, increasing the amount of automatic stabilisation due to the social security system, compared to what is usually assumed in policy anlyses.

APPENDIX 1: DATA SOURCES

Entry rates have been calculated using aggregate published figures from the National Insurance Administration (NIA) for each year 1970-1990. The figures are taken from various issues of the statistical yearbook of the NIA. I have made some corrections to the official figures in some years in the 1980's due to changes in handling time in the National Insurance system, based on information in NOU(1990). But possible remaining variations in the exact dating of disability status adds uncertainty to the data. More detail is given in Bowitz (1992).

It has not been possible to obtain figures for paid benefits for entrants into disability benefit each year. And if possible, such data would be exposed to self selection, as they say nothing about replacement ratios of the ones who did not choose to become disability benefit recipient.

I have therefore calculated benefit levels for entrants using the actual pension and tax rules in each year, using data on earnings for the total population, reported to the NIA for each of the 10 groups.

It has also been possible to take account of differences in average tax rates between benefit recipients and wage earners, utilizing the CBS' tax models. We then may account for tax rate differences both due to differences in income levels between wage earners and benefit recipients, but also the fact that a given income is taxed easier if it accrues to a benefit recipient than to a wage earner.

The replacement ratio also incudes a measure of income if the person does not become a disability recipient. I have used aggregate time series using national accounts data of wages paid pr. man-year distinguishing between averages for men and women. I thus cannot measure possible age-specific variations in wages. But if the age-related distribution of wages remains constant over time, the changes over time in the replacement ratios will not be affected, and time-variation is what matters in this analysis.

Numbers for participation rates have been calculated from the Labour Force Sample Survey (LFSS). Due to changes over time a number of estimations were neccessary in order to obtain continous timeseries for all groups back to 1972, the first year of the LFSS. Numbers for employment shares of different sectors and rates of marital status, by sex and age, are taken from the MODAG databank, based on national accounts and official demographic statistics.

APPENDIX 2: MORE ABOUT THE CONSTRUCTION OF BENEFIT PAYMENTS DATA

Disability benefits (DB) are in principle calculated exactly the same way as retirement pensions, as both are integral parts of the Norwegian system of National Insurance. It consists of a minimum benefit (MB) and (possibly) a supplementary benefit (SB), the latter being linked to the previous labour income history of the individual. Disability benefit thus becomes

$$DB=MB+SB,$$

Supplementary benefit can crudely be said to be calculated by:

$$SB = \alpha \cdot BPU \cdot FP \cdot PEY/PEYMAX$$

where α is the supplementary benefit rate, BPU is the basic pension unit in the National Insurance system (this is used to calculate individual pension points each year, as well as it is the key parameter in indexing pension payments), FP is the Final Pension point, which is positively linked to the income history of the individual, PEY is the number of years since 1967 the individual has had incomes and PEYMAX is the required number of years for the individual to obtain maximum supplementary benefits. PEYMAX is gradually increasing as the pension system for retirement pensioners reach maturity in 2007, making PEY/PEYMAX a number gradually approaching unity. Disability recipients is attributed their latest years' income in all years until they are 67.

PEY and PEYMAX can easily be calculated from the calendar. BPU is an amount for each year, and α has been 0,45 in all years analyzed here. The difficult part is to make an assessment on the FP. This has been done by using available figures from the NIA on earned pension points in 1970 and 1990 for the total polulation in each demographic group, and interpolating between these end-ponts. We also take account of the fact that a larger fraction of women than of men are only receiving minimum benefit. In this way we obtain a significant degree of variation in the benefit levels for new disabilitiy recipients each year.

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