VATT-KESKUSTELUALOITTEITA
VATT-DISCUSSION PAPERS

210

LABOUR MARKET POLICY AND UNEMPLOYMENT A JOB FLOW MODEL OF FINLAND*

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Helsinki 1999

* An earlier version of this paper was presented at the 11th Annual EALE Conference 23. - 26.9.1999, University of Regensburg, Germany. We thank our discussant Manuela Samek Ludovici and the participants of the Labour Market Policy session for helpful comments.

ISBN 951-561-299-3

ISSN 0788-5016

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Yliopistopaino Oy

Helsinki, November 1999

PASI HOLM, PEKKA SINKO AND PEKKA TOSSAVAINEN: LABOUR MARKET POLICY AND UNEMPLOYMENT - A JOB FLOW MODEL OF FINLAND. Helsinki, VATT, Valtion taloudellinen tutkimuskeskus, Government Institute for Economic Research, 1999, (C, ISSN 0788-5016, No 210). ISBN 951-561-299-3.

Abstract: In this study a numerical search equilibrium model of labour markets is applied to the Finnish data in order to analyse the factors behind the record high unemployment of the early 90's. Job creation and job destruction are endogenously determined from the dynamic optimising behaviour of firms and workers. We find that the labour market policy account for a remarkable part of the Finnish structural unemployment, but cannot explain the adverse development of employment over time. Instead, our analysis suggests that the upsurge in unemployment can be attributed to the increased uncertainty concerning the future productivity.

Key words: Matching models, structural unemployment, labour market policy.

Tiivistelmä: Tutkimuksessa kuvataan Suomen työmarkkinoita numeerisella työvoimavirtamallilla, jossa irtisanomiset, rekrytoinnit ja palkat määräytyvät endogeenisesti yritysten ja työntekijöiden dynaamisen optimointikäyttäytymisen perusteella. Mallin avulla arvioidaan rakenteellista työttömyyttä ja siihen vaikuttavia tekijöitä. Tulosten mukaan verot, työttömyysturva ja irtisanomissuoja selittävät huomattavan osan Suomen rakenteellisesta työttömyydestä. Politiikka-parametrit eivät kuitenkaan selitä työttömyyden kehitystä yli ajan. Mallin mukaan pääosa työttömyyden lisäyksestä 1990-luvulla aiheutui taloudenpitäjien odotuksiin liittyvän epävarmuuden kasvusta.

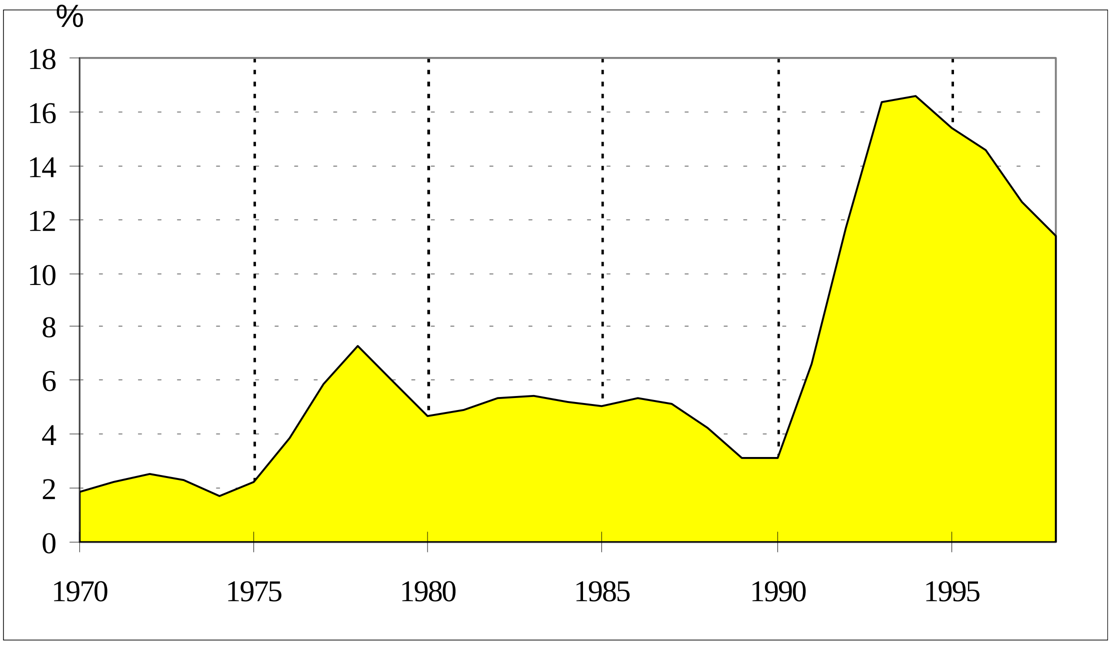
Asiasanat: Työvoimavirtamalli, rakenteellinen työttömyys, työmarkkina-politiikka.

Contents

1. Introduction

During the first half of the 90's Finnish economy experienced a dramatic increase in the number of the unemployed workers. The unemployment rate rose from the 3 per cent of 1990 to the peak of over 16 per cent in 1994 - a record high even in the European standards (Figure 1). At the same time the economy went through a major depression with a 13 per cent drop in the real GDP in years 1991-1993. Since 1994 Finnish economy has been growing rapidly, but the recovery of employment has been disappointingly slow.[1]

Figure 1. The unemployment rate in Finland 1970 - 1998



Source: OECD.

This development has lead to an active debate on the nature and causes of the unemployment in Finland. In particular, the question has been raised to what extent the unemployment can be considered structural and to what extent it may be attributed to general fluctuations in economic activity. It has been argued that part of the originally cyclical unemployment has transformed itself into a persistent structural phenomenon (OECD,1996).

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[1] For a more detailed description and analysis of the Finnish economic crises in 1990-1994 see e.g. Honkapohja & Koskela (1998).

Economists have developed methods for decomposing the observed unemployment rate into cyclical and structural components. Probably the most well known of these is the concept of *non-accelerating inflation rate of unemployment*, NAIRU. By definition, NAIRU refers to the rate of unemployment that economy converges to if inflation remains stable (see Layard et al, 1991). To press unemployment below the NAIRU-level, either inflationary policies or structural reforms are needed. Empirical estimates for the NAIRU in Finland range from 15 per cent in 1995 (OECD, 1996) to 12 per cent in 1994 (Holm & Somervuori, 1997) and 9 per cent in 1997 (Pohjola, 1998). [2]

An alternative approach to analysing structural unemployment is based on the so called *Beveridge-curve*, known also as the UV-curve (see e.g. Blanchard & Diamond, 1989). The Beveridge-curve depicts the empirically observed negative relationship between the unemployment ratio and the number of vacancies. Since 1970's the Beveridge-curve for Finland has gradually shifted outwards suggesting an increase in the structural rate of unemployment. The major problem with the Beveridge-curve is the difficulty of discriminating between movements due to structural and cyclical factors.

The factors behind the Beveridge-curve can be explicitly studied by constructing theoretical models of the labour market focusing on the flows of labour force between employment and unemployment.[3] In these models the UV-curve is implied by a *matching function* that relates the creation of new jobs to the number of vacancies and unemployed workers (Pissarides, 1990). A further refinement by Mortensen & Pissarides (1994) incorporates endogenous job separation process due to idiosyncratic shocks to labour productivity. An empirical application of this framework is provided by Millard & Mortensen (1997) who include a range of labour market policy parameters and calibrate the model to stylised US and UK data.

This study follows Millard & Mortensen (1997) in constructing an equilibrium unemployment model with endogenous *job creation* and *job destruction*. The model is then parametrised to produce a stylised description of the Finnish labour market in the mid 1990's. The purpose of the study is to gain further insight into the factors behind the record high unemployment in Finland. In particular, we evaluate the contribution on unemployment of various labour market policy parameters under government control: unemployment insurance, redundancy payment and payroll taxes. Our results suggest that labour market policy - though important determinant of the equilibrium unemployment in Finland - cannot

[2] The OECD (1996) estimate is actually based on a related method of NAWRU, non-accelerating wage rate of unemployment.

[3] A profound empirical assessment of the significance and behaviour of the job flows is provided by Davis et al (1996).

explain the adverse development in employment during the current decade. Instead, as our analysis suggests, the increase in unemployment can be attributed to an increased uncertainty concerning future productivity. This finding is in line with the results of the empirical studies proposing that adverse shocks on labour demand were the main determinants behind the surge of the Finnish unemployment in the early 90's (Kiander & Pehkonen, 1998).

Besides the *level* of unemployment, the present framework allows us to decompose the effect of the policy measures on the average *duration* and *incidence* of unemployment spells. This feature may be of high policy relevance since identical unemployment rates may hide quite different patterns of underlying labour market dynamics and therefore call for different policy responses. A recent example is the empirical finding by Hildreth et al (1998) suggesting that the high unemployment among young men in the UK is indicative of high labour market mobility in that group and should therefore cause less concern.

The structure of the paper is as follows. Section 2 introduces the model. Section 3 presents and discuss the parametrisation of the model to mimic Finnish economy. Section 4 presents simulations with alternative policy parameters and over time. Section 5 concludes and suggests some guidelines for further research.

2. The Model

The model framework used in the simulations is that developed in Mortensen & Pissarides (1994) and Millard & Mortensen (1997). The model provides a stylised picture of functioning of the labour market. Employment evolves in time dictated by separate job creation and job destruction processes. Both rates are endogenously determined by forward looking behaviour by workers and employers. The equilibrium rate of unemployment is calculated as a steady state solution equating the flows into and out of unemployment. The behaviour of workers and employers and thus equilibrium rate of unemployment is affected by - among others - the policy parameters set by the public authority.

The job creation process is assumed to follow a *matching function* with constant returns to scale over vacancies N_V and number of unemployed workers searching for a job N_U :

$$M = {N_V}^{\eta} {N_U}^{1-\eta}, \tag{1}$$

where M is the number of matches per time period and η is the elasticity of matches with respect to the number of vacancies. Writing $\theta = N_V / N_U$ for the vacancy to unemployed ratio we can then define the *unemployment hazard* as

$$m \equiv M / N_U = \theta^{\eta}, \tag{2}$$

which gives the probability of an unemployed worker to find a job as an concave increasing function of labour market ”tightness” measured by the endogenous θ. The average duration of an unemployment spell is then given by

$$dur \equiv 1/m = \theta^{-\eta}. \tag{3}$$

As for the job destruction, it is assumed that there is an underlying exogenous quit rate, δ. In addition a stochastic productivity shock arriving at frequency λ will make part of the filled jobs unprofitable. As the productivity shock is assumed distributed according to a cumulative distribution function $F(x)$, the rate of job destruction or the unemployment incidence is given by

$$inc = \delta + \lambda F(R), \tag{4}$$

where R is the endogenous *reservation productivity* giving the lowest level of productivity that makes continuation of a match profitable. The second term in the r.h.s. of (4) can thus be interpreted as the probability per time period of perceiving a shock that makes a job unprofitable.

With the job creation and destruction rates defined above, equating the flows into and out of unemployment yields

$$\frac{u}{1-u} = \frac{\delta + \lambda F(R)}{m(\theta)} \equiv dur \times inc\,, \tag{5}$$

where u is the steady state equilibrium rate of unemployment the economy converges to. Equation (5) suggests a useful decomposition of the unemployment rate into average duration and unemployment incidence, that provide additional information of the functioning of the labour market. Two economies with identical unemployment rates may possess completely different pattern of duration and incidence. Combination of high duration and low incidence, typical for European economies, is indicative for sluggish labour markets with long-term unemployment as a major problem.

As noted above, the duration of unemployment spells and the unemployment incidence depend on two endogenous variables in the model, the vacancy-unemployed ratio θ and the reservation productivity R. To determine these variables we first note that the labour market can be characterised by four states or ”assets” that an expected present value can be attached to assuming a forward looking behaviour by the model agents. The employer assigns some value for filled jobs and vacancies. The worker assigns some value for being employed and for being unemployed.

Applying the principles of dynamic programming, we can determine the expected present value of a filled job to employer through the Bellman equation

$$rJ(x) = x - (1+\pi)w(x) - \delta J(x) + \lambda\left[\int_R^1 J(z)dF(z) - F(R)T - J(x)\right], \tag{6}$$

where $J(x)$ is the expected present value of a filled job with productivity x, r is the real interest rate, π is the payroll tax rate and $w(x)$ is the wage rate of a job with productivity x. T is the expected value of payments by an employer who lays off a worker defined as

$$T = \varepsilon\,\rho w(R)\frac{\left[1-e^{-\tau[r+m(\theta)]}\right]}{r+m(\theta)} + \phi\ , \tag{7}$$

where ε is the ”experience rating” parameter defining employer’s share of the unemployment benefits paid to the worker, ρ is the replacement ratio, τ is the unemployment benefit period and ϕ is the lump sum redundancy payment made at the date of separation.

Similarly, we can determine the expected present value of a vacancy, V as follows:

$$rV = -c + \frac{m}{\theta}\left[J(1) - k + \psi - V\right], \tag{8}$$

where k is the training cost, ψ is the government subsidy per new job created and $J(1)$ is the expected present value of a new job assuming that jobs are created at upper end of the productivity dispersion.[4]

The worker's valuation of a job with productivity *x, W(x)* is given by

$$rW(x) = (1-\pi)w(x) - \delta\left[W(x) - U\right] + \lambda\left[\int_R^1 W(z)dF(z) + F(R)[U+B] - W(x)\right], \tag{9}$$

where B is the expected value of transfers received by a worker during an unemployment spell defined as

$$B = \rho w(R)\frac{\left[1 - e^{-\tau[r+m(\theta)]}\right]}{r + m(\theta)} + \phi., \tag{10}$$

and U is the expected present value of unemployment to a worker defined as

$$rU = b + m(\theta)\left[W(1) - U\right], \tag{11}$$

where b is the worker's valuation of leisure per time period.

Having defined the valuations of different states by workers and employers we can proceed to close the model with two equilibrium conditions. For that purpose we define surplus value of continuing a job with productivity x, $S(x)$, as follows:

$$S(x) = J(x) + W(x) - [U + B - T], \tag{12}$$

where the symbols are as defined above. The division of the surplus between workers and employers is dictated by wage negotiations so that

$$\beta\left[J(x) + T\right] = (1-\beta)\left[W(x) - U - B\right], \tag{13}$$

where β is the worker's share. In other words, the outcome of the negotiation is assumed to split the surplus from continuing in fixed proportions.[5] This

[4] This assumption is justified if new jobs are more productive than existing ones, see Mortensen & Pissarides (1994) for discussion.

guarantees that a job is destroyed only if it is mutually beneficial. Substituting (13) into (9) yields an explicit wage equation

$$w(x) = \frac{\beta[x + (r+\delta)T] + (1-\beta)[rU + (r+\delta)B]}{\beta(1+\pi) + (1-\beta)(1-\pi)}. \tag{14}$$

The *job destruction condition* defining the reservation productivity can now be written as

$$S(R) = 0, \tag{15}$$

which simply states that the surplus value of continuing a job with the reservation productivity is zero. The *job creation condition* derives from the assumption of free entry by competing employers that draws the value of a vacancy to zero.[6] In other words,

$$V = 0. \tag{16}$$

Substituting the relevant value equations (6)-(11) into the equilibrium condition (15) and some manipulation yields

$$R + \frac{(1-\pi)\lambda}{(1-\pi+2\beta\pi)(r+\delta+\lambda)}\int_R^1 (z-R)dF(z) = rU + 2\pi w(R) + (r+\delta)[B-T]. \tag{17}$$

Substituting the relevant value equations (6)-(11) into the equilibrium condition (16) and some manipulation yields

$$\frac{c\theta}{m(\theta)} = \frac{(1-\beta)(1-\pi)(1-R)}{(1-\pi+2\beta\pi)(r+\delta+\lambda)} - T + \psi - k. \tag{18}$$

The labour market equilibrium is the pair (θ, R) of labour market tightness and reservation productivity that solves (17) and (18). Unemployment duration, incidence and the equilibrium rate can then be found recursively by substituting θ and R into (3), (4) and (5) respectively.

[5] This type of wage rule is frequently used in the search models and can be derived from a Nash bargaining between workers and employers. For discussion and motivation see e.g. Pissarides (1990).

[6] The zero expected profit on a new vacancy is equivalent to a marginal productivity condition for any job with productivity at upper end of dispersion (Mortensen & Pissarides, 1994).

3. Application to the Finnish Labour Market

In the previous section we derived the equations of job flow model with equilibrium unemployment. In this section we select the exogenous model parameters so as to match those of the Finnish labour markets in the first half of the 90's. We then proceed to solve the model numerically to produce a benchmark equilibrium.[7]

The parameters of the model can be divided into *structural parameters* describing the general economic environment in the labour market and *policy parameters* involving the key instruments of labour market policy. Our strategy in parametrising the model is similar to that suggested by Millard & Mortensen (1997) in applying the model to UK data. That is, we use the available information to match the structural parameters with their Finnish counterparts as well as possible. If no reliable estimate can be found we use values identical to the ones of Millard & Mortensen (1997) in their benchmark for the US. We then set the labour market policy parameters equal to the actual values in Finland. Finally, we calibrate the value of leisure and the workers share parameter so that the equilibrium solution is consistent with the average unemployment duration and incidence in Finland for the period 1990-1995.

In what follows, we discuss in detail the selection of the parameter values presented in Table 1. Starting with the policy parameters, the workers' and employers' total social security contributions amount 30 per cent of the wages in Finland. This suggests the value $\pi = 0.15$ for the payroll tax parameter in the model that assumes equal rates for workers and employers.[8]

The average unemployment benefit replacement ratio in Finland is 60 per cent for those enrolled in the earnings-related system. For those receiving only the base benefit, the replacement ratio is much lower. Since roughly a half of the unemployed are entitled to the earnings-related benefits, we assume the average effective rate is 40 per cent, implying $\rho = 0.4$. The unemployment benefit period is 500 working days, which suggests a value $\tau = 8$ quarters for the effective benefit period.

The average redundancy payment by the employer amounts to one months salary in Finland. Therefore, we use value $\phi = 0.3$ for the severance payment parameter. The Finnish labour market legislation does not involve employer experience rating in the finance of unemployment insurance. Neither is the any remarkable

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[7] The numerical model was implemented using the GAMS -programming package (Brooke et al, 1992).

[8] This assumption to some extend exaggerates the employee's contribution which is less than half of the total nominal burden in Finland.

hiring subsidies paid by the public authority. Therefore the experience rate parameter ε. and the hiring subsidy parameter ψ are both set to zero in the benchmark.

Table 1. Benchmark parameter values for Finland 1990-1995

STRUCTURAL PARAMETERS	
real interest rate r	0.01 per quarter
exogenous quit rate δ	0.014 per quarter
recruitment cost c	0.33 per quarter
training cost k	0.30 per worker
productivity shock arrival rate λ	0.03 per quarter
minimum productivity γ	0.875 per quarter
matching elasticity η	0.5
worker's share β	0.584
value of leisure b	0.2 per quarter
POLICY PARAMETERS	
payroll tax rate π	0.15
unemployment benefit replacement ratio ρ	0.4
unemployment benefit period τ	8 quarters
unemployment benefit experience rate ε	0.0
severance payment ϕ	0.3
hiring subsidy ψ	0.0

Turning to the structural parameters of model, the noticeable feature is the lack of precise estimates and direct empirical counterparts in many cases. To start with the more straightforward ones, we set the real interest rate per quarter at $r = 0.01$ implying a four per cent rate in the annual basis. The recruitment cost per worker is assumed to correspond those in the US, that is $c = 0.33$. The training costs of new personnel is assumed a little bit higher in Finland, implying $k = 0.30$ (against $k = 0.275$ in the US). The exogenous quit rate, reflecting the underlying labour mobility, is assumed to lie at the same level as in the US, i.e. $\delta = 0.014$. Finally, the matching function elasticity with respect to vacancies is assumed to lie at $\eta = 0.5$. This value is based on the empirical studies with Finnish data by Rantala (1995).[9]

For the stochastic productivity shock, we follow Millard & Mortensen (1997) in specifying the shock to a draw from a uniform distribution with probability density

$$F(x) = \frac{x-\gamma}{1-\gamma} \tag{19}$$

where γ is the minimum productivity and the upper bound of the productivity range is normalised to unity. To determine the related parameters, i.e. the arrival rate λ and the minimum productivity γ, we rely on the stylised facts about the development of labour productivity in Finland. The average major productivity shock interval of 8 years suggests the value $\lambda = 0.03$ for the arrival rate per quarter. The variability in the growth rate of the labour productivity in Finnish manufacturing in the first half of the 90's ranged from zero to 12.5 per cent (Maliranta, 1997). This observation was used to set the value of lower bound of the productivity shock equal to $\gamma = 0.875$.

Finally, to determine the remaining parameters, worker's share and the value of leisure, we apply the calibration method suggested by Millard & Mortensen (1997) for the case of the UK. That is we choose these parameters values so that the model produces average unemployment duration and incidence consistent with the observations of Finnish labour markets. This procedure suggests a worker's share parameter $\beta = 0.584$ and value of leisure parameter $b = 0.2$. The calibrated values are close to those of the UK and in line with the a priori assumption of higher negotiation power of labour in Finland relative to that in the US.

Having determined the values for the exogenous parameters we can solve for benchmark equilibrium of the model. The equilibrium values of the key endogenous variables are presented in the second column of Table 2. The predicted equilibrium rate of unemployment is 10 per cent incorporating an average duration of less than six quarters and an incidence of 2 per cent. It can be seen that the model mimics relatively closely the observations of the Finnish labour market presented in the first column of Table 2.

[9] Millard & Mortensen (1997) use the value 0.6 for the matching elasticity in the US. The lower value for Finland is in line with our a priori beliefs.

Table 2. Observed unemployment experience in Finland 1990-1995 and the benchmark equilibrium of the model

	OBSERVATIONS 1990-1995	MODEL BENCHMARK
structural unemployment rate *u*	9-12 %	10 %
average duration *dur*	4-7 quarters	5.7 quarters
expected incidence *inc*	2 - 3.5 %	2.0 %

4. Policy Simulations

In above we calibrated the model to mimic the observations of the Finnish labour market in the first half of the 90's with relatively high structural unemployment. In this section we want to evaluate the relationship between the labour market policies and the unemployment. For that purpose, we run some experimental simulations with alternative values of the labour market policy parameters in Finland. First, we consider the effects of a single policy parameter, the payroll tax, on unemployment rate and average duration. After that, to find out about the relative importance of different policy instruments in explaining the structural unemployment, we run simulations where the key policy parameters are set to zero. Finally, to find out about the model's ability to trace the development of unemployment over time, we recalibrate the model to the Finnish labour markets for the period 1980-1990 with considerably lower unemployment.

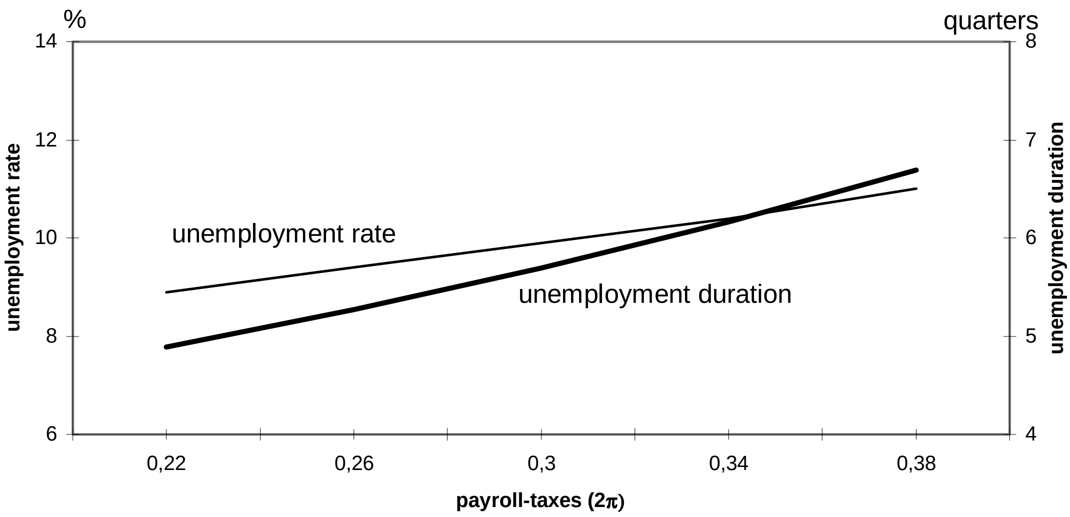
4.1 Simulations with Single Policy Instruments: the Payroll Tax

The persistent high rate of unemployment in Finland has given rise to lively debate on the role of labour taxation as a cause of inadequate use of labour. Much of the discussion and policy proposals have focused on the lowering of the payroll tax or social security contributions. It is therefore of interest to consider the effects of the payroll tax on unemployment in the present framework. For that purpose, we run a series of simulations where the payroll tax rate takes alternative values around the benchmark rate. The results are depicted in Figure 2.

It can be seen from Figure 2 that a four per cent point reduction in the payroll tax rate would reduce the unemployment rate by one per cent point and the average duration by one quarter. This result is in line with the econometric studies suggesting a relatively modest employment effect for a payroll tax drop in Finland (Honkapohja et al, 1999).

Figure 2 suggests that the average duration of an unemployment spell grows faster with payroll tax rate than the unemployment rate. This is because a higher payroll tax reduces the unemployment incidence. According to equation (4), the incidence is dictated by the reservation productivity, R, on which the increase in the payroll tax has two opposite effects. First, according to the job destruction condition (17), higher taxation makes continuing of a job less profitable and thus calls for a higher R. Second, the job creation condition (18) to hold, R has to drop in order to restore the value of a marginal vacancy that tends to decline due to higher taxes. With the chosen parameter values, the latter effect dominates leading to a lower reservation productivity, and consequently, lower incidence in the equilibrium.

Figure 2. *Effect of the payroll tax on the unemployment rate and average duration*



4.2 Labour Market Policies and Unemployment

In above we considered the effect on unemployment of a single policy parameter, the payroll tax. Similar analysis could be conducted for all the policy instruments included in the model.[10] An alternative exercise, suggested by Millard & Mortensen (1997), is to consider the effects of totally removing some of the key policy parameters. By this method we can derive the total contribution to the unemployment of the various labour market policy instruments. In particular, we consider the effects of removing the payroll tax, unemployment insurance and redundancy pay. Results of the simulations are presented in Table 3.

The results suggest that labour market policies account for a considerable part of the high unemployment of Finland in the first half of the 90's. Altogether, labour market policies explain seven percentage points of the ten per cent structural unemployment rate (case d in Table 3). Notably, the effect of the policies is particularly to increase the average duration of the unemployment spells. The effects on the incidence are either more moderate (unemployment benefits) or counteracting (payroll tax and redundancy pay). For the redundancy pay, the counteracting effect through lower incidence is strong enough to make the total effect on unemployment rate relatively modest (case c in Table 3).

[10] Holm, Sinko & Tossavainen (1999) contains similar analysis of replacement ratio, unemployment benefit period, severance payment, hiring subsidy and value of leisure.

Table 3. Effects of removing selected labour market policies on unemployment rate, average duration and incidence. Figures within the parenthesis indicate the relative change

	Unemployment rate, change in percentage points	average duration, change in quarters	incidence, change in percentage points
	Δu	Δdur	Δinc
a. no payroll tax $\pi = 0$	-3.1 (-31 %)	-2.3 (-41 %)	+0.3 (+16%)
b. no ue-benefits $\rho = 0$	-5.4 (-54 %)	-2.9 (-52 %)	-0.2 (-11 %)
c. no redundancy pay $\phi = 0$	-1.7 (-17 %)	-2.6 (-45 %)	+1.0 (+53 %)
d. no policy $\pi = \rho = \phi = 0$	-7.1 (-71%)	-4.6 (-80 %)	+0.6 (+32%)

Of the policies considered, the most remarkable contributor to the unemployment rate is the unemployment insurance. According to the model, removing unemployment benefits alone would reduce the unemployment rate to half of the initial 10 per cent (case b in Table 3).

4.3 Tracing Unemployment over Time: the Case of 1980's

So far, we have considered the implications of the model for the Finnish labour markets in the mid 90's, an era of exceptionally high unemployment. To test the models capability to trace the development of unemployment over time, we now recalibrate the model to mimic the situation in Finland the decade before, when the unemployment was much lower (see Figure 1).

Trying to calibrate the model to the Finnish labour markets of the 1980's, the striking observation is that there has been no major changes in the key policy parameters. Unemployment insurance and protection policies have stayed virtually unchanged. Only the payroll taxes went up to some extent in the 90's. Therefore, in the present framework, the explanation for the upswing in the unemployment rate has to be found from changes in the structural parameters. As for the latter, we base our scenario on changes in the bargaining power of labour and uncertainty concerning the future profitability of jobs.

To start with the payroll tax, we assume a payroll rate of $\pi = 0.13$ implying a 2 percentage points reduction in both employee's and employer's contribution in comparison to the 90's. Based on the observed increase of the union membership in the 90's in Finland we use a lower value $\beta = 0.48$ for the worker's share parameter.

As for the change in the uncertainty, we believe that the employees' expectations concerning future profitability became less precise in the turbulent early 90's. In terms of the present model, the dispersion of the expected productivity shock was widened. Therefore, to mimic the more steady era of the 1980's we increase the lower bound of the stochastic productivity shock $\gamma = 0.910$ up from 0.875 used in the mid 90's simulation. This correspond a 20 per cent reduction in the productivity shock dispersion. This scenario finds support in the empirical evidence showing a remarkable increase in the variability of the labour productivity in the Finnish manufacturing in the early 90's (Maliranta, 1997). The exogenous parameters of the 1980's simulation are listed in Appendix 3.

The equilibrium values of the key endogenous variables for 1980 - 90 are presented in the second column of table 4. The predicted equilibrium rate of unemployment is 7 per cent. The average duration of unemployment spells amounts to four quarters and the incidence is 1.7 per cent. The fit with the actual observations presented in the first column is relatively accurate except for the duration which to some extent overestimates the true value.

Table 4. Observed unemployment experience in Finland 1980 - 1990 and the corresponding benchmark equilibrium of the model

	OBSERVATIONS 1980-1990	MODEL BENCHMARK
unemployment rate u	6 - 8 %	7 %
average duration dur	2 - 3 quarters	4.2 quarters
expected incidence inc	1 - 2 %	1.7 %

The picture of the outgrowth of unemployment provided by the simulation is very much in line with the reasoning given in the studies of Finnish mass unemployment and recession. Changes in the policy parameters account for less than one percentage point of the three percentage point increase in the structural unemployment rate. The main cause of the increase can be attributed to the increased uncertainty about future profitability.

5. Conclusions

During the first half of the 90's the Finnish economy experienced a dramatic increase in the number of the unemployed. The unemployment rate rose to the peak of 18 per cent in 1994 - an exceptionally high rate even in European standards. Since 1994 Finnish economy has been growing rapidly, but the recovery of employment has been disappointingly slow.

In this study we followed Millard & Mortensen (1997) in constructing an equilibrium unemployment model with endogenous job creation and job destruction and then parametrised the model to produce a stylised description of the Finnish labour market in the mid 1990's. The purpose of the study was to gain further insight into the factors behind the record high unemployment in Finland. In particular, we evaluated three topical issues of the recent discussion: the effects of the payroll taxes, the role of labour market policies in determining the structural unemployment and the causes of the upsurge of the Finnish unemployment rate in the early 90's.

The results suggest that labour market policies account for a considerable part of the high unemployment of Finland in the first half of the 90's. Altogether, labour market policies explain seven percentage points of the ten per cent structural unemployment rate predicted by the model. The effect of the policies is especially to increase the average duration of the unemployment spells. Of the policies considered, the most remarkable contributor to the unemployment rate is the unemployment insurance. According to the model, removing unemployment benefits alone would reduce the unemployment rate to half of the initial 10 per cent.

Finally, our simulations suggest that the labour market policy is an important determinant of the equilibrium unemployment in Finland, but cannot explain the adverse development in employment over time. Instead, as our analysis suggests, the increase in unemployment can be attributed to the increased uncertainty concerning future productivity. This finding is supported by earlier empical results on the causes of the Finnish unemployment (Kiander & Pehkonen, 1998).

The modeling framework used in this paper has its relative strenght in its ability to analyse the underpinnings of the structural unemployment based on micro behaviour. However, the results seem to be relatively sensitive to the values of the exogenous parameters, whose empirical counterparts are not always easy to obtain. A more serious application of the framework would undoubtly call for additional empirical work to find accurate estimates for the key parameters. As for the policy relevance, the model would need some modification for a better fit to the Finnish labour market structures. Interesteresting amendments would include e.g. time dependent unemploymnet benefits and non-participation choice for the workers. The latter modification would facilitate the evaluations of active labour market programs in the present framework.

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Appendix 1: List of symbols

r - real interest rate

δ - exogenous quit rate

c - recruitment cost

k - training cost

λ - productivity shock arrival rate

γ - minimum productivity

η - matching elasticity

β - worker's share

b - value of leisure

w - nominal wage

π - payroll tax rate

ρ - unemployment benefit replacement ratio

τ - unemployment benefit period

ε - unemployment benefit experience rate

ϕ - severance payment

ψ - hiring subsidy

R - reservation productivity

θ - vacancy to unemployed ratio

T - expected value of payments by an employer who lays off a worker

x - expected present value of a new job

B - expected value of transfers received by a worker during an unemployment spell

U - expected present value of unemployment to a worker

u - unemployment rate

m - probability of an unemployed worker to find a job

Appendix 2: Model Equations

$$R+\frac{(1-\pi)\lambda}{(1-\pi+2\beta\pi)(r+\delta+\lambda)}G=rU+2\pi w+(r+\delta)[B-T] \qquad \text{(A.1)}$$

$$rU=b+m\left[B+\frac{\beta(1-\pi)(1-R)}{(1-\pi+2\beta\pi)(r+\delta+\lambda)}\right] \qquad \text{(A.2)}$$

$$\frac{c\theta}{m}=\frac{(1-\beta)(1-\pi)(1-R)}{(1-\pi+2\beta\pi)(r+\delta+\lambda)}-T+\psi-k. \qquad \text{(A.3)}$$

$$w=\frac{\beta[R+(r+\delta)T]+(1-\beta)[rU+(r+\delta)B]}{\beta(1+\pi)+(1-\beta)(1-\pi)} \qquad \text{(A.4)}$$

$$B=\rho w\frac{\left[1-e^{-\tau[r+m]}\right]}{r+m}+\phi \qquad \text{(A.5)}$$

$$T=\varepsilon\rho w\frac{\left[1-e^{-\tau[r+m]}\right]}{r+m}+\phi \qquad \text{(A.6)}$$

$$m=\theta^{\eta} \qquad \text{(A.7)}$$

$$G=\int_R^1(z-R)dF(z)=\frac{(1-R)^2}{2(1-\gamma)}, \qquad F(x)=\frac{x-\gamma}{1-\gamma} \qquad \forall x\in[\gamma,1] \qquad \text{(A.8)}$$

$$u=1-m[m+\delta+\lambda F(R)]^{-1} \qquad \text{(A.9)}$$

Appendix 3: Benchmark Parameter Values for Finland 1980-1990

STRUCTURAL PARAMETERS	
real interest rate r	0.01 per quarter
exogenous quit rate δ	0.014 per quarter
recruitment cost c	0.33 per quarter
training cost k	0.30 per worker
productivity shock arrival rate λ	0.03 per quarter
minimum productivity γ	0.91 per quarter
matching elasticity η	0.5
worker's share β	0.48
value of leisure b	0.2 per quarter
POLICY PARAMETERS	
payroll tax rate π	0.13
unemployment benefit replacement ratio ρ	0.4
unemployment benefit period τ	8 quarters
unemployment benefit experience rate ε	0.0
severance payment ϕ	0.3
hiring subsidy ψ	0.0