The Impact of Active Labour Market Policies

Jongen, E.L.W.; van Gameren, E.; Graafland, J.J.

Publication date:
2000

Research Memorandum

No 166

The impact of active labour market policies:
An AGE analysis for The Netherlands

Egbert L.W. Jongen, Edwin van Gameren and
Johan J. Graafland

CPB Netherlands Bureau for Economic Policy Analysis, The Hague,
June 2000

CPB Netherlands Bureau for Economic Policy Analysis
Van Stolkweg 14
P.O. Box 80510
2508 GM The Hague, The Netherlands

Telephone +31 70 33 83 380
Telefax +31 70 33 83 350

ISBN 90 5833 043 5

Contents

1 Introduction

Unemployment rose dramatically in The Netherlands during the 1980s.[1] Along with the rise in total unemployment, the number and share of individuals unemployed for more than a year rose sharply. Over the past decade unemployment in The Netherlands has fallen substantially. However, the share of long-term unemployed in the unemployment pool remains high in comparison with many other OECD countries (see *e.g.* OECD (1999)). To fight the rise and persistence of long-term unemployment the Dutch government implemented various active labour market policies (ALMPs) over the past decade.[2]

In this paper we consider the impact of these ALMPs in the context of an applied general equilibrium (AGE) model for the Dutch labour market. We study the impact on key variables like (long-term) unemployment, employment, production and government expenditures. The AGE model we use in this paper is an adapted version of the MIMIC model, the AGE model of CPB Netherlands Bureau for Economic Policy Analysis for the labour market.

Why do we study active labour market policies in the context of an AGE model? As noted by Calmfors (1994, p.36):

> "[T]he main conclusion from this analysis is that active labour market policy may give rise to a diverse set of effects, some of which are favourable and some of which are not. One cannot from a theoretical analysis evaluate the net impact of these policies. There are also severe problems of interpretation with much of the empirical macroeconomic research and a lot of conflicting evidence from the microeconomic studies. There are also crucial areas such as the optimal timing of labour-market-policy interventions as well as the optimal mix and size of programmes that remain more or less unexplored."

By explicitly modeling the behaviour of firms and workers, and the technology and design features of ALMPs, we can study the effects of ALMPs in a coherent structure. Furthermore, by calibrating the model we try to get more insight

[1]The research for this Research Memorandum was carried out in cooperation with ALERT (Free University Amsterdam).

[2]See Gravesteijn-Ligthelm *et al.* (1998) for a historical overview of ALMPs in The Netherlands.

into the net effect of ALMPs on unemployment, government expenditures etc. Unfortunately, for some parameters in our model we have a rather weak empirical basis. Hence, we also consider how sensitive the results are to these parameters.

The paper has the following outline. In Section 2 we briefly discuss the main characteristics of current ALMPs in The Netherlands, together with some indicators of their performance. Section 3 outlines the model we constructed for Dutch ALMPs, and the calibration of the model. In Section 4 we present the simulation results on various ALMPs. A sensitivity analysis of the results on some key assumptions is given in Section 5. Finally, in Section 6 we summarise our main findings and give some concluding remarks.

2 ALMPs in The Netherlands

The wide range of ALMPs can broadly be divided into: i) job broking by employment offices; ii) training programs in the public or private sector; and iii) subsidized jobs in the public or private sector (see *e.g.* Calmfors (1994)). In this paper we focus on training programs in the public sector, subsidised jobs in the public sector (relief jobs) and subsidies in the private sector ('vouchers'). Within these broad categories there is room for a huge variation in the construction of programs. Programs differ in the targeted group, the duration of the job or the subsidy, compensation to participants, etc. Table 1 summarises the main characteristics of current ALMPs in The Netherlands. Since 1998, the *'Wet Inschakeling Werkzoekenden'* (*WIW*, Unemployed Activation Act) is running. The aim of the *'WIW'* is to help the long-term unemployed and unemployed youngsters to find regular employment. The *'WIW'* replaces some of the older programs like the *'Banenpool'* (Labour pools), and the *'Jeugdwerkgarantieplan'* (*JWG*, Youth Employment Guarantee Scheme).

As of yet we have no information on participation in and the outflow from the *'WIW'*. However, Table 2 gives some information on the programs running in 1996 that appear to be the most relevant for this study. We report the number of participants, the yearly outflow rates to various destinations, and two efficiency measures:[3] a) the 'deadweight loss', and b) the substitution rate. The deadweight loss denotes the share of participants that would have found

[3] Efficiency measures are taken from Gravestein-Ligthelm *et al.* (1998) and Welters (1998).

Table 1: Current active labour market policies in The Netherlands

Program	Entry requirement	Compensation	Type of job
WIW-Dienstbetrekking (Unemployed Activation Act - Employment)	> 1 year unemployed, or unemployed and max. 23 years old.	max. 120% min. wage	public and private sector, 32 hours per week, max. 2 years
WIW-Werkervaringsplaats (Unemployed Activation Act - Experience Job)	> 1 year unemployed, or unemployed and max. 23 years old	min. 100% min. wage, max. collectively agreed wage	public and private sector, 32 hours per week, 6-12 months
In- en Doorstroombanen (Inflow and Flow-Through Jobs)	> 1 year unemployed and on benefits/social security	max. 130% min. wage (after 4 years: 150%)	public sector, additional work, 32 hours per week, no limit on duration
Melkert-2	> 1 year unemployed and on benefits/social security	100-120% min. wage, employer receives 8,168.- euro per year	regular job in private sector, at least 32 hours per week, 6 months - 2 years
Melkert-3	welfare recipient	employee remains on benefits	regular job
VLW (Reduction Long-Term Unemployed)	> 1 year unemployed	max. 130% min. wage, employer receives 2,042.- euro per new hire	regular job in private/public sector, max. 4 years
SPAK	all employees with salary ≤115% minimum wage	employer receives 830.- euro per employee earning ≤115% min. wage	regular job in private/public sector, no limit on duration

Sources: Gravestein-Ligthelm *et al.* (1998) and Ministry of Social Affairs.

Table 2: Participation, outflow, and efficiency indicators in 1996

Program	Participants	Outflow to regular work	Outflow to other destinations[a]	'Deadweight'[b]	'Substitution'[c]
JWG (Youth Employment Guarantee Scheme)	24,810	19%	17%	27%	14%
Banenpool (Labour pools)	22,932	3%	11%	3%	10%
Melkert-1	18,000	5%	8%	?	?
Melkert-2	6,000	-	-	?	?
Melkert-3	(50 projects)	?	?	?	?
VLW (Reduction Long-Term Unemployed)	110,000	-	-	48%	32%

Sources: Gravesteijn-Ligthelm *et al.* (1998), Welters (1998) and Ministry of Social Affairs.

[a] Other destinations includes outflow to another program, to welfare or disability benefits and women who gave birth.

[b] 'Deadweight' denotes the share of the flow of participants out of the program that would have found employment anyway.

[c] 'Subsitution' denotes the share of the flow of participants out of the program that substitutes other job seekers.

employment anyway, whereas the substitution rate denotes the share of vacancies filled by subsidised workers substituting other job seekers.

2.1 Relief Jobs

First, we consider the relief programs: the *'Banenpool'*, the *'Melkert-1'* program and the *'Melkert-3'* program. The outflow from the *'Banenpool'* to regular jobs is rather low, a meagre 3% per year. Most individuals that do leave the program flow to 'other destinations'. The flow to 'other destinations' includes the flow to the *'Melkert-1'* program, to welfare or disability benefits, and women who gave birth. In the past, reintegration of long-term unemployed and the provision of basic skills was the official goal of the *'Banenpool'*. However, since 1996 the official goal has been changed to increasing the outflow to regular employment. The contracts have been changed from an unlimited to a limited duration. The 'deadweight' in the *'Banenpool'* seems to be quite low, given the low job prospects of participants before they entered the program. 'Substitution' of other job seekers appears to be somewhat higher.

Outflow from the *'Melkert-1'*[4] program to regular employment is somewhat higher than from the *'Banenpool'*, but still quite low. Recently, the duration of contracts has become more limited. The *'Melkert-3'* program also creates jobs in the public sector, but targets individuals who remain on welfare benefits. We have no information on the outflow from this program. We have no information on the extent of 'deadweight' and 'substitution' from the *'Melkert'*-programs.

2.2 Training programs

Turning to the training program, the *'Jeugdwerkgarantieplan'*, the outflow to regular employment from the *'JWG'* is much higher than the outflow from relief jobs to regular employment. This is likely to be due to differences in the targeted group, unemployed youngsters versus long-term unemployed, and due to differences in the extent to which participants receive training. The outflow to 'other destinations' is also much higher. This might be due to the limited duration of contracts in the *'JWG'*. 'Deadweight' seems to be much higher for the training program, given the more favourable job prospects of unemployed

[4]Named after the minister under whose responsibility the program was enacted.

youngsters, whereas participants also seem to substitute more easily for other job seekers.

2.3 'Vouchers'

Finally, we consider the programs that provide subsidies for firms that hire previously long-term unemployed job seekers ('vouchers'): the *'Melkert-2'* program and the *'Vermindering Langdurig Werklozen'* (*VLW*, Reduction Long-term Unemployed). Data on the outflow is less informative, as outflow may occur because the match dissolves, or because the subsidy period ended, or both. Unfortunately we have no information on the extent of 'deadweight' and 'substitution' of the *'Melkert-2'* program. 'Deadweight' and 'substitution' under the *'VLW'* program is much higher than for the relief and training programs. All long-term unemployed are targeted, even those that find employment in the absence of the subsidy. Furthermore, the subsidised long-term unemployed subsitute a substantial part of competing job seekers.

We use the data on ALMPs in The Netherlands below, in the calibration of the flow model.

3 Modeling ALMPs

We model three types of active labour market policies: i) targeted subsidies for jobs in the private sector; ii) relief jobs (in the public sector); and iii) training programs in the public sector. We incorporate these ALMPs in a stripped down version of MIMIC, the applied general equilibrium model of CPB Netherlands Bureau for Economic Policy Analysis (for a complete overview of the MIMIC model see Gelauff and Graafland (1994), a small scale version and some recent extensions are discussed in Bovenberg *et al.* (1998)). The main simplifications of the stripped down version are exogenous labour supply, no (physical) capital, no schooling decision, and no division by sector. We use a stripped down version of MIMIC to keep the results tractable and to focus on the crucial mechanisms that play a role in the impact of the ALMPs that we study.

First we give an informal overview of our stripped down model, and consider, qualitatively, the impact of ALMPs on our model economy. Next, we outline the flow model that lies at the core of our model. Then we consider the optimal search and selection strategy of firms and workers. Finally we consider collective wage formation and government expenditures.[5]

3.1 The model - an informal overview

Our model economy is populated by firms and workers. Firms maximise profits and workers maximise utility, given technology and government policy. Not all workers are employed at any point in time. The flow from (old) unproductive production sites to (new) productive production sites involves costly search by firms and workers. Hence, at any point of time, part of the workers is searching for a job, and part of the jobs are searching for a worker. That is, the model features equilibrium unemployment. Furthermore, even in the absence of costly search the labour market will be characterized by equilibrium unemployment, as wages are determined by unions and employers' federations in a 'right-to-manage' bargaining structure. Unions maximize their utility by demanding a wage above the 'market clearing' level.

To highlight the main channels through which ALMPs affect our model, we have to be more explicit about firm and worker behaviour. Figure 1 below gives a highly stylised overview of our model, where we focus on the labour market. In the labour market firms have to make two decisions: they decide on the profit maximising level of employment (and the associated optimal number of vacancies), and they decide on which workers to accept. Productivity is heterogeneous. When a firm and a worker meet they take a random draw from a productivity distribution. Some productivity realizations will be unprofitable to the firm (due to the presence of minimum wage legislation). The share of contacts with workers that is profitable to the firm is denoted by the acceptance rate of the firm. Whereas firms decide on their level of vacancies and which workers to accept, workers choose the time they devote to job search (the search intensity) and which jobs to accept (the acceptance rate of workers). Some wage offers fall short of their reservation wage.

The number of vacancies, the number of job seekers and their search effort, and the acceptance rates of firms and workers are the inputs for the so-called 'matching process'. The matching process is formalised by a matching func-

[5] A more elaborate discussion of the model, the calibration of the model in particular, is given in Jongen *et al.* (2000).

tion that relates the number of matches ('output') to the number of searching units ('inputs'). With knowledge of the number of matches we can determine how many individuals are employed and how many are unemployed. We distinguish between low- and high-productive unemployment, where we associate low-productive unemployment with individuals that have lost part of their skills. Indeed, this assumption is driven by the empirical finding that there is negative duration dependence in the probability of finding employment in a given time interval in unemployment (see *e.g.* Devine and Kiefer (1991)). Although long-term unemployment does not correspond directly with our pool of low-productive unemployed, as we will see below, long-term unemployed are more likely to be low-productive in our model. Individuals may regain their lost skills in regular employment (or the training program, as we will see below).

The relative shares of individuals in regular employment and in the various states outside regular employment determine the fall-back position of workers in the wage bargain, via which they affect the wage outcome. Furthermore, average productivity depends on the share of low- and high-productive workers. Wages and productivity, combined with search costs for vacancies, feed back into the optimal employment decision by firms. Furthermore, as workers in high- and low-productive unemployment differ in their search and acceptance behaviour, the relative shares of these states affect the 'effective' number of job seekers.

The model is scale independent, that is, the unemployment *rate* and all other shares do not depend on labour supply. However, we have drawn a dotted box around the labour market to highlight that labour supply determines the *size* of the market.

The government transfers unemployment benefits to the unemployed. Combined with subsidies in the private sector, these transfers determine government outlays. To keep a balanced budget the government levies taxes on all workers, both employed and unemployed.

3.1.1 The impact of relief jobs

Outside regular employment, low-productive individuals can participate in relief jobs. The government posts vacancies for relief jobs. Compensation in relief jobs equals the minimum wage level. Production by relief job workers is a fraction

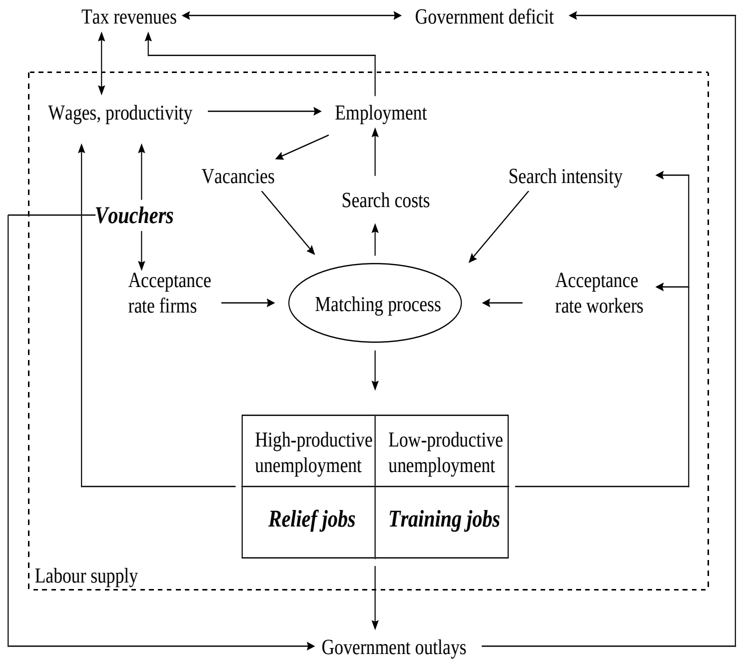

Figure 1: The model - an overview

of their compensation level.[6] For simplicity we deduct the production by relief job workers from the expenditures on wages for relief job workers. In our base model we assume that individuals do not regain lost skills in relief jobs.

The higher compensation level in relief jobs implies that it is optimal for participants to reduce their search effort for locating private sector vacancies, and they become more selective towards job offers from the private sector. Furthermore, search effort also suffers from the fact that participants devote part of their valuable leisure time to working (these adverse effects are typically referred to in the literature as the 'lock-in' effect, see *e.g.* Calmfors (1994)). Search costs for firms rise. The relatively high compensation level in relief jobs (relative to benefits in low-productive unemployment) increases wage pressure. Via higher

[6]Assuming that participants in relief jobs would fully cover their costs begs the question why private firms do not create these jobs.

wage and search costs, relief jobs crowd out private sector employment. When the government runs a net loss on relief jobs, tax rates have to rise. This will put further strains on participation of agents in the private sector.

3.1.2 The impact of training jobs

Low-productive individuals may also participate in training jobs. The government posts vacancies for training jobs. Individuals in the training program receive the minimum wage. Individuals in the training program do not produce output, they receive training. We assume that training costs per unit time period are a fraction of their compensation level. We further assume that individuals in the training program fully regain their lost skills.

Like the relief program, the higher compensation level in the training program adversely affects the search and acceptance behaviour of the participants for regular employment. Furthermore, they also have to devote part of their time to training, which further reduces their search effort. However, as participants regain their lost skills, they expect to receive higher payment in the private sector than before the training. This has a positive effect on the search effort of participants and makes more job offers acceptable to them. Furthermore, they become more attractive to firms which share in the higher productivity (these positive effects on an individual's skills and hence on the search and acceptance behaviour of workers (and firms) are typically referred to in the literature as the 'treatment effect', see *e.g.* Calmfors (1994)). Search costs for firms fall when the 'treatment effect' dominates the 'lock-in' effect. Firms further benefit from the higher productivity level. Whether or not labour costs per unit of output fall depends further on the effect of training programs on the wage outcome. Individuals prefer to be in the state of training jobs relative to being in the state of low-productive unemployment, which increases wage pressure. When labour costs per unit of output fall, production, and potentially employment, rise. Furthermore, the net effect on government expenditures determines the effect on tax rates. A net loss implies higher taxes, which will adversely affect private sector production and employment.

3.1.3 The impact of vouchers

Finally, we consider the impact of subsidies in the private sector for low-productive workers ('vouchers'). We consider a subsidy that is paid out to the employer as long as an individual is low-productive.[7]

The subsidy makes low-productive job seekers, *i.e.* low-productive unemployed and participants in the relief program, more attractive to firms. They will post more vacancies, *ceteris paribus*, and will accept more applicants as the subsidy lowers the minimum productivity required to cover minimum wage expenditures. As firms post more vacancies and are willing to take on more applicants, workers in low-productive unemployment and the relief program will increase their search effort for regular employment.

The subsidy scheme will increase wage pressure. Indeed, like any rise in productivity, workers will claim part of the subsidy via the wage bargain. In addition, wage pressure will mount further as individuals in low-productive unemployment and relief jobs are more likely to find employment.

The subsidy for low-productive workers will increase private sector employment, provided that the costs do not exceed the savings by too much. When the government runs a net loss, higher taxes will again adversely affect private sector production and employment.

Below we consider the model in more detail, as we consider the specification of the optimising behaviour of firms and workers, technology and government policy. At the end of each subsection we briefly discuss the calibration of the model that is specified before. We start with the flow model that lies at the core of the model.

3.2 The flow model

3.2.1 Specification of the flow model

Figure 2 below depicts the flow model we use to simulate ALMPs. We distinguish between the following states in the labour market: low- and high-productive employment, E_l and E_h respectively, low- and high-productive unemployment, U_l and U_h respectively, relief jobs, R, and training programs, T.

[7] We assume that the government has full information on whether or not an individual match is low- or high-productive.

First consider the states of employment and unemployment. Individuals in low- and high-productive unemployment move into (regular) employment at rates $\pi_{ul,el}$ and $\pi_{uh,eh}$, respectively. Individuals in low- and high-productive employment become unemployed at rates $\sigma_{el,ul}$ and $\sigma_{eh,uh}$, respectively. Furthermore, we assume that high-productive individuals run a risk $\tau_{uh,ul}$ of becoming low-productive unemployed when they are unemployed, *i.e.* they run the risk that they lose part of their skills. On the other hand, we assume that low-productive individuals become high-productive again in employment at rate $\tau_{el,eh}$, *i.e.* they may regain their lost skills.

Now consider the states of relief jobs and training programs. Only low-productive unemployed individuals are eligible for a relief job or placement in a training program, and they flow into these states at rates $\pi_{ul,r}$ and $\pi_{ul,t}$, respectively. Individuals in relief jobs do not regain their lost skills. Hence, exit from relief jobs is either back to low-productive unemployment, at rate $\sigma_{r,ul}$, or to a regular low-productive job, at rate $\pi_{r,el}$. Individuals that participate in training programs may regain their lost skills, or they may not. If they do regain their lost skills they exit either to high-productive unemployment (individuals can only participate in a training program for a limited time period), at rate $\sigma_{t,uh}$, or they exit to high-productive employment, at rate $\pi_{t,eh}$.[8] For some individuals the training will be unsuccesful. Hence, part of the participants in the training program will flow back to low-productive unemployment once their training period ends, this occurs at rate $\sigma_{t,ul}$.

The rates at which workers flow back to either low- or high-productive unemployment ($\sigma_{el,ul}$, $\sigma_{eh,uh}$, $\sigma_{r,ul}$, $\sigma_{t,uh}$ and $\sigma_{t,ul}$) are exogenous in the model. The rates at which individuals in high-productive unemployment lose their skills, $\tau_{uh,ul}$, and the rate at which individuals regain their lost skills in low-productive employment, $\tau_{el,eh}$, are also exogenous. The rates at which individuals move into employment, relief jobs and the training program ($\pi_{ul,el}$, $\pi_{uh,eh}$, $\pi_{ul,r}$, $\pi_{ul,t}$, $\pi_{r,el}$ and $\pi_{t,eh}$) are endogenous. We consider their determination below. Note that for simplicity we only consider steady states, *i.e.* when the inflow into a particular state equals the outflow, for all states. Hence, the simulation results should be interpreted as 'long-run'. We do not consider the transition path from the

[8]Note that participants in training programs do not exit to low-productive employment. Hence, we implicitly assume that individuals that did not regain their lost skills in the training program yet, do not search for a regular job.

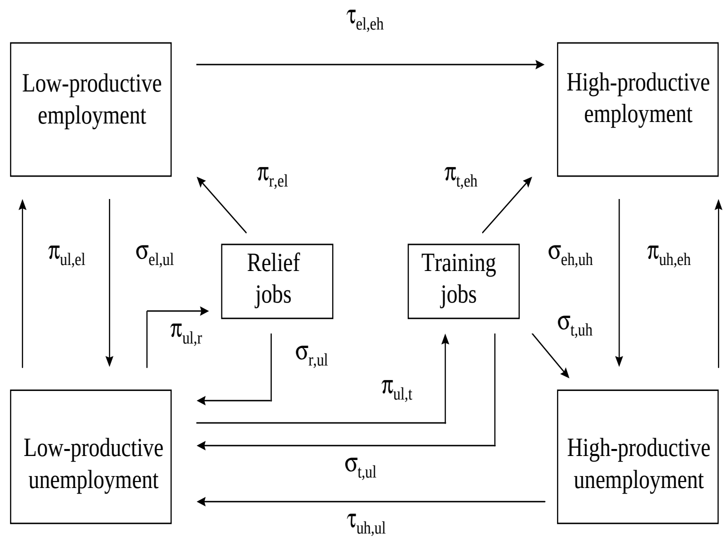

Figure 2: Flows and stocks

initial steady state to the new steady state (this would require that we specify the behaviour of all agents along the transition path). In a steady state we can express the stocks in terms of the flow rates, independent of initial conditions.[9]

3.2.2 Calibration of the flow model

Table 3 below gives the data we use to calibrate the flow model, and the calibrated parameters. The model is calibrated on data for the Dutch labour market in 1993. We calibrate the flow model for three different levels of education: high-skilled, low-skilled and unskilled.[10]

We have data on the stocks of high- and low-productive unemployment, relief jobs, training jobs and total employment, by level of education. We associate *high-productive unemployment* with the stock of *individuals on unemployment benefits*, and *low-productive unemployment* with the stock of *individuals on welfare* that are obliged to search for a job. Furthermore, we have data on the flow

[9]The resulting expressions for the stocks in terms of the flows are given in the Appendix.
[10]The data indicates that they have rather different productivity profiles.

rates into employment out of unemployment, the rate at which individuals flow from relief and training jobs back into unemployment and the flow rate from high-productive unemployment to low-productive unemployment.

We further have data on the average flow rates from relief jobs and training jobs into regular employment. However, we do not use these data in the calibration. The data tell us that the outflow rate into regular employment from relief jobs is in the order of 3 percent per year. The outflow rate from low-productive unemployment into regular employment is in the order of 30 percent per year. Furthermore, the data tell us that the flow rate into regular employment from training jobs is in the order of 15 percent per year. The outflow rate from high-productive unemployment into regular employment is in the order of 70 percent per year. The discrepancies in these outflow rates are due to differences in income, leisure time and the composition of the group that participates in relief and training programs. Our model assumes that participants in relief and training programs are drawn randomly from the pool of low-productive unemployed. As a consequence we can not reproduce the low outflow rates from relief and training jobs in our baseline calibration. The differences in income and leisure in the states of relief and training programs relative to low- and high-productive unemployment are insufficient to generate low enough search intensities and acceptance rates (discussed below) for participants in these programs. In our baseline calibration we therefore let the model determine the outflow rate, assuming that participation is random. We do some sensitivity analysis on the outflow rates from relief and training jobs in Section 5.

The model suggests that if inflow into relief and training programs were random, the outflow rate from relief jobs into low-productive employment is about half of the outflow rate from low-productive unemployment. Furthermore, the model suggests that the outflow rate from training programs would be in the order of 3 quarters of the outflow rate from high-productive unemployment.

The inflow into relief and training jobs follows from the steady state assumption. The inflow is rather low in a steady state, given the low outflow.

Finally, some remarks on the flow rate from high- to low-productive unemployment, and from low- to high-productive employment. We have data on the average rate at which individuals lose their entitlement for unemployment benefits. We assume that this is the flow rate from high-productive unemployment to low-productive unemployment.

We have no data on the flow rate from low- to high-productive employment. We set $\tau_{el,eh}$ so as to obtain a higher separation rate for low-productive than for high-productive employment (in line with the scant evidence, see *e.g.* De Beer (1996)). Setting $\tau_{el,eh}$ =$0.75\tau_{uh,ul}$ for the high-skilled and $\tau_{el,eh}$ =$0.50\tau_{uh,ul}$ for the low-skilled and unskilled yields plausible values for the separation rate from low-productive employment relative to the separation rate from high-productive employment.

We calibrate the separation rates from high- and low-productive employment, relief and training jobs on the relative shares of the corresponding stocks and the flow rates into employment and relief and training jobs (see the Appendix).

Table 3 further gives information on the share of the different groups in employment, the groups differ in the state they are in and their history. Indeed, we have the share of individuals in high-productive employment that came from the state of high-productive unemployment and training jobs, $e_{eh,uh}$ and $e_{eh,t}$ respectively, the share of individuals in low-productive employment that came from the state of low-productive unemployment and relief jobs, $e_{el,ul}$ and $e_{el,r}$ respectively, and the share of individuals in high-productive employment that came from the state of low-productive employment and from the state of low-productive unemployment and relief jobs before that, $e_{eh,ul}$ and $e_{eh,r}$ respectively. To calculate the average productivity of employees we have to keep track of these shares as the respective groups differ in their productivity profiles (see below).

3.3 Matching jobs and workers

3.3.1 Specification of the matching process

In this section we specify the matching technologies. First, we consider the matching technology for low- and high-productive employment. Subsequently, we consider the matching technology for relief jobs and training programs.

The flow rates from low-productive unemployment, high-productive unemployment, relief jobs and training programs into regular employment are given by

$$\pi_x = s_x f m_x \mu \theta^\alpha, \quad x \ \epsilon \ \{uh, eh\}, \{ul, el\}, \{r, el\}, \{t, eh\}, \tag{1}$$

where s_x denotes the search effort exerted by individuals from the respective states (see below), and fm_x denotes their respective share of contacts that are

Table 3: Calibration of the flow model

Data										
	$\pi_{uh,eh}$	$\pi_{ul,el}$		$\tau_{uh,ul}$		u_h	u_l	u_r	u_t	
high-skilled	0.800	0.404		0.211		0.039	0.025	0.001	0.000	
low-skilled	0.760	0.383		0.211		0.048	0.044	0.004	0.004	
unskilled	0.560	0.283		0.211		0.051	0.094	0.010	0.006	
Calibration										
	$\sigma_{eh,uh}$	$\sigma_{el,ul}$	$\sigma_{r,ul}$	$\sigma_{t,ul}$	$\sigma_{t,uh}$	$\pi_{r,el}$	$\pi_{t,eh}$	$\pi_{ul,r}$	$\pi_{ul,t}$	$\tau_{el,eh}$
high-skilled	0.034	0.045	0.076	0.131	0.031	0.242	0.578	0.016	0.006	0.158
low-skilled	0.042	0.183	0.087	0.183	0.044	0.233	0.571	0.037	0.105	0.105
unskilled	0.037	0.284	0.082	0.184	0.044	0.109	0.360	0.029	0.050	0.105
	e_h	e_l	$e_{h,uh}$	$e_{h,t}$	$e_{l,ul}$	$e_{l,r}$	$e_{h,ul}$	$e_{h,r}$		
high-skilled	0.908	0.040	0.758	0.003	0.041	0.001	0.191	0.006		
low-skilled	0.870	0.049	0.745	0.067	0.050	0.004	0.126	0.009		
unskilled	0.818	0.055	0.687	0.069	0.059	0.004	0.171	0.010		

acceptable to both the employer and the respective job seekers (see below).[11] Futhermore, θ denotes labour market tightness, defined as $\theta = V_{pr}/(s_{ul,el}U_l + s_{uh,eh}U_h + s_{r,el}R + s_{t,eh}T)$, where V_{pr} is the stock of vacancies posted by firms. Finally, μ and α denote technology parameters. In the next section we consider how profit maximisation on the part of firms and utility maximisation by job seekers determine the inputs in the matching process: the number of vacancies, the respective search efforts of the various groups of job seekers and the respective share of job offers acceptable to both the firm and job seekers.

Given the flow rates for job seekers we also have the rate at which vacancies are filled (note that vacancies are homogeneous *ex ante*, but yield a low-productive job if matched with a low-productive unemployed or relief job worker, and yield a high-productive job when matched with a high-productive unemployed or training program participant). The rate at which vacancies are filled,

[11] Aggregation of the respective flow rates times the respective stocks yields a constant-returns-to-scale matching function.

z_{pr}, is given by

$$z_{pr} = \frac{\pi_{ul,el}U_l + \pi_{uh,eh}U_h + \pi_{r,el}R + \pi_{t,eh}T}{V_{pr}} \tag{2}$$

We assume a similar type of technology for the matching process for relief jobs and training programs and low-productive unemployed. The flow rates into relief jobs and training programs are given by

$$\pi_{ul,r} = s_{ul,r}\mu_r\theta_r^{\alpha}, \tag{3}$$

and

$$\pi_{ul,t} = s_{ul,t}\mu_t\theta_t^{\alpha}, \tag{4}$$

respectively. $s_{ul,r}$ and $s_{ul,t}$ denote search effort exerted by low-productive unemployed individuals for relief jobs and placement in a training program, respectively. θ_r and θ_t denote tighness in the market for relief jobs and training programs, respectively. $\theta_r = \frac{V_r}{s_{ul,r}U_l}$ and $\theta_t = \frac{V_t}{s_{ul,t}U_l}$, where V_r and V_t denote the number of vacancies posted for relief jobs and the training program, respectively. μ_r and μ_t denote technology parameters. The matching technologies do not contain a variable that indicates the share of job offers that is accepted by both parties. Indeed, policy dictates that all applicants are accepted by the government, and compensation in the respective ALMP is set so that all offers are accepted by low-productive unemployed job seekers. Below we consider how the search effort by low-productive unemployed results from utility maximisation. The number of vacancies for relief jobs and training programs is a policy parameter.

Given the flow rates of job seekers we also have the rate at which relief and training jobs are filled, z_r and z_t respectively. These are given by

$$z_r = \frac{\pi_{ul,r}U_l}{V_r}, \tag{5}$$

and

$$z_t = \frac{\pi_{ul,t}U_l}{V_t}, \tag{6}$$

respectively.

3.3.2 Calibration of the matching process

Table 4 below gives the data we use to calibrate the matching process, the inputs from other submodels and the calibrated parameters and stocks. The relative weight of vacancies in the matching function, α, is similar to the value in the original MIMIC model. We assume that the relative weight of vacancies in the matching function is the same for relief and training jobs.

Given the other inputs, α, and the flow rates we can rewrite the matching functions for the technology parameter μ. The search effort of each group of job seekers contains a parameter that is set so as to let μ be the same across all job seekers (the parameter is normalized to unity for high-productive job seekers). The rates at which vacancies for relief and training jobs are filled, z_r and z_t respectively, are chosen so as to let the technology parameter in the matching function for these jobs, μ_r and μ_t respectively, equal μ in the private sector. Hence, we assume that the government has no technological advantage (or disadvantage) over private firms in acquiring new workers for relief and training jobs.

The stocks of vacancies for relief and training jobs follow from the steady state assumption and the other inputs in the respective matching functions.

3.4 Search strategy of firms

3.4.1 Specification of the search strategy of firms

Firms maximise profits by varying the number of vacancies per skill type. The optimal number of vacancies follows from the optimal stock of employment per skill type.

The economy consists of three types of domestic firms. These firms employ, respectively, high-skilled, low-skilled and unskilled workers. We assume a fixed number J_i of symmetric firms per skill type which produce output according to a linear production technology

$$y_i^j = \overline{\alpha_i} e_i^j, \tag{7}$$

where y_i^j denotes the output produced by firm j, $j = 1, ..., J_i$, using labour type i, $i = h, l, u$, where h, l, and u denote high-skilled, low-skilled and unskilled, respectively. $\overline{\alpha_i}$ denotes the average productivity of labour of type i and e_i^j denotes the number of employees of type i employed by firm j. Aggregate output

Table 4: Calibration of the matching process

Data and input from other submodels										
	U_h	U_l	R	T	V	α				
high-skilled	148.2	95.00	3.179	0.613	25.00	0.650				
low-skilled	60.06	54.88	4.834	5.431	12.50	0.650				
unskilled	37.55	68.55	7.574	4.205	7.000	0.650				
	$s_{uh,eh}$	$s_{ul,el}$	$s_{r,el}$	$s_{t,eh}$	$s_{ul,r}$	$s_{ul,t}$	fm_h	fm_l	fm_r	fm_t
high-skilled	1.030	0.632	0.380	0.630	0.067	0.078	0.693	0.570	0.568	0.818
low-skilled	0.989	0.684	0.418	0.678	0.119	0.408	0.763	0.556	0.555	0.837
unskilled	0.888	0.809	0.312	0.571	0.195	0.388	0.163	0.091	0.091	0.163
Calibration										
	μ	μ_r	μ_t	z	z_r	z_t		V_r	V_t	
high-skilled	3.880	3.880	3.880	4.979	17.47	31.73		0.067	0.014	
low-skilled	3.334	3.334	3.334	4.366	11.89	13.27		0.130	0.327	
unskilled	17.02	17.02	17.02	4.484	217.1	235.4		0.007	0.010	

Note: stocks are in thousands.

and employment by firms using labour type i are given by $Y_i = \sum_{j=1}^{J_i} y_i^j$ and $E_i = \sum_{j=1}^{J_i} e_i^j$, respectively.

Firms of type i are perfect competitors, and hence make zero profits. In equilibrium, employment is found by equating the marginal labour cost per productivity unit with the output price per productivity unit. The output price of firm j per productivity unit using labour type i, p_i^j is given by

$$p_i^j = wc_{i,j}/\overline{\alpha_i}, \tag{8}$$

where $wc_{i,j}$ denotes the per unit labour cost of labour type i for firm j. Symmetric firms implies $p_i = p_i^j$.

Per unit labour costs for labour type i, in a steady state, are given by

$$wc_i^j = \overline{w_i}(1 + c(\sigma_i + r_{int})/z_{pr,i}). \tag{9}$$

Labour costs equal gross wages (including employers' taxes), $\overline{w_i}$, plus the per period vacancy cost to keep a constant (the optimal) workforce, $\overline{w_i}\ c\ (\sigma_i +$

$r_{int})/z_{pr,i}$) (note that in a steady state the average quit rate times the workforce has to equal the number of vacancies times the rate at which these are filled), where c denotes a fraction, σ_i denotes the average separation rate for labour type i, $z_{pr,i}$ denotes the average rate at which private sector vacancies are filled for labour type i, and r_{int} denotes the interest rate. The appropriate depreciation rate for vacancy costs is given by the rate at which matches separate plus the interest rate (the optimal control problem is given in Gelauff and Graafland (1994)).

In a steady state, vacancies for labour type i, $V_{pr,i}$, equal the outflow from employment of labour type i, $\sigma_i\ E_i$, times the average duration of a vacancy to be filled, $1/z_{pr,i}$.

Finally, we consider the demand for the products produced by the skill types i and the role of foreign producers and consumers. Total domestic production follows from a CES function with as inputs the commodities produced by firms using the different skill types. The optimal allocation of consumers over the three types of commodities is derived from a CES sub-utility function. The optimal allocation of demand over the three types of commodities is given by

$$Y_i/Y_{av} = (p_i/p_{av})^{-a}, \tag{10}$$

where Y_{av} denotes the CES-weighted average output of the three types of commodities and p_{av} denotes the CES-weighted average price. a denotes the partial price elasticity of demand for the three skill types. In line with empirical evidence we assume that the output of the three skill types are imperfect substitutes (see Draper and Manders (1996)).

Demand is exerted both by domestic and foreign consumers. The allocation of demand by domestic and foreign consumers depends on the terms of trade, and the preferences over domestic and foreign production. The net demand for domestic goods, X_y, is given by

$$X_y = (p_{av}/p_m)^{-\zeta}, \tag{11}$$

where p_m denotes the average price of foreign goods. ζ denotes the subsitution elasticity between domestic and foreign goods. The consumer price index, pc, follows from the relative shares of consumption of domestic and foreign production.

3.4.2 Calibration of the search strategy of firms

Most parameters of the production and demand structure are taken from the MINI-MIMIC model outlined in Bovenberg *et al.* (1998). The per unit time period vacancy cost equals 75% of the gross wage rate. The partial price elasticity of skill types, a, is set at 1.5. The price elasticity of export demand, ζ, is set at 2.67. The calibration of the other parameters is discussed below.

3.5 Selection strategy of firms

3.5.1 Specification of the selection strategy of firms

We assume that the productivity of a potential job-worker match in low- and high-productive employment is match-specific. When a high-productive unemployed job-seeker or a training program participant meets a vacancy they take a random draw from the (lognormal) productivity distribution $g_h(\alpha)$, with mean $\overline{\alpha}_h$. Similarly, when a low-productive unemployed job-seeker or a relief job worker meets a vacancy they take a random draw from the (lognormal) productivity distribution $g_l(\alpha)$, with mean $\overline{\alpha}_l$. Low-productive unemployed job-seekers and relief workers have lost part of their skills, so $\overline{\alpha}_l = \omega\overline{\alpha}_h$ with $0 \leq \omega < 1$. We denote the wage associated with match-specific productivity α_j by $w(\alpha_j)$.

Firms do not accept all workers in the context of stochastic productivity and minimum wage legislation. Denote the minimum productivity level required from a low- and high-productive match by the firm by $\alpha^f_{\min,l}$ and $\alpha^f_{\min,h}$, respectively (the superscript f indicates that we are dealing with the minimum productivity required by the firm).

First, consider the minimum productivity required from a match with a high-productive worker or a training program participant. The asset value of a high-productive match with match specific productivity α_j, $J_h(\alpha_j)$, satisfies

$$r_{int}J_h(\alpha_j) = \alpha_j - w(\alpha_j) + \sigma_{eh,uh}(J_v - J_h(\alpha_j)), \tag{12}$$

where J_v denotes the asset value of a vacancy. The per period return on a high-productive worker with match specific productivity α_j consists of the match-specific productivity minus the associated wage and the capital loss associated with a separation, J_v-$J_h(\alpha_j)$, which occurs at exogenous rate $\sigma_{eh,uh}$. Free entry of vacancies implies that the asset value of a vacancy equals zero, *i.e.* J_v=0. The minimum productivity required from a match is the productivity level that makes the asset value of a high-productive job zero at the minimum wage, *i.e.* $J_h(\alpha^f_{min,h}) = 0$ for wm, where wm denotes the minimum wage. This implies $\alpha^f_{min,h}{=}wm$.

Next, consider the minimum productivity required from a match with a low-productive unemployed or a relief job worker. The asset value of a low-productive match with match-specific productivity α_j, $J_l(\alpha_j)$, satisfies

$$r_{int} J_l(\alpha_j) = \alpha_j - w(\alpha_j) + \sigma_{el,ul}(J_v - J_l(\alpha_j)) + \tau_{el,eh}(J_h(\alpha_j/\omega)) - J_l(\alpha_j)). \quad (13)$$

Once again, the return on the job-match for the employer consists of the productivity level net of the associated wage and the probability that the job changes state times the associated capital gain or loss. At rate $\sigma_{el,ul}$ low-productive matches are hit by an idiosyncratic shock that leads to a separation of the worker and the firm. The associated capital loss is given by J_v-$J_l(\alpha_j)$. Low-productive matches become high-productive (workers regain their lost skills) at rate $\tau_{el,eh}$. The associated capital gain is given by $J_h((\alpha_j/\omega\ ))$-$J_l(\alpha_j)$. Using the free entry condition for vacancies, $J_v{=}0$, and the condition that $J_l(\alpha^f_{min,l}) = 0$ at wm, we find the minimum productivity required from low-productive matches

$$\alpha^f_{min,l} = wm - \tau_{el,eh}(J_h(\alpha^f_{min,l}/\omega)). \quad (14)$$

Hence, the firm will hire low-productive unemployed job-seekers and relief job workers with match-specific productivity below the minimum wage if $J_h(\alpha^f_{min,l}/\omega)$ > 0.[12] We assume that wages are proportional to productivity. Then, using the asset value of high-productive jobs for $J_h(\alpha^f_{min,l}/\ \omega)$ we obtain the following expression for the minimum productivity level in low-productive employment required by the firm

$$\alpha^f_{min,l} = \frac{\omega(r_{int} + \sigma_{eh.uh})}{\omega(r_{int} + \sigma_{eh.uh}) + \tau_{el,eh}(1 - \frac{\overline{w}}{\overline{\alpha}})} wm, \quad (15)$$

where $\frac{\overline{w}}{\overline{\alpha}}$ denotes the gross wage costs per productivity unit (which is determined by collective bargaining between unions and employers' federations, see below). As firms have to spend part of their receipts on search costs, $\frac{\overline{w}}{\overline{\alpha}} < 1$, the minimum productivity required from a low-productive job match lies below the minimum wage.[13]

[12] Note that all workers with the same match-specific productivity receive the same wage, independent of their previous state.

[13] Assuming that the productivity in high-productive employment lies above the minimum wage and the reservation wage of a high-productive unemployed.

Table 5: Calibration of the selection strategy of workers and firms

Parameter						
	ω	ϵ				
high-skilled	0.500	-5.000				
low-skilled	0.600	-5.000				
unskilled	0.925	-5.000				
Calibration[a]						
	$w(\alpha^w_{min,uh})$	$w(\alpha^w_{min,ul,el})$	$w(\alpha^w_{min,ul,r})$	$w(\alpha^w_{min,ul,t})$	$w_{min,ul,r}$	$w_{min,ul,t}$
high-skilled	32.80	10.50	14.52	1.068	13.14	27.18
low-skilled	27.42	11.26	16.32	1.246	14.07	23.61
unskilled	18.09	9.942	14.78	2.601	15.53	18.00
	fu_h	fu_l	fu_r	fu_t	fr_h	fr_l
high-skilled	0.718	0.984	0.931	0.902	0.991	0.578
low-skilled	0.814	0.992	0.949	0.940	0.987	0.563
unskilled	0.585	0.998	0.783	0.599	0.163	0.091
	fr_r	fr_t	fm_h	fm_l	fm_r	fm_t
high-skilled	0.578	0.991	0.693	0.570	0.568	0.818
low-skilled	0.563	0.987	0.763	0.556	0.555	0.837
unskilled	0.091	0.163	0.163	0.091	0.091	0.163

[a] Reservation wages are in thousands of Dutch guilders.

We obtain the share of job applicants accepted by the firm by confronting the reservation productivities with the relevant productivity distributions. The share of applicants accepted from the pool of low-productive unemployed individuals and relief job workers, fr_l, is given by $1 - G_l(a^f_{\min,l})$. The share of applicants accepted from the pool of high-productive unemployed and participants in the training program, fr_h, is given by $1 - G_h(a^f_{\min,h})$.

3.5.2 Calibration of the selection strategy of the firm

The calibration of the selection strategy of the firm is given in Table 5 below. The skill loss parameter ω is set so as to obtain reasonable differences in the acceptance rate of applicants from different states by the firm. The parameter values are 'reasonable' because they accord with the skill loss parameter for job search skills (discussed below). Hence, loss of skills applies to the same extent to output-producing skills and 'search units'-producing skills. The skill loss parameter for job search skills is calibrated on the outflow rate from the state of low-productive unemployment relative to the outflow rate from high-productive unemployment (see below).

3.6 Search strategy of workers

3.6.1 Specification of the search strategy of workers

Individuals in low- and high-productive unemployment, in relief jobs and training programs maximise their utility by varying their search effort. Before we consider the determination of the utility maximising search strategy we define the variables that enter the respective utility functions.

b_l and b_h denote (in real terms) the net benefit level in low- and high-productive unemployment, respectively. Individuals in relief jobs produce $\overline{\alpha_r}$ and receive w_r. Individuals in training jobs receive w_t. Define δ, η, T and l_0 as the subjective discount rate of workers, the relative weight of income in the utility function (relative to leisure time), total time available to an individual in a given time unit and the collectively agreed working time ('hours'), respectively. The parameters κ_{uh}, κ_{ul}, κ_r and κ_t denote the utility gain or loss outside employment in the private sector not accounted for by the difference in income or leisure time.[14] Time spent on job search by a high-productive unemployed, a relief job worker and a training program participant is denoted by $ts_{uh,eh}$, $ts_{r,el}$ and $ts_{t,eh}$, respectively. Finally, time spent on job search by a low-productive unemployed job seeker for a job in low-productive employment, a relief job and placement in a training program is denoted by $ts_{ul,el}$, $ts_{ul,r}$ and $ts_{ul,t}$, respectively.

Now that we have the elements of (dis-)utility we consider the so-called 'asset' equations of individuals in the various states. Denote the asset value of being in the state of low-productive unemployment, high-productive unemployment, low-productive employment, high-productive employment, a relief job or the training program by V_{ul}, V_{uh}, $V_{el}(\alpha_j)$, $V_{eh}(\alpha_j)$, V_r and V_t, respectively. The per period

[14] The individual may feel isolated, intruded in his or her private life by the social security office, *etc.*

return on these assets is given by the following Bellman equations

$$\begin{aligned}\delta V_{el}(\alpha_j) &= \eta \ln w(\alpha_j) + \ln(T - l_0) + \sigma_{el,ul}(V_{ul} - V_{el}(\alpha_j)) \\ &\quad + \tau_{el,eh}(V_{eh}(\frac{\alpha_j}{\omega}) - V_{el}(\alpha_j)),\end{aligned} \tag{16}$$

$$\delta V_{eh}(\alpha_j) = \eta \ln w(\alpha_j) + \ln(T - l_0) + \sigma_{eh,uh}(V_{uh} - V_{eh}(\alpha_j)), \tag{17}$$

$$\begin{aligned}\delta V_{ul} &= \eta \ln b_l + \ln(T - ts_{ul,el} - ts_{ul,r} - ts_{ul,t}) + \kappa_{ul} + \pi_{ul,el}(V_{el}(\overline{\alpha_{ul,el}}) - V_{ul}) \\ &\quad + \pi_{ul,r}(V_r - V_{ul}) + \pi_{ul,t}(V_t - V_{ul}),\end{aligned} \tag{18}$$

$$\begin{aligned}\delta V_{uh} &= \eta \ln b_h + \ln(T - ts_{uh,eh}) + \kappa_{uh} + \pi_{uh,eh}(V_{eh}(\overline{\alpha_{uh,eh}}) - V_{uh}) \\ &\quad + \tau_{uh,ul}(V_{ul} - V_{uh}),\end{aligned} \tag{19}$$

$$\begin{aligned}\delta V_r &= \eta \ln w_r + \ln(T - l_0 - ts_{r,el}) + \kappa_r + \sigma_{r,ul}(V_{ul} - V_r) \\ &\quad + \pi_{r,el}(V_{el}(\overline{\alpha_{r,el}}) - V_r),\end{aligned} \tag{20}$$

and

$$\begin{aligned}\delta V_t &= \eta \ln w_t + \ln(T - l_0 - ts_{t,eh}) + \kappa_t + \sigma_{t,ul}(V_{ul} - V_t) \\ &\quad + \sigma_{t,uh}(V_{uh} - V_t) + \pi_{t,eh}(V_{eh}(\overline{\alpha_{t,eh}}) - V_t),\end{aligned} \tag{21}$$

where $\overline{\alpha_{x,y}}$ indicicates the average productivity of individuals accepted from state x in state y. The asset equations take the familiar form where the return on the 'asset' equals the immediate utility derived from the asset in the current state and the utility gains or losses when the individual changes state times the rate at which these changes occur. Note that we assume that working time in relief jobs, and training time in training jobs, equals the collectively agreed working time in regular employment.

Job seekers maximise the asset value in a given state by varying their time spent on job search. The search effort produced by an individual rises with time spent on job search, but is subject to diminishing returns. Low-productive unemployed job seekers produce search effort for a low-productive job, $s_{ul,el}$, a relief job, $s_{ul,r}$, and placement in a training program, $s_{ul,t}$, according to

$$s_{ul,x} = \nu_{ul} ts_{ul,x}^{\frac{1}{\varsigma}}, \qquad x = el, r, t, \tag{22}$$

with $\varsigma > 1$. Furthermore, ν_{ul} denotes a parameter that reflects the relative productivity of the group of low-productive unemployed in converting search time into search units relative to the group of high-productive unemployed, *i.e.* ν_{uh} is normalised to 1. The transition rate of an individual in the state of low-productive unemployment (indexed by superscript i) to a given state depends on the individual's search effort for that state (indexed by superscript i), the average search intensity of the low-productive unemployed for that state and the average transition rate into that state from low-productive unemployment

$$\pi^i_{ul,x} = \frac{s^i_{ul,x}}{s_{ul,x}} \pi_{ul,x}, \qquad x = el, r, t. \tag{23}$$

Maximising utility for a given individual, and invoking the representative agent assumption (*i.e.* $s_{ul,x} = s^i_{ul,x}$, with $x = el, r, t$), we obtain the following utility maximising search intensities:

$$s_{ul,el} = \nu_{ul} \left[\frac{(T - (s_{ul,r}/\nu_{ul})^{\zeta} - (s_{ul,t}/\nu_{ul})^{\zeta})\pi_{ul,el}(V_{el}(\overline{\alpha}_{ul}) - V_{ul})}{\zeta + \pi_{ul,el}(V_{el}(\overline{\alpha}_{ul}) - V_{ul})} \right]^{\frac{1}{\zeta}}, \tag{24}$$

$$s_{ul,r} = \nu_{ul} \left[\frac{(T - (s_{ul,el}/\nu_{ul})^{\zeta} - (s_{ul,t}/\nu_{ul})^{\zeta})\pi_{ul,r}(V_r - V_{ul})}{\zeta + \pi_{ul,r}(V_r - V_{ul})} \right]^{\frac{1}{\zeta}}, \tag{25}$$

and

$$s_{ul,t} = \nu_{ul} \left[\frac{(T - (s_{ul,el}/\nu_{ul})^{\zeta} - (s_{ul,r}/\nu_{ul})^{\zeta})\pi_{ul,t}(V_t - V_{ul})}{\zeta + \pi_{ul,t}(V_t - V_{ul})} \right]^{\frac{1}{\zeta}}, \tag{26}$$

for search effort devoted to locating a vacancy in the private sector, a relief job and placement in a training program, respectively.

In a similar way we can derive the utility maximising search effort of high-productive unemployed job-seekers, individuals in relief jobs and individuals in the training program. Their respective utility maximising search efforts are given by

$$s_{uh,eh} = \nu_{uh} \left[\frac{T\pi_{uh,eh}(V_{eh}(\overline{\alpha}_{uh}) - V_{uh})}{\zeta + \pi_{uh,eh}(V_{eh}(\overline{\alpha}_{uh}) - V_{uh})} \right]^{\frac{1}{\zeta}}, \tag{27}$$

$$s_{r,el} = \nu_{r} \left[\frac{(T - l_0)\pi_{r,el}(V_{el}(\overline{\alpha}_{r}) - V_{r})}{\zeta + \pi_{r,el}(V_{el}(\overline{\alpha}_{r}) - V_{r})} \right]^{\frac{1}{\zeta}}, \tag{28}$$

and

$$s_{t,eh} = \nu_{t} \left[\frac{(T - l_0)\pi_{t,eh}(V_{eh}(\overline{\alpha}_{t}) - V_{t})}{\zeta + \pi_{t,eh}(V_{eh}(\overline{\alpha}_{t}) - V_{t})} \right]^{\frac{1}{\zeta}}. \tag{29}$$

3.6.2 Calibration of the search strategy of workers

Table 6 below gives the calibration of the search strategy of the workers given the inputs from the other models and parameters taken from the original MIMIC model. We set ζ to 2. The instantaneous monetary compensation in relief and training jobs, w_r and w_t, equals the minimum wage. Furthermore, individuals in relief jobs produce output equivalent to 25% of the minimum wage.

We set the disutility parameters, κ_{uh}, κ_{ul}, κ_r and κ_t, so as to obtain reasonable outcomes for the reservation wages of the respective groups of job seekers (discussed below). Low-productive individuals suffer from being outside regular employment. High-productive workers do not.[15]

Furthermore, we calibrate the parameter that converts search time (raised to the power $1/\zeta$) into effective search units for the low-productive unemployed, ν_l, on the technology parameter μ in the matching functions so as to let μ be the same for both groups of job seekers. We set ν_r equal to ν_l as they have the same productivity profile. Furthermore, we set ν_t=0.5ν_l + 0.5ν_h, as only part of the individuals in the training program has regained their lost skills at any point in time.[16]

High-productive unemployed have a higher search intensity for regular employment than their low-productive counterparts. Indeed, high-productive unemployed individuals are more succesful in converting search time into effective search units, $\nu_{uh} > \nu_{ul}$, whereas high-productive unemployed do not spend time on locating relief and training jobs. The search effort of low-productive unemployed for relief and training jobs is lower than their search effort for regular employment. They have less to gain from moving into these programs whereas the probability that they actually enter one of these programs is rather low. The search effort of training program participants is lower than the search effort of high-productive unemployed. They have to devote a substantial part of their valuable time on training. Individuals with a relief job have the lowest search intensity. They have the least to gain from moving into regular employment and have to devote a substantial part of their time on working.

[15]Note that utility is specified in logs, so a value of -1 for the disutility parameter implies that the other elements in the utility function are reduced by a factor $\frac{1}{e}$.

[16]Note that the values of skill loss in job search correspond well with the skill loss parameters in production (see above). Hence, loss of skills affects both types of production.

Table 6: Calibration of the search strategy of workers

Parameters and input from other submodels[a]									
	η	T	l_0	δ	ζ				
high-skilled	2.000	2.400	1.000	0.250	2.000				
low-skilled	2.000	2.400	1.000	0.250	2.000				
unskilled	2.000	2.400	1.000	0.250	2.000				
	w(α^w_{uh})	w(α^w_{ul})	w(α^w_r)	w(α^w_t)		b_h	b_l	w_r	w_t
high-skilled	43.46	23.36	23.37	41.45		31.12	13.75	22.51	22.51
low-skilled	35.72	23.24	23.24	34.92		25.14	14.73	22.51	22.51
unskilled	23.23	22.12	22.12	23.23		16.52	14.74	22.51	22.51
Calibration									
	κ_{uh}	κ_{ul}	κ_r	κ_t		ν_h	ν_l	ν_r	ν_t
high-skilled	0.000	-2.000	-1.000	0.000		1.000	0.568	0.568	0.784
low-skilled	0.000	-2.000	-1.000	0.000		1.000	0.741	0.741	0.871
unskilled	0.000	-2.000	-1.000	0.000		1.000	0.958	0.958	0.979
	$s_{uh,eh}$	$s_{ul,el}$	$s_{r,el}$	$s_{t,eh}$	$s_{ul,r}$	$s_{ul,t}$			
high-skilled	1.030	0.632	0.380	0.630	0.067	0.078			
low-skilled	0.989	0.684	0.418	0.678	0.119	0.408			
unskilled	0.888	0.809	0.312	0.571	0.195	0.388			

[a] Wages and benefits are in thousands of Dutch guilders.

3.7 Selection strategy of workers

3.7.1 Specification of the selection strategy of workers

The reservation wage of a job seeker is defined as the wage for which the individual is indifferent between the job offer and the current state. First consider the reservation wage of high-productive unemployed job-seekers and participants in training programs. Denote their respective reservation wages by $w(\alpha^w_{min,uh})$ and $w(\alpha^w_{min,t})$, where $\alpha^w_{min,uh}$ and $\alpha^w_{min,t}$ denote the corresponding minimum productivity levels (w is a superscript for workers). Denote discounted lifetime utility in high-productive employment at the reservation wage by $V_{eh}(\alpha^w_{min,uh})$ and $V_{eh}(\alpha^w_{min,t})$, for a high-productive unemployed and a training program participant, respectively. By definition $V_{eh}(\alpha^w_{min,uh})$=$V_{uh}$ and $V_{eh}(\alpha^w_{min,t})$=V_t. Rewriting these conditions we find the reservation wages

$$\ln w(\alpha^w_{min,uh}) + \frac{1}{\eta}\ln(T - l_0) = \frac{1}{\eta}\delta V_{uh}, \tag{30}$$

and

$$\ln w(\alpha^w_{min,t}) + \frac{1}{\eta}\ln(T - l_0) = \frac{1}{\eta}(\delta V_t - \sigma_{eh,uh}(V_{uh} - V_t)). \tag{31}$$

Now consider the reservation wage of individuals in relief jobs w($\alpha^w_{min,r}$). The reservation wage follows from $V_{el}(\alpha^w_{min,r})$=V_r. Rewriting this condition we obtain the reservation wage

$$\begin{aligned}\ln w(\alpha^w_{min,r}) + \frac{1}{\eta}\ln(T - l_0) &= \frac{1}{\eta}(\delta V_r - \sigma_{el,ul}(V_{ul} - V_r) \\ &\quad -\tau_{el,eh}(V_{eh}(\alpha^w_{min,r}/\omega) - V_r)) \\ &= \frac{1}{\eta}\frac{\delta + \sigma_{eh,uh}}{\delta + \sigma_{eh,uh} + \tau_{el,eh}}((\delta + \tau_{el,eh})V_r \\ &\quad -\sigma_{el,ul}(V_{ul} - V_r) \\ &\quad +\frac{\tau_{el,eh}}{\delta + \sigma_{eh,uh}}(\eta \ln \omega - \sigma_{eh,uh}V_{uh}))\end{aligned} \tag{32}$$

Note that the possibility to become high-productive again lowers the reservation wage of relief job workers. Furthermore, note that the reservation wage rises in ω, the skill-loss parameter. A higher ω implies that the productivity of low-productive workers is closer to the productivity of high-productive workers. Consequently, a low-productive individual has less to gain from a transition into the state of high-productive employment.

Finally, consider the reservation wage of a low-productive unemployed for the different states. The low-productive unemployed holds a different reservation wage for low-productive employment, relief jobs and placement in a training program because the exit routes from (and disutilities in) these states differs. Denote the reservation wage and the corresponding minimum productivity level relevant for low-productive employment by w($\alpha^w_{min,ul,el}$). The reservation wage for low-productive employment follows from $V_{el}(\alpha^w_{min,ul,el}) = V_{ul}$

$$\begin{aligned}\ln w(\alpha^w_{min,ul,el}) + \frac{1}{\eta}\ln(T - l_0) &= \frac{1}{\eta}(\delta V_{ul} - \tau_{el,eh}(V_{eh}(\alpha^w_{min,ul,el}/\omega) - V_{ul})) \\ &= \frac{1}{\eta}\frac{\delta + \sigma_{eh,uh}}{\delta + \sigma_{eh,uh} + \tau_{el,eh}}((\delta + \tau_{el,eh})V_{ul} \\ &\quad +\frac{\tau_{el,eh}}{\delta + \sigma_{eh,uh}}(\eta \ln \omega - \sigma_{eh,uh}V_{uh})).\end{aligned} \tag{33}$$

Like for a relief job worker, the reservation wage is reduced by the possibility to become high-productive again, and rises when there are less skills to (re)gain.

In a similar way derive the reservation wages for relief and training jobs. However, we only derive these reservation wages to ensure that compensation exceeds the reservation wage for relief and training jobs. Their derivation can be found in Jongen *et al.* (2000).

Now that we have all the reservation wages we can determine how many job offers are accepted by the respective groups of job seekers. As mentioned before, wages are proportional to productivity. This implies that the minimum productivity levels associated with the reservation wages for employment in the private sector are given by

$$\alpha^w_{min,x} = \frac{w(\alpha^w_{min,x})}{w(\overline{\alpha_x})}\overline{\alpha_h}, \quad x = uh, ul, r, t. \tag{34}$$

where $w(\overline{\alpha_x})$ denotes the respective average wage of accepted job offers of the respective group. The share of job offers acceptable to the respective job-seekers, fu_x with $x = l, h, r, t$, is then given by fu_l=1-$G_l(\alpha^w_{min,ul,el})$, fu_h=1-$G_h(\alpha^w_{min,uh})$, fu_r=1-$G_l(\alpha^w_{min,r})$ and fu_t=1-$G_h(\alpha^w_{min,t})$.

3.7.2 Calibration of selection strategy of workers

Table 5 above gives the resulting outcomes for the reservation wages and the acceptance rates of the various groups of job seekers in the calibrated model. The reservation wage rises with the level of education, as the compensation outside employment rises with the level of education. Furthermore, we find that the reservation wage of the low-productive unemployed for a regular job lies substantially below the reservation wage of the high-productive unemployed for a regular job. Relief jobs do not offer the opportunity to regain lost skills, whereas training jobs do. This explains why the reservation wage for training jobs lies far below the reservation wage for relief jobs. The reservation wage of participants in relief jobs lies substantially below the reservation wage of participants in training jobs as they are less likely to obtain alternative regular employment, and are willing to trade a lower paying job now for the option to become high-productive again.

The acceptance rates of the various groups of job seekers for regular jobs reflects the differences in reservation wages and the potential wage distribution.

Low-productive unemployed accept more job-offers than high-productive unemployed. Training job participants are also quite willing to accept a job, the unskilled training participants being the notable exception. The relief job workers are more choosy than the low-productive unemployed, they have less to gain from a move into regular employment.

3.8 Share of job-worker contacts accepted

3.8.1 Specification of the share of job-worker contacts accepted

Both the firm and the job seeker hold a minimum productivity standard. Since workers are homogeneous *ex ante*, they hold the same minimum productivity standard. Firms do the same. This would imply that the 'short-side of the market' determines the actual share of contacts that results in match, *i.e.* $fm_l = \min\{fu_l, fr_l\}$ *etc.* However, to capture some heterogeneity in reservation wages within a certain group we assume that the actual share of contact that results in a match is given by a CES function. For the respective groups we have

$$fm_x = ((fu_x)^\epsilon + (fr_x)^\epsilon)^{\frac{1}{\epsilon}}, \quad x \;\epsilon\; \{uh, eh\}, \{ul, el\}, \{r, el\}, \{t, eh\}, \tag{35}$$

where ϵ denotes the CES-parameter.

3.8.2 Calibration of the share of job-workers contacts accepted

The resulting overall acceptance rates for job-worker contacts in the calibrated model are given in Table 5 above. For all skill levels the low-productive unemployed and relief job workers are more restricted by the minimum wage than by their reservation wage. The same holds for the unskilled high-productive unemployed and training program participants. High- and low-skilled high-productive unemployed and training program participants are more likely to be restricted by their reservation wage.

Moving down the table to the overall acceptance rate, we observe the negative effect of the loss of skills. Despite the fact that low-productive job seekers are quite willing to accept a lower wage, they are still less likely to fill a vacant job, due to the presence of minimum wages. Furthermore, note that the unskilled suffer more from the presence of minimum wages than the low- and high-skilled, given their low productivity profile.

3.9 Wage determination

The determination of wages is quite similar to the original MIMIC model. In Bovenberg *et al.* (1998), wages per productivity unit are a mark-up on the outside option of workers, determined by bargaining between unions and employers' federations. We adjust the outside option of the union to take into account the distinct states of high- and low-productive unemployment, and relief and training jobs. Furthermore, we assume that wages only depend on skill specific variables, and not on aggregate variables (as opposed to the original MIMIC model).

Compensation outside current employment depends on the distribution over the states according to the shares of these states in the labour market and their compensation levels. Hence, the 'fall-back' compensation, w^o (the superscript o indicates the outside option), is given by a weighted sum of compensation outside current matches

$$w^o = (1 - (u_h + \delta_w(u_l + r + t)))\overline{w} + u_h b_h + \delta_w(u_l b_l + r w_r + t w_t), \tag{36}$$

where $\overline{w}$ denotes the average wage in regular employment. We introduce a parameter δ_w so as to discount the difference between income in low-productive unemployment, relief and training jobs and private sector employment. Empirical studies for The Netherlands suggest that low-productive unemployment[17] generates the same downward pressure on wages as high-productive unemployment (see *e.g.* Jongen and Graafland (1998)). Hence, we discount the *difference* between income in low-productive unemployment and formal employment by a factor δ_w which effectively brings b_l in line with b_h. Using our data on welfare benefits and unemployment insurance benefits, we come to a value of .45 for δ_w.

ALMPs will affect the 'fall-back' position of the union directly when their compensation level differs from the benefit level in low-productive unemployment, and indirectly via their impact on the distribution of individuals over the different states.

All parameters in the wage bargaining model, except δ_w, are taken from the original MIMIC model (see Bovenberg *et al.* (1998)).

[17] Actually, these studies use long-term unemployment, a proxy for our pool of low-productive unemployed.

3.10 Government budget

Finally, we consider government expenditures and receipts. The government budget, GB, is given by

$$\begin{aligned} GB &= \overline{tax}\overline{w}E_{pr} - w_{ps}E_{ps} - b_h U_h - b_l U_l - w_r R - w_t T \\ &\quad - cw_r V_r - cw_t V_t - A_{ps}, \end{aligned} \tag{37}$$

where $\overline{tax}$ denotes the average tax rate, and E_{pr} denotes private sector employment. The government receives taxes but has to pay (net) wages to workers in the public sector[18], $w_{ps}E_{ps}$, benefits to unemployed (note that benefits are expressed net of taxes), payments to relief and training job workers and search costs for attracting relief and training job workers (note that we assume that search costs per vacancy for relief and training jobs per period are a fraction of compensation in these programs, like in the private sector). A_{ps} denotes autonomous government consumption. We set A_{ps} so as to have a balanced budget in our base projection, using the actual average tax rate in 1993.

4 Simulations

First we consider simulations where we increase the number of vacancies posted for relief and training jobs, and employment subsidies for individuals in low-productive employment. We present simulation results for an equal 'ex ante' impuls of 115 million euro (approximately 250 million Dutch guilders) in 1999 and subsequent periods for the three programs. By 'ex ante' we mean that we change the number of vacancies for relief jobs, training jobs or the level of the employment subsidy so as to let the immediate impact on expenditures on participants equal 115 million euro, *i.e.* without taking into account the induced changes in behaviour and stocks.

The discussion of the simulation outcomes is structured as follows: i) first we consider the micro level, *i.e.* the induced changes in behaviour; ii) then we consider how these behavioural changes are reflected in some macro-economic variables, and finally; iii) we consider the impact on government expenditures. For the macro-economic variables and government expenditures we give the results both with and without compensating taxation.

[18]Public sector wages are indexed to private sector wages.

4.1 Relief jobs

First consider the impact of increasing vacancies for relief jobs. Table 7 below gives the induced changes in the behaviour of workers and firms. As more vacancies for relief jobs come into the market, individuals in low- productive unemployment devote more time to locating these vacancies.[19] This goes at the expense of time devoted to locating private sector vacancies and vacancies for training jobs.[20] The acceptance rates of workers hardly change, the changes mainly reflect composition effects of skill types.[21]

Turning to the firms' side, we observe that more vacancies for relief jobs partly crowd out private sector vacancies. As noted in the calibration, it is optimal for participants in the relief program to search less intensely for regular employment than their low-productive unemployed counterparts. Hence, when participation in the relief program increases, the effective supply of labour falls. Hence, search costs for firms rise. In addition, as we will see below, wages rise as well. As both wage and search costs rise, firms close down part of their vacancies.[22]

The acceptance rate of the firm of the different groups hardly changes, differences are mostly due to changes in the skill-composition of the pools of job seekers.[23] The overall acceptance rates also harldy change, as the acceptance rates of workers and firms hardly change.

Next, consider how these changes in the 'inputs' of the matching process affect the endogenous flow rates and stocks. Obviously, the flow rate from low-productive unemployment into relief jobs increases. Individuals in low-productive unemployment spend less time on locating vacancies in the private sector. Consequently, their flow rate into regular employment falls. Individuals in the training program and high-productive unemployment face less competi-

[19]See equations (3) and (23). More vacancies for relief jobs raise the flow rate into relief jobs. The individual search effort for relief jobs depends positively on the flow rate into relief jobs.

[20]Individuals in relief jobs also increase their search effort. Low-productive employment becomes more attractive for them. Indeed, more vacancies for relief jobs makes the state of low-productive unemployment more attractive, reducing the costs associated with job loss in low-productive employment.

[21]Noteworthy is the increase in the acceptance rate of relief job workers. As mentioned above, low-productive employment at a given wage becomes more attractive for relief job workers. The reduced costs of job loss in low-productive employment lowers their reservation wage.

[22]The fall in vacancies is somewhat masked by the rise in the average duration of vacancies.

[23]This also explains the diverging effects on the acceptance rates of the low-productive unemployed vs. relief job workers.

tion from individuals in the relief program than individuals in low-productive unemployment. Hence, they are more likely to encounter a vacant job slot.

Turning to the stocks, participation in relief jobs rises and low-productive unemployment falls. Less individuals move into the training program. High-productive unemployment falls as well. As relief jobs reduce private sector employment (see below), they reduce the inflow into high-productive unemployment. *Note that the rise in the stock of relief job participants is much larger than the fall in low-productive unemployment. This reflects the effect that individuals 'get stuck' in the relief program, with a reduced outflow into regular employment.*

Table 8 below gives the impact of an increase in relief jobs on some key macro-economic variables and government expenditures, with and without compensating taxation. First consider the impact on some aggregate price levels in the economy. As individuals prefer to be in the state of relief jobs relative to the state of low-productive unemployment, the outside option of workers in the wage bargain goes up. This raises labour costs. Productivity rises as less individuals in the low-productive segment are in employment. The rise in labour costs leads to a rise in production and consumption prices.[24]

Moving down the table, we find that private sector employment and production are adversely affected by the rise in labour costs. Relief jobs partly crowd out regular employment, leaving a net positive effect on total employment (including relief and training jobs). The unemployment rate falls as individuals move into relief jobs. However, the 'inactivity rate' (defined as the stocks of unemployment, relief jobs and training jobs over the labour force) rises.

Turning to the receipts and expenditures of the government, the wage bill of the government rises. This is mostly due to the rise in relief job expenditures (the remainder is due to the rise in average labour costs for the government (wages in the public sector are linked to the private sector)). Note that the rise in the wage bill for relief jobs is lower 'ex post' than 'ex ante', as individuals in relief jobs produce part of their compensation.[25] Unemployment insurance expendi-

[24]Production prices rise less than average labour costs due to changes in the skill-composition of the labour inputs. Consumption prices rise less than production prices as part of the consumption bundle is imported.

[25]Search costs hardly rise, the average vacancy duration is very low for vacancies for relief and training jobs.

tures and welfare benefits fall. Tax receipts fall with the fall in private sector employment. Overall, expenditures rise by less than the 'ex ante' expenditures.

Table 8 also gives the corresponding effects on the macro level and government expenditures when the government finances the rise in expenditures by increasing income tax rates. The rise in income tax rates, the 'additional burden' is reflected in the rise of the average burden. This raises labour costs, and hence production and consumption prices. With compensating taxation, relief jobs crowd out more private sector employment and production.

4.2 Training jobs

Tables 7 and 8 also gives the changes induced by an 'ex ante' impuls of 115 million euro into training jobs. With more vacancies for training jobs in the market, low-productive unemployed devote more search effort to locating these vacancies. This goes at the expense of search effort devoted to locating vacancies in the private sector. The acceptance rates of the various groups of job seekers for private job offers is hardly affected by the rise in training job participation, the changes mainly reflect changes in the skill-composition of the various pools.

Trained individuals are more attractive for firms than low-productive unemployed. Furthermore, as individuals in training jobs search more intensely for jobs, the average vacancy duration falls. Firms respond by posting more vacancies, *ceteris paribus*. However, the rise in vacancies is limited by the rise in wages (see below). Note that vacancies for training jobs rise more in percentage terms than for relief jobs, for the same 'ex ante' impuls. This is due to the lower average duration in the state of training jobs, which implies more vacancies for the same 'ex ante' rise in participation. The acceptance rates of firms are hardly affected. The overall acceptance rates hardly change either.

Turning to the flow rates and stocks. The flow rate into the training program rises. The other flow rates are hardly affected. The stock of participants in the training program rises. Low-productive unemployment falls. *Note that the fall in low-productive unemployment is larger than the rise in the participation in the training program. The training program speeds up the process by which job seekers find regular employment.* High-productive unemployment rises as more individuals flow into this state from the training program and regular employment. Despite the positive 'treatment effect' in the training program, *i.e.*

Table 7: Relief jobs, training jobs and vouchers - changes in behaviour, flows and stocks[a]

Simulation	relief	training	voucher[b]		relief	training	voucher[b]
Individual level				Aggregate level			
Job-seekers		*perc. changes*				*perc. changes*	
Search intensity				Overall accept. rates			
$s_{uh,eh}$	-0.10	-1.91	-1.74	fm_h	0.02	-1.05	-1.30
$s_{ul,el}$	-1.20	-10.8	2.98	fm_l	0.25	1.00	10.8
$s_{ul,r}$	36.4	-10.8	-6.44	fm_r	0.56	-3.84	18.3
$s_{ul,t}$	-0.09	45.8	-4.10	fm_t	0.26	-1.76	-1.68
$s_{r,el}$	0.84	-2.73	10.8				
$s_{t,eh}$	-0.03	-3.81	-3.50	Flow rates			
Acceptance rate				$\pi_{uh,eh}$	0.16	-4.31	-3.92
				$\pi_{ul,el}$	-0.65	-11.3	13.7
fu_h	-0.33	-0.55	-1.08	$\pi_{ul,r}$	93.3	1.78	2.39
fu_l	-0.05	-0.34	-0.29	$\pi_{ul,t}$	2.27	154.	3.11
fu_r	0.71	1.95	2.49	$\pi_{r,el}$	1.19	-7.85	23.7
fu_t	-0.33	-1.09	-2.03	$\pi_{t,eh}$	0.64	-9.21	-6.52
Firms				Stocks		*abs. changes*	
Vacancies							
				U_h	-0.51	8.87	5.76
V_{pr}	-0.50	-6.64	-3.12	U_l	-5.95	-18.7	-10.3
V_r	125.	0.00	0.00	R	13.7	-0.74	-2.77
V_t	0.00	210.	0.00	T	-0.19	14.4	0.12
				$U_h + U_l + R + T$	7.03	3.76	-7.18
Acceptance rate							
fr_h	0.18	-0.90	-0.98				
fr_l	0.25	0.99	11.4				
fr_r	0.55	-3.92	19.2				
fr_t	0.31	-1.67	-1.66				

[a]Outcomes denote differences between the simulation and the base projection, no compensating taxation.
[b]Subsidy equals 7% of the net benefit level in low-productive unemployment.

Table 8: Relief jobs, training jobs and vouchers - macro-ec. variables and gov. exp.[a]

Simulation	*no compensating taxation* relief	training	voucher[b]	*with compensating taxation* relief	training	voucher[b]
Prices		*perc. changes*			*perc. changes*	
Labour cost[c]	0.12	0.13	-0.08	0.15	0.18	-0.06
Labour productivity	0.04	0.08	-0.06	0.04	0.07	-0.06
Production price	0.07	0.00	-0.06	0.11	0.05	-0.05
Consumption price	0.05	0.00	-0.05	0.08	0.04	-0.04
Volumes						
Production[d]	-0.11	0.00	0.09	-0.16	-0.07	0.07
Employment (total)[e]	0.12	0.19	0.09	0.09	0.14	0.07
Employment (firms)[e]	-0.15	-0.08	0.16	-0.20	-0.15	0.14
Ratio's		*abs. changes*			*abs. changes*	
Unemployment rate	-0.11	-0.17	-0.08	-0.08	-0.13	-0.07
- incl. r and t[f]	0.12	0.07	-0.13	0.16	0.12	-0.11
Tax burden	0.00	0.00	-0.08	0.07	0.10	-0.05
- additional burden	0.00	0.00	0.00	0.07	0.10	0.03
Government budget						
Expenditures[g]						
Wage bill	0.11	0.19	-0.03	0.13	0.20	-0.02
- relief jobs	0.10	0.00	-0.02	0.11	0.00	-0.02
- training jobs	0.00	0.18	0.00	0.00	0.19	0.00
Unemployment insurance[h]	0.00	0.09	0.06	0.00	0.10	0.06
Welfare benefits[h]	-0.04	-0.12	-0.07	-0.03	-0.11	-0.06
Voucher expenditures	0.00	0.00	0.12	0.00	0.00	0.12
Receipts[g]						
Taxes	-0.02	0.04	0.05	0.10	0.20	0.10
Gov. budget	-0.10	-0.13	-0.04	0.00	0.00	0.00
Ex ante expenditures[i]	0.12	0.12	0.12	0.12	0.12	0.12

[a]Outcomes denote differences between the simulation and the base projection.
[b]Subsidy equals 7% of the net benefit level in low-productive unemployment.
[c]Gross labour cost per unit of labour, excluding search costs.
[d]Production in the private sector.
[e]Total employment includes relief and training jobs, employment by firms denotes private sector employment.
[f]The stock of unemployment plus the stocks of relief and training participants divided by the labour force.
[g]Expenditures in billions of euro.
[h]High-productive un. individuals receive unemployment insurance, low-productive un. receive welfare benefits.
[i]Expenditures *ceteris paribus*, *i.e.* disregarding behavioural changes.

a higher flow rate into regular employment, the number of individuals outside regular employment rises. This is due to the rise in wages (see below), which crowds out part of private sector employment.

Table 8 gives the resulting changes in some macro-economic variables, and government expenditures. Regarding price levels, wages rise with the increase in training jobs. The rise in wages is partly due to the increase in average productivity and partly due to the more favourable outside option of workers. Production and consumption prices are harldy affected despite the rise in wages, due to lower search costs.

Private sector employment falls as labour costs rise. However, production is unaffected due to the rise labour productivity. Total employment rises, as the rise in participation in the training program dominates the fall in regular employment. Unemployment falls. However, the 'inactivity ratio' (the stocks of unemployment, relief and training jobs over the labour force) increases.

Government expenditures rise due to the higher expenditures on the training program. Expenditures on unemployment insurance benefits rise with high-productive unemployment. However, the government saves on welfare benefits, relief jobs expenditures and receives more taxes due to the rise in wages. Overall, expenditures fall short of receipts, but more than the 'ex ante' expenditures. Expenditures are higher 'ex post' due to the training costs (25% of the minimum wage per participant per period).

Table 8 also gives the corresponding changes in macro-economic variables and government expenditures and receipts when we finance the rise in the deficit with higher income tax rates. The average burden rises, see the 'additional burden'. With compensating taxation production prices and consumption prices rise. Consequently, production falls, and private sector employment falls more than without compensating taxation.

4.3 Vouchers

We further consider the impact of a uniform subsidy for the employer for each low-productive worker ('vouchers'). With the uniform subsidy, the minimum productivity standard of the firm for individuals from the state of low-productive unemployment and relief jobs becomes

$$\alpha^f_{\min,l} = \frac{\omega(r_{int} + \sigma_{eh.uh})}{\omega(r_{int} + \sigma_{eh.uh}) + \tau_{el,eh}(1 - \frac{\overline{w}}{\overline{\alpha}})}(wm - v), \tag{38}$$

where v denotes the level of the subsidy the employer receives per unit time period. Why do we consider a subsidy for the employer and not for the unemployed? In the calibrated model the minimum wage is more restrictive than the reservation wage of the low-productive unemployed. Hence, the firm and the worker will agree to leave all of the subsidy to the firm as long the productivity falls short of the minimum wage. For productivity levels (including the subsidy) above the minimum wage, workers and firms bargain over the additional surplus. The additional surplus is split 50/50 on average.

We consider the impact of an 'ex ante' impuls of 115 million euro on the voucher program. The corresponding subsidy level is 7% of the net benefit level of low-productive unemployed.

Table 7 gives the resulting changes in behaviour. As the subsidy mainly affects firm behaviour, it is best to start with the firm's side of the market. The acceptance rates for low-productive job seekers rise significantly. The fall in search costs leads to a rise in vacancies posted, *ceteris paribus*. However, the rise in vacancies posted is dominated by the fall in the average duration of vacancies.

Turning to the workers side, as more workers from the pools of low-productive unemployment and relief jobs are accepted by firms, individuals in these states spend more time on locating private sector vacancies. The search effort for relief and training jobs falls as time is reallocated to search effort for regular employment. High-productive unemployed and training job workers face tougher competition from individuals in low-productive unemployment and relief jobs. Hence, they are less likely to locate a vacancy. They reduce their search effort. The acceptance rates of workers are hardly affected. The overall acceptance rates relevant for low-productive unemployed and relief job workers rises in line with the rise in the acceptance rate of the firm. The overall acceptance rates relevant for high-productive unemployed and training program participants hardly change.

Now consider the changes in the stocks and flow rates. More individuals flow from low-productive unemployment and the relief program into regular employment. The flow rates for high-productive unemployment and the training program fall due to the increase in competition. The stocks of low-productive unemployment and relief jobs fall. Due to the lower outflow high-productive unemployment and participation in the training program rise.

In Table 8 we report the changes in some macro-economic variables and goverment expenditures. Labour costs fall due to the subsidy. However, labour productivity falls by more than labour costs, showing a slight increase in wage pressure. Production and consumption prices fall in line with labour costs.

Private sector production and employment rise. Note that the rise in production is less than the rise in employment, due to the lower productivity of the workers that are drawn into employment by the subsidy. Total employment rises by less than private sector employment, as participation in the relief program falls. The unemployment rate falls as more individuals flow from low-productive unemployment into regular employment. The fall in the 'inactivity rate' is more pronounced, due to the fall in participation in the relief program. We include the subsidy in the 'wedge' between labour costs and net wages. The subsidy leads to a fall in the average (tax) burden.

Turning to the effects on government expenditures, the wage bill falls. Furthermore, the government saves on welfare benefits. However, this effect is nullified by an equivalent rise in unemployment insurance benefits. Subsidy expenditures rise slightly above the level expected 'ex ante' as more individuals are drawn into low-productive employment. Tax receipts rise with the rise in production. Savings on wages by the government and additional tax receipts lead to an 'ex post' deficit that is only approximately one third of the 'ex ante' expenditures.

Table 8 also gives the corresponding changes with compensating taxation. The rise (fall) in private sector employment (unemployment and inactivity) and production is somewhat limited by the rise in taxes.

4.4 Relief jobs, training jobs and vouchers - a comparison

How do the different programs affect our model economy relative to one another? For the same 'ex ante' level of expenditures, relief and training jobs are more effective in reducing unemployment than 'vouchers' for the low-productive unemployed, especially when we do not compensate the additional expenditures by higher income tax rates. However, relief and training jobs crowd out private sector employment, whereas 'vouchers' do not. Indeed, the most detrimental to private sector employment is the rise in relief jobs. Individuals 'get stuck' in relief jobs, and reduce their search effort for regular employment. The training program has the opposite effect on the effective supply of labour. The positive 'treatment effect' increases the flow rate into regular employment. However, the induced fall in search costs is dominated by the rise in wages due to the more favourable outside option of workers. This leaves a negative net effect on private sector employment. The effect of subsidies targeted at low-productive workers is in some ways similar to the training program. More individuals are drawn into low-productive employment which is another route through which individuals may regain their lost skills. However, in the calibrated model, the rate at which individuals regain their lost skills in low-productive employment is less than the rate at which individuals move from the training program into high-productive employment (the rate at which they 'regain' their lost skills). Still, the effect of 'vouchers' on private sector employment is much more positive than for the training program. Individuals produce output right from the start when they enter low-productive employment with the subsidy, and the rise in wages is limited as the subsidy is only a fraction of the compensation in low-productive employment. Furthermore, part of the subsidy goes to the employer, which leads to an overall reduction in labour costs. Overall, the training program is most effective in reducing ('open') unemployment, but the voucher program is most effective in reducing 'inactivity' (the sum of unemployment, relief job participants and training program participants) and enhancing production.

4.5 Design features relief and training jobs

We now consider the impact of changing some design features of the relief and training program. Over the past few years the compensation in training and particularly relief jobs has increased, from 100 percent of the minimum wage level to (approximately) 115 percent of the minimum wage level. We consider the impact of raising the compensation level in relief and training jobs to 115 and 150 percent. Furthermore, contract durations have become more limited. Hence, we consider the impact of a doubling of the firing rates from the relief and training program back into low-productive unemployment.

Tables 9 and 10 give the resulting changes in behaviour, the flows and stocks and some macro-economic variables and government expenditures, respectively.

First consider the induced changes in behaviour from increasing the compensation level in relief and training jobs. The higher compensation level induces low-productive individuals to search more actively for relief and training jobs. The rise in the search time devoted to locating relief and training job vacancies goes at the expense of search time devoted to locating regular vacancies. As individuals in the relief and training program, particularly the relief program, have less to gain from moving into regular employment, they reduce their search effort for regular employment. The acceptance rates of workers in the relief and training program falls. They become more choosy with their more favourable current compensation level. Firms close down part of their vacancies. Individuals in relief and training jobs reduce their search effort for regular jobs. Furthermore, the rise in the compensation in relief and training jobs puts upward pressure on wages, increasing labour costs even further. The changes in the acceptance rates of firms towards the various groups of job seekers mainly reflects changes in the skill composition of the various pools. The overall acceptance rates for regular employment relevant for relief and training job participants falls.

We observe the rise in the flow rate into relief and training jobs, and the reduced flow rates from these states into regular employment. The high-productive unemployed suffer from the crowding out of private sector employment.

The stocks of relief and training jobs rise. Higher compensation in these programs increases the inflow and reduces the outflow. Low- and high-productive unemployment rise as well, due to the crowding out of private sector employment.

Table 10 gives the changes in some macro-economic variables and government expenditures. Higher wage and search costs increase labour costs. Labour productivity rises, as less individuals flow into low-productive employment. Production and consumption prices rise in line with labour costs. The rise in labour costs adversely affects private sector employment and production. Total employment falls, as the rise in participation in relief and training jobs is dominated by the fall in private sector employment. As noted above, the unemployment and 'inactivity' rate increase. Government expenditures rise due to higher wages, more transfers and lower tax receipts. With compensating taxation private sector employment and production are more adversely affected.

Tables 9 and 10 also report the effects of doubling the quit rate from relief and training jobs back into the state of low-productive unemployment. For individuals outside relief and training jobs a higher quit rate is just like a decrease

Table 9: Design features - changes in behaviour, flows and stocks[a]

Simulation	$w_r\&w_t$ +15%	$w_r\&w_t$ +50%	$\sigma_{r,ul}$ +100%	$\sigma_{t,ul}$ +100%		$w_r\&w_t$ +15%	$w_r\&w_t$ +50%	$\sigma_{r,ul}$ +100%	$\sigma_{t,ul}$ +100%
Individual level					Aggregate level				
Job-seekers		*perc. changes*					*perc. changes*		
Search intensity					Overall accept. rate				
$s_{uh,eh}$	-0.05	-0.07	0.00	0.20	fm_h	0.36	2.01	-0.07	0.10
$s_{ul,el}$	-0.89	-2.71	0.29	1.61	fm_l	-0.93	-4.93	-0.22	-0.19
$s_{ul,r}$	19.4	54.3	-8.51	0.75	fm_r	-7.01	-31.9	6.57	0.40
$s_{ul,t}$	3.00	8.19	0.02	-8.81	fm_t	-2.62	-15.0	-0.24	6.21
$s_{r,el}$	-28.4	-74.7	10.2	0.48					
$s_{t,eh}$	-9.13	-37.9	-0.07	15.6	Flow rates				
Acceptance rate					$\pi_{uh,eh}$	-0.37	-1.96	-0.09	0.58
					$\pi_{ul,el}$	-2.14	-9.84	0.10	1.97
fu_h	0.21	1.58	0.07	-0.03	$\pi_{ul,r}$	4.61	5.01	-3.69	-0.96
fu_l	0.02	0.15	0.01	0.03	$\pi_{ul,t}$	-0.86	-7.57	-0.70	-4.26
fu_r	-30.2	-67.1	8.93	-0.33	$\pi_{r,el}$	-27.1	-73.2	10.8	1.47
fu_t	-9.92	-32.5	0.02	18.2	$\pi_{t,eh}$	-10.3	-43.9	-0.33	18.7
Firms							*abs. changes*		
Vacancies					Stocks				
V_{pr}	-1.48	-6.59	0.32	1.38	U_h	0.15	0.80	0.23	-1.28
V_r	0.00	0.00	0.00	0.00	U_l	4.45	26.6	1.85	3.39
V_t	0.00	0.00	0.00	0.00	R	5.08	22.7	-4.87	0.01
					T	0.98	5.45	0.07	-3.31
Acceptance rate					$U_h + U_l + R + T$	10.7	55.5	-2.72	-1.18
fr_h	0.21	1.02	-0.09	0.15					
fr_l	-0.96	-5.07	-0.22	-0.19					
fr_r	-6.66	-7.49	6.52	0.42					
fr_t	-1.51	-8.43	-0.24	4.38					

[a]Outcomes denote differences between the simulation and the base projection, no compensating taxation.

Table 10: Design features - macro-economic variables and gov. expenditures[a]

	no compensating taxation				with compensating taxation			
Simulation	w_r&w_t +15%	w_r&w_t +50%	$\sigma_{r,ul}$ +100%	$\sigma_{t,ul}$ +100%	w_r&w_t +15%	w_r&w_t +50%	$\sigma_{r,ul}$ +100%	$\sigma_{t,ul}$ +100%
Prices	*perc. changes*				*perc. changes*			
Labour cost[b]	0.19	0.98	-0.05	-0.03	0.26	1.41	-0.06	-0.04
Labour productivity	0.06	0.34	-0.02	-0.02	0.06	0.30	-0.02	-0.02
Production price	0.11	0.59	-0.03	0.00	0.18	1.00	-0.04	-0.02
Consumption price	0.08	0.44	-0.02	0.00	0.13	0.75	-0.03	-0.01
Volumes								
Production[c]	-0.17	-0.87	0.04	0.01	-0.26	-1.47	0.06	0.02
Employment (total)[d]	-0.09	-0.51	-0.04	-0.04	-0.16	-0.93	-0.03	-0.03
Employment (firms)[d]	-0.23	-1.20	0.06	0.03	-0.32	-1.77	0.08	0.04
Ratio's	*abs. changes*				*abs. changes*			
Unemployment rate	0.08	0.48	0.04	0.04	0.15	0.88	0.02	0.03
- incl. r and t[e]	0.19	0.98	-0.05	-0.02	0.26	1.44	-0.06	-0.03
Government budget								
Expenditures[f]								
Wage bill	0.11	0.58	-0.04	-0.05	0.13	0.72	-0.05	-0.05
- relief jobs	0.06	0.33	-0.04	0.00	0.07	0.36	-0.04	0.00
- training jobs	0.04	0.17	0.00	-0.04	0.04	0.19	0.00	-0.04
Unemployment insurance[g]	0.00	0.03	0.00	-0.01	0.01	0.06	0.00	-0.01
Welfare benefits[g]	0.03	0.20	0.01	0.02	0.04	0.30	0.01	0.02
Receipts[f]								
Taxes	-0.02	-0.12	0.00	0.00	0.20	1.09	-0.04	-0.05
Net receipts	-0.17	0.93	0.03	0.03	0.00	0.00	0.00	0.00

[a]Outcomes denote differences between the simulation and the base projection.
[b]Gross labour cost per unit of labour, excluding search costs.
[c]Production in the private sector.
[d]Total employment includes relief and training jobs, employment by firms denotes private sector employment.
[e]The stock of unemployment plus the stocks of relief and training participants divided by the labour force.
[f]Expenditures in billions of euro.
[g]High-productive un. individuals receive unemployment insurance, individuals in low-productive un. receive welfare benefits.

in the number of vacancies for relief and training jobs, respectively. Hence, qualitatively, the results are the mirror image of an increase in the number of vacancies of relief and training jobs already reported. Hence, we shall only highlight the differences between a reduction in the number of vacancies for relief and training jobs, and increasing the quit rate from these jobs to low-productive unemployment.

The main difference is on the search behaviour of individuals in relief and training jobs. As they are more likely to be sent back to low-productive unemployment in the state of relief and training jobs, they increase their search effort for locating private sector vacancies. Furthermore, they become less choosy towards job offers, their acceptance rates rise.

Reducing the contract durations in relief and training jobs has a positive effect on private sector employment and government expenditures (less expenditures). However, the positive effect is more limited for training jobs as more individuals re-enter the pool of low-productive unemployment, potentially before they complete their training.

5 Sensitivity analysis

In this section we consider how sensitive the simulation results are to assumptions for which we have a weak empirical basis. Due to a lack of space, and not to exhaust the reader, we limit the discussion to the macro-economic variables and government expenditures.

5.1 Production and supervision costs

In our baseline simulations we assume that production by relief workers equals 25 percent of their compensation level. Furthermore, in our baseline simulations we assume that there are no supervision costs for the relief and training programs. Table 11 gives the outcomes of the changes in some macro-economic variables and government expenditures when we assume, respectively, that: i) supervision costs in relief jobs equal 100 percent of the minimum wage, per participant; ii) supervision costs in training jobs equal 100 percent of the minimum wage, per participant and; iii) production in relief jobs equals the minimum wage (the compensation of participants) for relief jobs, per participant.

Table 11: Sensitivity analysis production and supervision costs, 115 million ex ante[a]

Simulation	no compensating taxation			with compensating taxation		
	supervision cost r = min. wage	supervision cost t = min. wage	production r = min. wage	supervision cost r = min. wage	supervision cost t = min. wage	production r = min. wage
Prices		*perc. changes*			*perc. changes*	
Labour cost[b]	0.12	0.13	0.12	0.21	0.24	0.11
Labour productivity	0.04	0.08	0.04	0.03	0.07	0.04
Production price	0.07	0.00	0.07	0.16	0.11	0.07
Consumption price	0.05	0.00	0.05	0.12	0.08	0.05
Volumes						
Production[c]	-0.11	0.00	-0.11	-0.25	-0.16	-0.10
Employment (total)[d]	0.12	0.19	0.12	0.03	0.08	0.12
Employment (firms)[d]	-0.15	-0.08	-0.15	-0.28	-0.22	-0.15
Ratio's		*abs. changes*			*abs. changes*	
Unemployment rate	-0.11	-0.17	-0.11	-0.03	-0.07	-0.12
- incl. r and t[e]	0.12	0.07	0.12	0.22	0.18	0.12
Government budget						
Expenditures[f]						
Wage bill	0.25	0.34	0.01	0.29	0.37	0.01
- relief jobs	0.25	0.00	0.00	0.26	0.00	0.00
- training jobs	0.00	0.33	0.00	0.00	0.34	0.00
Unemployment insurance[g]	0.00	0.09	0.00	0.00	0.10	0.00
Welfare benefits[g]	0.04	-0.12	-0.04	-0.01	-0.10	-0.04
Receipts[f]						
Taxes	0.02	0.04	-0.02	0.28	0.39	-0.03
Net receipts	0.24	-0.28	0.01	0.00	0.00	0.00

[a] Outcomes denote differences between the simulation and the base projection.
[b] Gross labour cost per unit of labour, excluding search costs.
[c] Production in the private sector.
[d] Total employment includes relief and training jobs, employment by firms denotes private sector employment.
[e] The stock of unemployment plus the stocks of relief and training participants divided by the labour force.
[f] Expenditures in billions of euro.
[g] High-productive un. individuals receive unemployment insurance, low-productive un. receive welfare benefits.

Table 12: Sensitivity analysis wage bargain, 115 million ex ante, $\delta = .3$ [a]

	no compensating taxation			*with compensating taxation*		
Simulation	relief	training	voucher[b]	relief	training	voucher[b]
Prices		*perc. changes*			*perc. changes*	
Labour cost[c]	0.11	0.05	-0.14	0.16	0.08	-0.14
Labour productivity	0.04	0.06	-0.06	0.03	0.06	-0.06
Production price	0.07	-0.06	-0.11	0.12	-0.02	-0.12
Consumption price	0.05	-0.04	-0.09	0.09	-0.02	-0.09
Volumes						
Production[d]	-0.11	0.09	0.17	-0.18	0.04	0.18
Employment (total)[e]	0.13	0.26	0.15	0.08	0.22	0.15
Employment (firms)[e]	-0.15	0.02	0.23	-0.21	-0.02	0.24
Ratio's		*abs. changes*			*abs. changes*	
Unemployment rate	-0.12	-0.24	-0.14	-0.07	-0.21	-0.14
- incl. r and t[f]	0.12	-0.02	-0.19	0.17	0.02	-0.19
Government budget						
Expenditures[g]						
Wage bill	0.11	0.17	-0.04	0.13	0.18	-0.04
- relief jobs	0.10	-0.01	-0.02	0.11	-0.01	-0.02
- training jobs	0.00	0.18	0.00	0.00	0.18	0.00
Unemployment insurance[h]	0.00	0.08	0.05	0.00	0.09	0.05
Welfare benefits[h]	-0.04	-0.15	-0.08	-0.03	-0.14	-0.09
Voucher expenditures	0.00	0.00	0.12	0.00	0.00	0.12
Receipts[g]						
Taxes	-0.02	0.05	0.05	0.10	0.14	0.05
Gov. budget	-0.10	-0.07	0.00	0.00	0.00	0.00
Ex ante expenditures[i]	0.12	0.12	0.12	0.12	0.12	0.12

[a] Outcomes denote differences between the simulation and the base projection.
[b] Subsidy equals 7% of the net benefit level in low-productive unemployment.
[c] Gross labour cost per unit of labour, excluding search costs.
[d] Production in the private sector.
[e] Total employment includes relief and training jobs, employment by firms denotes private sector employment.
[f] The stock of unemployment plus the stocks of relief and training participants divided by the labour force.
[g] Expenditures in billions of euro.
[h] High-productive un. individuals receive unemployment insurance, low-productive un. receive welfare benefits.
[i] Expenditures *ceteris paribus*, *i.e.* disregarding behavioural changes.

Table 13: Sensitivity analysis wage bargain, 115 million ex ante, $\delta = .6$ [a]

	no compensating taxation			*with compensating taxation*		
Simulation	relief	training	voucher[b]	relief	training	voucher[b]
Prices		*perc. changes*			*perc. changes*	
Labour cost[c]	0.12	0.19	-0.03	0.15	0.24	-0.01
Labour productivity	0.05	0.09	-0.06	0.04	0.09	-0.06
Production price	0.07	0.04	-0.03	0.10	0.09	-0.01
Consumption price	0.06	0.03	-0.02	0.08	0.07	-0.01
Volumes						
Production[d]	-0.11	-0.06	0.04	-0.15	-0.13	0.01
Employment (total)[e]	0.12	0.14	0.05	0.09	0.08	0.02
Employment (firms)[e]	-0.16	-0.15	0.10	-0.20	-0.22	0.08
Ratio's		*abs. changes*			*abs. changes*	
Unemployment rate	-0.11	-0.13	-0.04	-0.08	-0.08	-0.02
- incl. r and t[f]	0.13	0.12	-0.09	0.16	0.18	-0.06
Government budget						
Expenditures[g]						
Wage bill	0.11	0.20	-0.02	0.12	0.22	-0.01
- relief jobs	0.10	0.00	-0.02	0.11	0.00	-0.02
- training jobs	0.00	0.19	0.00	0.00	0.19	0.00
Unemployment insurance[h]	0.00	0.10	0.07	0.00	0.10	0.07
Welfare benefits[h]	-0.04	-0.11	-0.05	-0.03	-0.10	-0.05
Voucher expenditures	0.00	0.00	0.12	0.00	0.00	0.12
Receipts[g]						
Taxes	-0.02	0.03	0.05	0.10	0.23	0.13
Gov. budget	-0.10	-0.17	-0.07	0.00	0.00	0.00
Ex ante expenditures[i]	0.12	0.12	0.12	0.12	0.12	0.12

[a] Outcomes denote differences between the simulation and the base projection.
[b] Subsidy equals 7% of the net benefit level in low-productive unemployment.
[c] Gross labour cost per unit of labour, excluding search costs.
[d] Production in the private sector.
[e] Total employment includes relief and training jobs, employment by firms denotes private sector employment.
[f] The stock of unemployment plus the stocks of relief and training participants divided by the labour force.
[g] Expenditures in billions of euro.
[h] High-productive un. individuals receive unemployment insurance, low-productive un. receive welfare benefits.
[i] Expenditures *ceteris paribus*, *i.e.* disregarding behavioural changes.

Table 14: Sensitivity analysis 'lock-in/treatment effects', 115 million ex ante[a]

Simulation	*no compensating taxation*				*with compensating taxation*			
	μ_r -50%	μ_r +50%	μ_t -50%	μ_t +50%	μ_r +50%	μ_r -50%	μ_t -50%	μ_t +50%
Prices		*perc. changes*				*perc. changes*		
Labour cost[b]	0.11	0.12	0.12	0.12	0.15	0.16	0.18	0.14
Labour productivity	0.05	0.04	0.07	0.08	0.04	0.03	0.06	0.07
Production price	0.07	0.07	0.04	-0.07	0.11	0.11	0.10	-0.04
Consumption price	0.05	0.05	0.03	-0.05	0.08	0.08	0.08	-0.03
Volumes								
Production[c]	-0.11	-0.11	-0.06	0.10	-0.16	-0.16	-0.15	0.07
Employment (total)[d]	0.11	0.13	0.13	0.21	0.08	0.10	0.07	0.19
Employment (firms)[d]	-0.16	-0.15	-0.13	0.03	-0.21	-0.19	-0.22	-0.01
Ratio's		*abs. changes*				*abs. changes*		
Unemployment rate	-0.11	-0.12	-0.13	-0.20	-0.07	-0.09	-0.07	-0.17
- incl. r and t[e]	0.13	0.12	0.11	-0.02	0.17	0.16	0.17	0.01
Government budget								
Expenditures[f]								
Wage bill	0.11	0.05	0.18	0.16	0.12	0.13	0.20	0.17
- relief jobs	0.10	0.10	0.00	-0.04	0.11	0.11	0.00	-0.04
- training jobs	0.00	0.00	0.18	0.20	0.00	0.00	0.18	0.20
Unemployment insurance[g]	-0.01	0.00	0.03	0.19	-0.01	0.01	0.04	0.19
Welfare benefits[g]	-0.03	-0.05	-0.06	-0.20	-0.02	-0.04	-0.05	-0.19
Receipts[f]								
Taxes	-0.03	-0.01	-0.01	0.10	0.10	0.10	0.19	0.19
Gov. budget	-0.10	-0.09	-0.16	-0.07	0.00	0.00	0.00	0.00
Ex ante expenditures	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12

[a] Outcomes denote differences between the simulation and the base projection.
[b] Gross labour cost per unit of labour, excluding search costs.
[c] Production in the private sector.
[d] Total employment includes relief and training jobs, employment by firms denotes private sector employment.
[e] The stock of unemployment plus the stocks of relief and training participants divided by the labour force.
[f] Expenditures in billions of euro.
[g] High-productive un. individuals receive unemployment insurance, individuals in low-productive un. receive welfare benefits.

First consider cases i) and ii). Expenditures on these programs rise when we assume supervision costs. Expenditures approximately double. Income tax rates have to rise more than without the additional supervision costs. Consequently, regular employment and production fall by more.

Now consider the case where production by relief job workers equals their compensation, case iii).[26] Effectively, this makes the relief program virtually costless to the government, as participants receive as much as they produce. We are left with feedback effects when we raise the number of relief jobs. The rise in wages in the private sector induced by the more favourable outside option of workers, and reduced tax receipts, bite a significant piece out of the savings on benefits. Overall, additional receipts just exceed additional expenditures. The effects on the private sector are virtually the same as in the baseline simulations without compensating taxation. The main difference lies in the effects with compensating taxation.

5.2 Discounting the states of low-productive unemployment, relief and training jobs

In line with empirical findings, we discount the loss of income in the state of low-productive unemployment with a factor δ_w (see eq.(36)). We further assume that the same discounting holds for the lower income in relief and training jobs, as only the low-productive unemployed are eligible for these programs.

Below we consider how the results change if we discount the loss of income in the states of low-productive unemployment, relief and training jobs by more, $\delta_w = 0.3$, and less, $\delta_w = 0.6$. The resulting simulation outcomes are given in Table 12. First consider the case where the states of low-productive unemployment, relief and training jobs are discounted more heavily, $\delta_w = 0.3$. With more discounting, the rise in the fall-back position of workers in the wage bargain is less pronounced. Production and consumption prices still rise when we increase relief jobs, but fall when we increase training jobs. Production still falls when we increase relief job participation. Regular employment and production now rise when we increase participation in the training program. The fall in labour costs, production prices and consumption prices becomes more pronounced un-

[26]We only consider this case for relief jobs, as we regard it as unlikely that production in training jobs is substantial.

der the voucher scheme, and so does the rise in private sector employment and production. The scheme becomes self-financing as there is virtually no upward wage pressure from the subsidy.

The effects of less discounting of the states of low-productive unemployment, relief and training jobs, $\delta_w = 0.6$ are the mirror image of the effects with heavier discounting of these states, see Table 13. Now wages rise more than in the baseline simulations. More participation in relief and training programs now implies even less private sector production and employment. This also pushes up expenditures by the government and reduces savings and tax receipts. The voucher scheme becomes less effective in boosting private sector employment, but the effect is still positive. Receipts by the government now fall far short of expenditures for the voucher scheme.

Overall the results for training jobs and the voucher scheme appear quite sensitive to the extent to which the states of low-productive unemployment, relief and training jobs are discounted in the wage bargain. The results for relief jobs are hardly affected.

5.3 'Treatment/lock-in' effects

Finally, we consider to what extent the results depend on the net effect of 'treatment' and 'lock-in' effects from relief job and training program participation. Unfortunately we do not have much information on these effects from microeconomic studies. We consider how sensitive the results are to the efficiency by which relief and training workers are matched to vacant jobs. Specifically, we consider how the impact of the impuls of 115 million 'ex ante' varies when we decrease or increase the efficiency parameters μ_r and μ_t, respectively.

When we vary the efficiency parameter μ_r for relief job workers, the results are hardly affected, see Table 14. The outflow rate from relief jobs to private sector employment is quite low to begin with. We have to look at the two digit level to observe minor changes in labour productivity, private sector employment and net government receipts.

The results for training jobs are more sensitive to variations in the efficiency parameter μ_t. When the training program is less succesful in bringing individuals to high-productive employment production prices rise, which harms the employment effect. The reverse happens when the training program is more succesful in bringing individuals to high-productive employment. The effect on private sector employment becomes positive when we increase the μ_t with 50 percent. When the training program is much more effective, receipts still fall short of expenditures though.

6 Summary and concluding remarks

We consider the impact of active labour market policies in the context of an applied general equilibrium model for the Dutch labour market. We study the impact of publicly provided relief and training programs, and subsidies in the private sector for low-productive workers ('vouchers'). To ease the comparison between the different programs we consider the impact of an equal 'ex ante' impuls of 115 million euro for all programs. 'Ex post' expenditures differ due to feedback effects via the tax base and transfer payments.

Our findings are that relief jobs reduce unemployment and increase production in the public sector. However, participants have a very low incentive to continue job search for a job in the private sector. Higher wage and search costs crowd out private sector employment and production. Without compensating taxation the government runs a net loss of 95 million euro.

For the same 'ex ante' impuls training programs reduce unemployment more than relief jobs. On the individual level training programs speed up the process by which workers move into private sector employment. However, the higher compensation in the training program causes wages to rise. The rise in wages leaves a negative net effect on private sector employment. Production is hardly affected though, due to the rise in the average productivity of the workforce. Without compensating taxation the government runs a net loss of 132 million euro on the training program. Expenditures are higher 'ex post' due to training costs.

Subsidies for low-productive workers substantially reduce labour costs and hence increase private sector employment and production. For the same 'ex ante' impuls unemployment falls by less than under the relief and training program. Inactivity (measured by the sum of unemployment and relief and training job workers) falls more. Individuals are drawn out of the relief and training program. Without compensating taxation, the voucher scheme implies a net loss for the government of 41 million euro. Expenditures are much lower 'ex post' as there are substantial savings on transfers and additional receipts due to the rise in the tax base. As the 'voucher' program is less expensive 'ex post', the results on private sector employment and production are even more favourable relative to the other programs after compensating taxation.

We further report some sensitivity analysis on parameters for which we have a weak empirical basis. The results are quite sensitive to the weight carried by low-productive workers in the wage bargain, and the effect of training on the flow rate into regular employment. However, the results are qualitatively the same. Finally, we note that the model predicts that relief jobs reduce the flow rate into regular employment, and that the flow rate from training programs to regular employment is higher than from relief jobs to regular employment. This is in line with the findings of studies on Dutch ALMPs that focus on the individual level.[27] However, our model predicts higher outflow rates for both programs than we actually observe. This is probably due to selectivity in the participation of these programs.

[27]See *e.g.* Table 2 above.

Abstract

We study the impact of active labour market policies (ALMPs) in the context of an applied general equilibrium model for the Dutch labour market. By using a calibrated general equilibrium model we try to narrow down the possible range of the net effect of various ALMPs. We consider the impact of publicly provided relief and training programs, and subsidies in the private sector for low-productive workers ('vouchers') on the steady state of the labour market (the 'long-run'). Our findings are:

1. Relief jobs reduce unemployment and increase production in the public sector. However, higher wage and search costs crowd out private sector employment and production. Overall production falls.

2. Training programs reduce unemployment more than relief jobs. Individuals that participate in training programs (re-)gain (lost) skills. In this way training programs speed up the process by which workers move into private sector employment. Search costs for firms fall. However, additional wage pressure leaves a negative net effect on private sector employment. Production is hardly affected though, due to the training effect on average labour productivity.

3. Vouchers for low-productive workers reduce labour costs and hence increase private sector employment and production. Unemployment falls by less than under the relief and training programs.

All programs lead to a rise in the budget deficit, especially the relief and training program. The voucher program is less expensive, as there are substantial savings on transfers, whereas the tax base rises. We further report some sensitivity analyses on assumptions for which we have a weak empirical basis. The numerical outcomes are quite sensitive to some parameters in the wage-bargaining model and the effect of training on an individual's productivity level. However, qualitatively the results are unaffected.

References

Beer, P. de, 1996, *Het Onderste Kwart (The Bottom Quarter)*, SCP, Rijswijk.

Bovenberg, A.L., Graafland, J.J. and R.A. de Mooij, 1998, *Tax Reform and the Dutch Labor Market - An Applied General Equilibrium Approach*, NBER Working Paper, W6693, Cambridge.

Broersma, L., 1996, *Job Searchers, Job Matches and the Elasticity of Matching*, Free University Amsterdam Working Paper, 96-04, Free University Amsterdam, Amsterdam.

Calmfors, L., 1994, *Active Labour Market Policy and Unemployment - A Framework for the Analysis of Crucial Design Features*, OECD Economic Studies, 22, OECD, Paris.

Devine, T.J. and N.M. Kiefer, 1991, *Empirical Labor Economics*, Oxford University Press, Oxford.

Draper, N. and T. Manders, 1996, *Structural Changes in the Demand for labor*, Research Memorandum, 128, CPB Netherlands Bureau for Economic Policy Analysis, The Hague.

Gelauff, G. and J.J. Graafland, 1994, *Modeling Welfare State Reform*, North Holland.

Gravesteijn-Ligthelm, J.H. *et al.*, 1998, *Wordt Succes Bepaald door de Vorm? Onderzoek naar de Doorstroom van Gesubsidieerde naar Reguliere Arbeid (Does the Format Determine the Success? Research into the Flow from Subsidised to Regular Jobs)*, Ministry of Social Affairs.

Jongen, E.L.W., 1999, What Can We Expect from Subsidies for the Long-Term Unemployed?, *De Economist*, 147, pp. 205-228.

Jongen, E.L.W. and J.J. Graafland, 1998, *Vouchers for the Long-Term Unemployed: A Simulation Analysis with MIMIC*, Research Memorandum, 139, CPB Netherlands Bureau for Economic Policy Analysis, The Hague.

Jongen, E.L.W., Gameren, E. van and J.J. Graafland, 2000, *The impact of ALMPs - an AGE analysis*, mimeo, CPB Netherlands Bureau for Economic Policy Analysis (available on request).

OECD, 1993, Active Labour Market Policies: Assessing Macroeconomic and Microeconomic Effects, *OECD Employment Outlook*, pp. 39-80, OECD, Paris.

OECD, 1999, *OECD Employment Outlook*, OECD, Paris.

Verkaik *et al.*, 1998, *JWG-signalement Jaaroverzicht 1996 (JWG-Report Year Review 1996)*, Ministry of Social Affairs.

Welters, R., 1998, De Effectiviteit van het Nederlandse Actieve Arbeidsmarktbeleid (The Effectiveness of Dutch Active Labor Market Policies), *Maandschrift Economie*, 62, pp. 257-272.

Appendix

Stock-flow relations in steady-state

The steady-state assumption that we make in the analysis of the flow model in Figure 2, gives rise to the the following set of steady-state constraints:

$$\pi_{ul,el}U_L + \pi_{r,el}R = (\tau_{el,eh} + \sigma_{el,ul})E_L, \tag{39}$$

$$\pi_{uh,eh}U_H + \tau_{el,eh}E_L + \pi_{t,eh}T = \sigma_{eh,uh}E_H, \tag{40}$$

$$\sigma_{el,ul}E_L + \sigma_{r,ul}R + \sigma_{t,ul}T = (\pi_{ul,el} + \pi_{ul,el} + \pi_{ul,r})U_L, \tag{41}$$

$$\sigma_{eh,uh}E_H + \sigma_{t,uh}T = (\tau_{uh,ul} + \pi_{uh,eh})U_H, \tag{42}$$

$$\pi_{ul,r}U_L = (\pi_{r,el} + \sigma_{r,ul})R, \tag{43}$$

$$\pi_{ul,t}U_L = (\pi_{t,eh} + \sigma_{t,ul} + \sigma_{t,uh})T, \tag{44}$$

$$E_L + E_H + U_L + U_H + R + T = L, \tag{45}$$

where L denotes the labour force. We assume a constant labour force and present all stocks as fractions of the labour force L, *i.e.* $e_L = E_L/L$, $e_H = E_H/L$ etc. Before we present the steady state values of the stocks we introduce some notation. Let α_T the total outflow rate from T,

$$\alpha_T = \pi_{t,eh} + \sigma_{t,ul} + \sigma_{t,uh}, \tag{46}$$

let α_R the total outflow rate from R,

$$\alpha_R = \pi_{r,el} + \sigma_{r,ul}, \tag{47}$$

let α_{EL} the total outflow rate from E_L,

$$\alpha_{EL} = \sigma_{el,ul} + \tau_{el,eh}, \tag{48}$$

(the total outflow from E_H is $\sigma_{eh,uh}$), let α_{UH} the total outflow rate from U_H,

$$\alpha_{UH} = \tau_{uh,ul} + \pi_{uh,eh}, \tag{49}$$

Furthermore, define $\alpha_{L,R}$,

$$\alpha_{L,R} = \pi_{ul,el}\sigma_{r,ul} + \pi_{r,el}\pi_{ul,r} + \pi_{ul,el}\pi_{r,el}. \tag{50}$$

Then the steady state stocks can be expressed as

$$e_L = \frac{\sigma_{eh,uh}\tau_{uh,ul}\alpha_T\alpha_{L,R}}{N}, \tag{51}$$

$$e_H = \frac{\tau_{el,eh}\alpha_{UH}\alpha_T\alpha_{L,R} + \pi_{ul,t}\alpha_R\alpha_{EL}(\sigma_{t,uh}\pi_{uh,eh} + \pi_{t,eh}\tau_{uh,ul} + \pi_{t,eh}\pi_{uh,eh})}{N}, \tag{52}$$

$$u_L = \frac{\sigma_{eh,uh}\tau_{uh,ul}\alpha_T\alpha_R\alpha_{EL}}{N}, \tag{53}$$

$$u_H = \frac{\sigma_{eh,uh}[\tau_{el,eh}\alpha_T\alpha_{L,R} + \alpha_R\alpha_{EL}\pi_{ul,t}(\pi_{t,eh} + \sigma_{t,uh})]}{N}, \tag{54}$$

$$r = \frac{\sigma_{eh,uh}\tau_{uh,ul}\pi_{ul,r}\alpha_T\alpha_{EL}}{N}, \tag{55}$$

$$t = \frac{\sigma_{eh,uh}\tau_{uh,ul}\pi_{ul,t}\alpha_R\alpha_{EL}}{N}. \tag{56}$$

The denominator N in each of those expressions is given by

$$\begin{aligned} N \;=\; & \alpha_T[\sigma_{eh,uh}\tau_{uh,ul}\alpha_{EL}(\alpha_R + \pi_{ul,r}) + \alpha_{L,R}(\sigma_{eh,uh}(\tau_{uh,ul} + \tau_{el,eh}) + \tau_{el,eh}\alpha_{UH})] \\ & +\pi_{ul,t}\alpha_R\alpha_{EL}[\sigma_{eh,uh}(\pi_{t,eh} + \sigma_{t,uh} + \tau_{uh,ul}) \\ & +\pi_{uh,eh}\pi_{t,eh} + \tau_{uh,ul}\pi_{t,eh} + \pi_{uh,eh}\sigma_{t,uh}]. \end{aligned} \tag{57}$$

Determining the quit rates

The quit rates from employment, relief and training programs under the steady state assumption are obtained as follows. Dividing (53) by (55) and rearranging gives $\sigma_{r,ul}$. Dividing (53) by (56) gives $\sigma_{t,ul}$+ $\sigma_{t,uh}$. The data on training jobs indicates that $\frac{\sigma_{t,uh}}{\sigma_{t,ul}} = 0.24$. This gives us $\sigma_{t,ul}$ and $\sigma_{t,uh}$. Dividing (53) by (54) gives $\sigma_{el,ul}$ given $\sigma_{r,ul}$, $\sigma_{t,ul}$ and $\sigma_{t,uh}$. Finally, rearranging (54) gives $\sigma_{eh,uh}$ given $\sigma_{r,ul}$, $\sigma_{t,ul}$, $\sigma_{t,uh}$ and $\sigma_{el,ul}$.