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Substitution and Crowding-Out Effects of Active Labour Market Policy

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Substitution and Crowding-Out Effects of Active Labour Market Policy*

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ABSTRACT: The search model contains two matching technologies, the public employment service (PES) with its type-specific registers for workers and vacancies, and the search market where firms advertise vacancies and unemployed who have not been placed by the PES search for jobs. The placement activity of the PES increases the bargained wages, reduces active job search, decreases the number of advertised vacancies, but - compared with the laissez-faire regime - increases employment and per capita consumption. Of all the instruments of ALMP, the probabilities of a match, the portion of unskilled not interested in a job, and the hiring subsidies generate crowding-out effects. The productivity of the unskilled, (re-employment)bonuses, penalties for violations of the search rule, and the stringency of the search rule cause crowding-in effects. Assistance for "problem groups" is less effective than promoting active job search.

ZUSAMMENFASSUNG: Das Suchmodel umfasst zwei Matching-Technologien, die des PES mit typspezifischen Registern für Arbeitslose und Vakanzen und die des Suchmarkts, wo Firmen Vakanzen annoncieren und nicht Vermittelte nach Stellen suchen. Die Vermittlungstätigkeit des PES erhöht die Lohnkosten, reduziert die aktive Suche und die annoncierten Vakanzen, senkt im Vergleich zum Laissez-faire Regime die Arbeitslosenquote und steigert den Pro-Kopf-Konsum. Von den Instrumentvariablen der ALMP verdrängen die Matchwahrscheinlichkeiten, der Anteil der „Arbeitsunwilligen“ und die Lohnkostenzuschüsse Arbeitsplätze. Die Produktivität der Geringqualifizierten, (Wiederbeschäftigungs-) Prämien, Sanktionen für Suchregel-Verstöße sowie die Intensität der Regeldurchsetzung senken die Arbeitslosigkeit. Die Förderung von „Problemgruppen“ ist weniger wirkungsvoll als die Förderung der aktiven Jobsuche.

KEY-WORDS: Matching model, active labor market policy, PES, search market, heterogeneous unemployment pool, ranking

JEL-CODE: J 41, 63, 64, 68

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1. INTRODUCTION

Active labour market policy (ALMP) is designed to enhance the productivity and qualifications of unemployed job seekers, to improve their search and self-presentation techniques, and – given a limited demand for labour – to allocate the available jobs of a country more evenly. In Europe and Scandinavia, ALMP consumes a sizeable amount of resources - within the OECD on average 0.9% of GDP in 1996 (Martin 1998). Efficiency gains of ALMP are hard to measure. Many authors estimate that they are modest or even negative if job-creation and saved insurance and transfer payments are balanced against the high expenses of the public employment service (PES) for training, wage and income subsidies, and especially for job-creation programmes. Nevertheless, in the reform of social security systems in Europe, wage and income subsidies seem to have a bright future (Snower 1997; Phelps 1997; OECD 1998). ALMP is considered to be relatively successful if the instruments are tailored to well-defined (problem) groups, or if they are designed to intensify job search (OECD 1993a, 1996a). On the other hand, job-creation schemes and subsidies are often criticised as having considerable deadweight losses and crowding-out effects. Deadweight losses exist if job seekers or suppliers of vacancies are subsidised even though they would have ended up with job contracts without help. Substitution effects are present if subsidised persons or vacancies crowd out those that are not supported by the subsidies. In this paper, we discuss the substitution effects and the crowding-out effects of ALMP using a simulation model with a fully integrated PES and a private search market.

Aside from microeconometric studies of ALMP (LaLonde 1995) there are two approaches that analyse the interdependence between ALMP and the aggregate unemployment rate. The first consists of macroeconometric regressions (Layard et al. 1991; OECD 1993a; Calmfors 1994; Calmfors and Skedinger 1995; Burda and Lubyova 1995; Scarpetta 1996; Bellmann and Jackman 1996; Nickell 1997; Büttner and Prey 1998; Nickell and Layard 1999; Blanchard and Wolfers 1999). In those papers, the estimating equation is usually based on a labour market theory that goes back to Layard and Nickell (1986) and Layard et al. (1991) and has become a standard framework for labour market analysis. Calmfors (1994) has modified the standard model and, following OECD (1993a), has provided a classification of ALMP effects that has been widely used since. Calmfors identifies three effects that influence aggregate employment through the labour demand function, the *productivity effect*,

the *substitution effect,* and the *deadweight loss* which is connected with the active policies. The *competition effect* and the *incentive effect* work through the wage-setting function. Finally, effects that directly influence the *matching process* can express themselves either through the demand or through the wage-setting function. The second approach focuses on the simulation of ALMP and uses a labour market model which is based on the more recent theory of two-sided-search (Millard and Mortensen 1997; Mortensen 1994). This branch of search theory employs a matching function to model the information imperfections and the heterogeneities of the labour market (Diamond 1982; Pissarides 1986, 1990; Hosios 1990; Mortensen and Pissarides 1994, 1999).

The results of the macroeconometric regressions suffer from identification and endogeneity problems (OECD 1993a; Calmfors and Skedinger 1995; Jackman and Bellmann 1996). Nevertheless, Layard et al. (1991), OECD (1993a), Nickell (1997), and Nickell and Layard (1999) find a significant negative correlation between the ALMP budget and the aggregate rate of unemployment. These studies focus on the *competition effect* as the main cause of the identified correlation. Training and counselling increase the competitiveness of the participants of ALMP programmes and reduce the “discouraged-worker effect.” Thus the labour supply grows, and the employed are confronted with more and better qualified competitors and with a reduced transition rate into employment when becoming unemployed. Consequently, they will moderate their wage demands, the wage-setting schedule will shift downwards, and regular employment will increase. By contrast, Calmfors and Skedinger (1995), using regional labour market data from Sweden, find a negative correlation between job-creation programmes and regional employment. The programmes crowd out regular jobs and, in the period 1973-90, had no significant positive influence on employment anywhere in Sweden. The results of Swedish training programmes are mixed. It is, however, clear that training programmes show positive employment effects significantly more often than job-creation programmes. Unlike Calmfors and Skedinger, Büttner and Prey (1998) in their analysis of West German regional data for the period 1986-93 find no significant effects of training programmes while job-creation programmes are positively correlated with regional employment. Bellmann and Jackman (1996) estimate the employment effects of specific ALMPs using cross-sectional data from 17 OECD countries for the years 1975-93. The study includes the budget of the PES, expenses for training and job-creation programmes, and wage and income subsidies as explanatory variables. The

authors find no significant correlation between these ALMPs and aggregate employment. However, all four policy instruments have a significant influence on the proportion of long-term unemployed: Training and the budget of the PES reduce the incidence of long-term unemployment while job-creation programmes and subsidies increase it.

Millard and Mortensen (1997) use the matching model with endogenous separation rate introduced by Mortensen and Pissarides (1994, 1999) and supplement it with a finite duration of unemployment insurance (UI) benefits, with payroll taxes, severance payments, and a hiring subsidy for newly created jobs. The authors show that the hiring subsidy is positively correlated with the steady state rate of unemployment. They calibrate the model to the US labour market and find that a hiring subsidy of 10% of the wage bill would cause the unemployment rate to increase by 2.7 percentage points.

Following Pissarides (1979), our simulation model allows for the fact that in Europe government organised placement services (PES) and private search technologies coexist. Firms choose between the two search methods, and the unemployed who have not been placed by the PES decide whether to search for a job on their own. Skilled (type 1) and unskilled (type 2) unemployed are registered separately with the employment service. Moreover, the PES offers firms looking for (un-)skilled workers the opportunity to post their vacancies. After the registration has terminated, the PES combines the registers and arranges a certain number of matches. Most matching models assume that the unemployed have sufficient incentives to actively search for a job. Yet, active job search is costly, and therefore the endogenous rate of job seekers is only a fraction of the total number of unemployed. Certainly, search rules compel the unemployed to engage in active job search, but, in spite of the impending penalties, the PES is not at all able to get all unemployed who have not been placed to actively search for a posted vacancy. While the PES ex ante puts workers and notified vacancies in separate registers according to their type, in the search market this separation happens ex post: Firms rank their applicants according to the expected market value of the filled job. A second-rate worker is employed only if no first-rate worker applies. The ranking order in our model is endogenous and influenced by the ALMP.

The structure of the paper is as follows. Section 2 introduces the PES with its registers for unemployed workers and vacancies. Section 3 describes the search market. Section 4 contains a simulation of the substitution and crowd-

ing out effects of ALMP, and experiments with the following parameters: (1) the efficacy of the placement activities of the PES, (2) the percentage of unemployed who participate in ALMP programmes, (3) the percentage of unemployed who are “unwilling” to work, (4) the productivity of the unskilled, (5) the share of skilled workers among the labour force, (6) the different hiring subsidies, (7) the assistance for “problem groups”, and (8) re-employment bonuses and penalties designed to increase the number of active job seekers among the unemployed. The results are summarised in Section 5.

2. The Public Employment Service

Matching Technology. As in Germany, Italy, and Japan (OECD 1996a), the PES is a fully integrated system covering the three functions: placement service, UI, and ALMP. The placement activities of the PES are represented by a matching function $e_i M(\mu_i U_i, R_i)$ which indicates the number of matches for type-*i* workers if U_i unemployed and R_i vacancies are on file in the registers for type *i*. A percentage $1-\mu_i$ of the unemployed is participating in ALMP programmes so that of all U_i workers only $\mu_i U_i$ are available for the placement activities. Both firms and workers have unobservable characteristics and ex ante are not entirely distinguishable from their competitors. But once contact is made, both sides know with certainty whether the partner meets their expectations, an event that with respect to the given placement efficacy of the PES will happen with the probability e_i. The parameter e_i is an effort variable expressing the screening capacity of the PES and the effort of its agents. The matching function *M* is assumed to be differentiable, concave, and homogenous of degree one, and to have positive derivatives in both arguments.

For type-*i* workers the transition rate into employment is $P(\Theta_i, \mu_i, e_i) \equiv e_i M(1, \Theta_i / \mu_i) = e_i M(\mu_i U_i, R_i) / \mu_i U_i$ and the arrival rate at the registered vacancies is $Q(\Theta_i, \mu_i, e_i) \equiv e_i M(\mu_i / \Theta_i, 1) = e_i M(\mu_i U_i, R_i) / R_i$, where Θ_i measures the tightness R_i / U_i between the number of registered vacancies and the number of registered unemployed. As the tightness decreases, the arrival rate tends to zero and the transition rate tends to infinity, an increasing tightness drives P_i to infinity, while Q_i approaches zero. If the PES augments the share of unemployed who participate in ALMP programmes (μ_i decreases), the transition rate increases while the arrival rate decreases. With growing probability of a match, e_i, both the transition rate and the arrival rate increase.

Only τ_i of the registered unemployed of type *i* are interested in finding a job. For simplicity we do not model the preferences of this type explicitly. How many of the unemployed are actually willing to work is a question that is rarely studied. Von Rosenbladt (1991) reports that according to estimates of the German PES agents interviewed, approximately 21% of all registered unemployed are not really looking for a job. Some PES agents even guess that 60% of their clients are not interested in a new job. The information about those preferences is asymmetrical. Only the unemployed themselves know whether they prefer to live on UI benefits. Since availability for the placement service is a precondition for UI payments, each unemployed must hide those preferences from investigations by the PES. Ex ante, we assume, firms only know that the portion $1-\tau_i$ of the unemployed are not interested in taking up work; ex post, all uncertainty about the job match is resolved, but neither the firm nor the PES are able to tell whether a rejected job match is due to a lack of interest on the side of the applicant or due to a mismatch, an event which happens with the probability $1-e_i$. Thus, if the probabilities of the three events - contact, interest, and aptitude - are independent from each other, $\tau_i Q_i$ is the arrival rate of interested applicants who meet the job profile.

ASSET EQUATIONS. In the steady state, the asset equations for the registered vacancies, the unemployed who are willing to work, and the employed of type *i* have the form:

$$rV_i = -k_R + \tau_i Q_i (\Pi_i - V_i + G_{R_i}) \quad (1)$$

$$r\Pi_i = y_i - w_i + s(V - \Pi_i) \quad (2)$$

$$rN_i = B_i + P_i (W_i - N_i) \quad (3)$$

$$rW_i = w_i + s(N_i - W_i) \quad (4)$$

$$TP_i = (W_i - N_i) + (\Pi_i + G_{R_i}) \quad (5)$$

$$W_i - N_i = \beta TP_i, \quad (6)$$

where *r* denotes the interest rate, k_R the costs of registration with the PES, y_i the output of a job occupied by a worker of type *i*, w_i the wage measured in units of output, B_i the reservation utility, and *s* the exogenous separation rate. V_i, Π_i, N_i and W_i are the market values of a registered vacancy, a filled job, a registered worker, and an employed worker respectively. Finally TP_i is the present value of the match rent, the distribution of which is bargained bilaterally between the firm and the job seeker. The result of the bargain depends on the parameter β, representing the bargaining power of the job applicant. The instruments of ALMP include hiring subsidies G_{R_i} that in-

crease the quasi-rent of a match. Hiring subsidies are paid to the firms that fill their registered vacancies with unemployed workers sent by the PES.

REGISTERED VACANCIES. Suppliers of vacancies first decide whether to advertise in the search market or to register their job with the PES. If they prefer registration, they must choose between the two registers for the different types of workers, unskilled and skilled. Both decisions depend on the market value of the vacancies. Firms prefer the search method and the register that maximises the market value of their vacancy. Access to the search market and to the registers is unlimited; thus, in equilibrium, vacancies have the same value on all three submarkets. In addition, the perfectly elastic inflow of new vacancies guarantees that in the steady state $V_i = 0$. Therefore it follows from (1) that the value of a filled job equals the expected costs of registration less the hiring subsidy:

$$\Pi_i = \frac{k_R}{\tau_i Q_i} - G_{R_i} = \frac{y_i - w_i}{r + s}. \tag{7}$$

FILLED JOBS. Π_i denotes the value of a job filled with a worker of type *i*. In the steady state, an investor who ties up capital in a filled job receives the permanent income $r\Pi_i$, and, in the case of job destruction, suffers a capital loss $V - \Pi_i$, an event which occurs with the exogenous probability *s*. Since in equilibrium $V = 0$ it follows from (2) that the value of a filled job as in (7) equals the present value of the expected cash flow. From (7) we can derive the wage cost at which market entry of vacancies for type-*i* workers no longer pays:

$$w_i = y_i - (r + s)\left[\frac{k_R}{\tau_i Q_i} - G_{R_i}\right], \tag{8}$$

WORKERS. The permanent income rW_i of an employed worker is determined in equation (4), where $N_i - W_i$ is the capital loss suffered by the worker when his job is destroyed. In equation (3), the Bellman equation of the unemployed human capital, B_i is the endogenous reservation income for which $B_i = b - (1 - P_i)\gamma g_i$; here *b* represents UI benefits and $(1 - P_i)\gamma g_i$ the expected penalty for violations of the search rule. Unemployed workers who do not receive a job offer through the PES must actively search for a job. The probability that an unemployed worker will not be assigned a registered vacancy by the PES is $1 - P_i$. If he does not search actively but prefers to wait for future job offers through the PES he violates the search rule. The PES will detect the

shirker with probability γ and reduce his UI benefits by a penalty equal to g_i such as in Switzerland (OECD 1996b).

For the capital gain $W_i - N_i$ that an unemployed worker realises upon transition into employment it follows from (3) and (4) that

$$W_i - N_i = \frac{w_i - B_i}{r + s + P_i} = \frac{w_i - rN_i}{r + s}, \tag{9}$$

where w_i denotes the wage of a worker who accepts a registered vacancy offered through the PES.

WAGE BARGAINING. The quasi-rent of a match is given by equation (5) considering that $V = 0$. The firm and the job applicant negotiate the wage. As in the generalised Nash solution, they distribute the rent so that equation (6) holds in equilibrium. β measures the bargaining power of the worker and is a constant between zero and one determined by the prevailing labour law and social legislation. With (3) and (5) through (9) the result of wage bargaining is

$$w_i = B_i + \beta(y_i - B_i) + \beta\Theta_i k_R / \mu_i \tau_i + \beta(r + s)G_{R_i}. \tag{10}$$

The wage income consists of two components: the endogenous reservation income B_i and the insider income. The insider income is the sum of the insider's share of the static quasi-rent $\beta(y_i - B_i)$, his share of the transaction costs $\beta\Theta_i k_R / \mu_i \tau_i$, and his share of the subsidy $\beta(r + s)G_{R_i}$. The share of the search costs depends on the tightness $\Theta_i / \mu_i \tau_i$ measured in "efficiency units" that prevails in the PES-administered market segment for type-*i* workers, where Θ_i represents the tightness between the registers for vacancies and for unemployed workers, μ_i the portion of unemployed workers who are available for the placement activities by the PES, and τ_i the portion of unemployed who are interested in finding a job. The greater the number of workers who either participate in ALMP programmes or are unwilling to work (μ_i and τ_i decrease), the higher the wage (10). Since the probability of a match, e_i, has a symmetrical effect on the transition rate and the arrival rate of type *i*, it has no direct influence on the wage level.

PES EQUILIBRIUM. The PES-administered labour market segment for workers of type *i* is fully characterised by the wage and the tightness (w_i, Θ_i). In equilibrium, the wage (10) reaches the level of wage costs (8), and the inflow of new vacancies into the register for workers of type *i* stops. The wage-setting

function (10) gives us a strictly monotonically increasing relationship between wage and tightness in the (w_i, Θ_i) plane; the entry condition (8) gives us a strictly monotonically decreasing schedule. The intersection of the two schedules determines the equilibrium of the PES-administrated labour market segment for workers of type *i*.

COMPARATIVE STATIC ANALYSIS. Passive labour market policy (PLMP) through higher UI payments, *b*, leads to an upward shift of the wage-setting schedule (10) in the (w_i, Θ_i) plane; consequently, the wage rate increases, the tightness of the register Θ_i decreases, and both the value of a filled job (7) and the incentive to accept the job (9) decrease. Due to the distribution rule (6), the incentive (9) and the value of the filled job (7) always change in the same direction. ALMP in the form of a higher probability γ that shirking is detected or a higher penalty g_i decreases the reservation income and shifts the wage-setting schedule downwards so that the wage decreases, the tightness increases, and both the market value and the incentive to accept the job increase. In contrast, the hiring subsidy G_{R_i} has an increasing effect on the wage and the tightness of the registers.

The probability of a match e_i works only through the entry condition (8) causing it to shift upwards. Thus, the wage and the tightness increase, and the incentive to accept a job offered through the PES decreases. Both the portion of unemployed workers who are available for the placement activities of the PES, μ_i, and the portion of those willing to work, τ_i, move the entry condition (8) upwards and the wage-setting schedule (10) downwards; thus, the tightness between the registers for type *i* increases when those portions grow. At first sight any reaction of the equilibrium wage to changes in μ_i and τ_i seems possible. Whether the wage increases, decreases, or remains unchanged depends on the reaction of the arrival rate $\tau_i Q_i$ as equation (8) shows. Implicitly differentiating (8) and (10) one can show that the arrival rate $\tau_i Q_i$ does not react to changes in μ_i but increases with τ_i even though a higher tightness reduces the frequency of contacts Q_i. Thus, using (8), it follows that the equilibrium wage increases with τ_i while it does not react to μ_i. With growing productivity y_i both the wage-setting curve (10) and the entry condition (8) are shifted upwards so that the wage increases. However, the tightness between the registers also increases because the shift of the wage-setting curve is smaller than the shift of the entry condition. With growing productivity the current profit, $y_i - w_i$, also increases. Thus, in the “natural equilibrium” (without ALMP), the market value of a job occupied by a type-1 worker

is higher than the market value of a job that is filled with a type-2 worker, since $y_1 > y_2$ and, moreover, since all unemployed get the same UI benefits *b* and have the same bargaining power β.

3. The Search Market

Unemployed workers who have not been placed through the PES can and – because of the search rule – must make an effort to screen the search market for vacancies. But active job search is time-consuming and produces monetary and psychological costs. Moreover, with a growing number of active job seekers, the congestion externalities from search increase, the transition rates into employment decrease, and the expected gain from search disappears, such that the search strategy has no advantage in comparison to waiting passively for the PES to find an appropriate job. Therefore, in spite of the impending penalties, in equilibrium only a certain fraction of the unemployed workers who have not yet been placed by the PES are actively engaging in job search.

Firms post vacancies on the search market as long as the market value of the advertised vacancies is at least as high as that of the registered ones. Since there are no barriers to entry the perfectly elastic inflow of new vacancies continues until the value of the advertised jobs drops to zero. Firms want to fill their vacancies as soon as possible. Consequently, job advertisements are not type-specific so that job seekers of both types apply. Firms employ those applicants who maximise the expected market value of the filled job. For that purpose they rank the applicants, accepting a second-rate worker only if no first-rate worker shows up.

Matching technology. The arrival rate q_i for the S_i active job seekers among the U_i unemployed type-*i* workers at the *A* advertised vacancies is generated by the transaction technology of the search market. The number of matches is determined by the matching function $fm(a_i S_i, A)$. *f* is a shift factor which can be interpreted as the probability of a match. The matching function of the search market has the same properties as that of the PES. The arrival rate of job seekers of type *i* is given by $q_i \equiv q(\theta_i, a_i) \equiv fm(a_i / \theta_i, 1) = fm(a_i S_i, A)/A$. Due to search externalities, the arrival rate q_i is a monotonically decreasing function of the tightness of submarket *i*, $\theta_i = A/S_i$, and a monotonically increasing function of the search intensity a_i.

RANKING ORDER. Firms rank applicants according to the expected market value of the filled jobs. Let i_+ represent the group of first-rate workers and i_- the group of second-rate workers, then the market values of the filled jobs are $J_{i_+} \geq J_{i_-}$. The ranking order protects first-rate applicants against the congestion externalities caused by the group of second-rate workers. In contrast, the transition rate of second-rate workers not only depends on the tightness in the submarket of the lower ranking type, $\theta_{i_-} = A / S_{i_-}$, but also on the tightness $\theta_{i_+} = A / S_{i_+}$ of the higher ranking segment of the search market,

$$p_{i_+} \equiv p(\theta_{i_+}) = \theta_{i_+} q(\theta_{i_+}) \tag{11}$$

$$p_{i_-} \equiv p(\theta_{i_+}, \theta_{i_-}) = [1 - q(\theta_{i_+})] \theta_{i_-} q(\theta_{i_+}) . \tag{12}$$

Due to positive externalities from search, both transition rates increase strictly monotonically with the tightness of the respective submarket. In addition, the transition rate of the second-rate group grows strictly monotonically with θ_{i_+}.

ASSET EQUATIONS. The Bellman equations of the advertised vacancies and those employed who have found a job through random search are

$$rV_A = -k(A) + q_1(1-q_2)J_1 + q_2(1-q_1)J_2 + q_1 q_2 \max\{J_1, J_2\} - qV_A \tag{13}$$

$$rE_i = \omega_i + s(N_i - E_i) \tag{14}$$

$$TS_i = (E_i - N_i + G_{A_i}) + J_i , \tag{15}$$

where $k(A)$ is the advertisement costs of a vacancy as a function of the aggregate number of advertised vacancies, q is the arrival rate of job seekers at an advertised job, $q = q_1 + q_2 - q_1 q_2$, V_A is the market value of an advertised vacancy, J_i is the market value of a filled job, E_i is the value of an employed worker of type i who has found a job through the search market, ω_i is the wage rate negotiated by the firm and the applicant, TS_i is the quasi-rent of the match, and G_{A_i} is a (re-employment) bonus which the PES – as in Japan (OECD 1993c) – pays to active job seekers. The space for advertisements is scarce. Thus, the firms' search costs increase strictly monotonically with the aggregate number of ads, $k' > 0$.

FIRMS. The inflow of advertised vacancies into the search market stops as soon as $V_A = 0$. Therefore, in the steady state, the value of an occupied job is

$$J_i = (y_i - \omega_i) / (r + s) , \tag{16}$$

with y_i denoting the output of the job and ω_i the wage rate measured in units of output. Furthermore, using $V_A = 0$, it follows from (13) that in the steady state

$$H_A(\theta_{i_+}, \theta_{i_-}, A) \equiv q_{i_+} J_{i_+} + (1 - q_{i_+}) q_{i_-} J_{i_-} - k(A) = 0 . \tag{17}$$

WORKERS. Equation (3) determines the permanent income of an unemployed worker, rN_i, and equation (14) the permanent income of an employed worker who has found a job through active search, rE_i. The capital gain $\Delta_i = E_i - N_i$ that an active job seeker realises upon transition into employment follows from (3) and (14):

$$\Delta_i \equiv E_i - N_i = \frac{\omega_i - B_i - P_i (W_i - N_i)}{r + s} , \tag{18}$$

where the incentive to accept a job placement by the PES, $W_i - N_i$, is determined by equation (9). The greater the gain from a PES placement, and the higher the probability of such a match, P_i, the smaller the incentive to engage in active search Δ_i.

WAGE BARGAINING. The (re-employment) bonus G_{A_i} is part of the quasi-rent (15) that is distributed between the firm and the applicant through the wage rate ω_i so that in the bargaining equilibrium

$$E_i - N_i + G_{A_i} = \beta T S_i . \tag{19}$$

From (15), (19), (3), and (14) it follows that the wage for type-*i* workers who have found a job through random search is $\omega_i = \beta y_i + (1 - \beta) r N_i - (1 - \beta)(r + s) G_{A_i}$. Inserting (3) again and taking account of (5), (6), and (7), we get the result of the bargaining between the parties in the search market:

$$\omega_i = B_i + \beta (y_i - B_i) + \beta \Theta_i k_R / \mu_i \tau_i - (1 - \beta)(r + s) G_{A_i} . \tag{20}$$

The registration costs k_R and the tightness of the PES-administered labour market measured in efficiency units, $\Theta_i / \mu_i \tau_i$, also play a crucial role in the wage negotiations in the search market. This is because an active job seeker can base his wage demands on the permanent income of an unemployed worker (3), which is the sum of the reservation income B_i and the expected capital gain $P_i (W_i - N_i)$ which he can count on in case the negotiations fail. However, it follows from (5), (6) and (7) that the capital gain $W_i - N_i$ upon transition into a job offered through the PES equals the expected registration

costs weighted with the relative bargaining power $\beta/(1-\beta)$. From this we can infer that the wage on the search market is a function of $\Theta_i k_R / \mu_i \tau_i$.

Comparing (10) with (20) we can see that without intervention of the PES in the submarkets for type-*i* workers, the "law of one wage" holds. Hiring subsidies and (re-employment) bonuses drive a wedge between the wage bargained in the search market and that bargained in the PES-administered labour market such that the wage differential for type-*i* worker is non-negative, $w_i - \omega_i = (r+s)[\beta G_{R_i} + (1-\beta) G_{A_i}] \geq 0$. Search costs imply that we could observe a strictly positive wage differential and at the same time a strictly positive number of active job seekers, which is strictly smaller than the number of unemployed who have not been placed by the PES.

ACTIVE JOB SEARCH. The capital gain (18) and the bonus G_{A_i} are the incentives to search actively for an advertised vacancy. However, active job search is costly. The number of unemployed workers who decide to actively engage in job search increases until either all unemployed workers of one type who have not been offered a job by the PES search actively, or H_{i_+} and H_{i_-}, the gains from search for first-rate and second-rate applicants, disappear, and the unemployed are indifferent between active search and passive waiting for a job offer through the PES

$$H_{i_+}(\theta_{i_+}) \equiv p_{i_+}(G_{A_{i_+}} + \Delta_{i_+}) - c(a_{i_+}) = 0 \tag{21}$$

$$H_{i_-}(\theta_{i_+}, \theta_{i_-}) \equiv p_{i_-}(G_{A_{i_-}} + \Delta_{i_-}) - c(a_{i_-}) = 0\,, \tag{22}$$

where p_i is the transition rate generated by the matching technology of the search market, and $c(a_i)$ are the private search costs for type-*i* job seekers that are a function of the intensity of the search. If we assume that the participants in ALMP programmes also have an opportunity to search actively for a job, the upper limit for the number of active job seekers of type *i*, S_i, is determined as follows. Out of U_i unemployed $P_i \mu_i U_i$ are well matched and could sign a contract but only τ_i are interested in accepting the offered job. Therefore we have $S_i \leq \tau_i (1-\mu_i P_i) U_i$. In the following, we analyse equilibria with "interior solutions" so that for both types of workers: $0 < S_i < \tau_i (1-\mu_i P_i) U_i$.

SEARCH MARKET EQUILIBRIUM. A search market equilibrium with the variables $(A, \theta_{i_+}, \theta_{i_-})$ denoting the number of advertised vacancies, the tightness in both submarkets, and the endogenous ranking order is characterised by the equations (17), (21), and (22). Since the incentive to search and the ranking order

are exogenous with respect to the search market, the equation system is recursive. First we determine θ_{i_+} using (21), then θ_{i_-} using (22), and finally the number of advertised vacancies using (17).

Each period, out of L_i workers of type *i*, $s(L_i - U_i)$ lose their job. At the same time, $P_i \tau_i \mu_i U_i + p_i S_i$ unemployed find a new job. In the steady state, the inflow into the pool of unemployed equals the outflow so that the type-specific rates of unemployment $u_i = U_i / L_i$ and the aggregate rate of unemployment *u* are given by

$$u_i = \frac{s}{s + \tau_i \mu_i P_i + \sigma_i p_i}, \; i = 1,2, \qquad u = \lambda_1 u_1 + \lambda_2 u_2, \tag{23}$$

where $\sigma_i = S_i / U_i$ is the rate of active job seekers among unemployed workers of type *i*, and λ_i is the fraction of type-*i* workers among the labour force $L = \sum L_i$.

4. Simulation

In order to measure the crowding-out and employment effects of the ALMP, we first simulate a basic scenario without active measures (Table A2 in the Appendix). Then we experiment with the instruments of ALMP and show their effects through comparison with the basic scenario (3) of the mixed economy (Tables A2 and A3). The vector of policy instruments is $(e_i, \mu_i, \tau_i, y_i, G_{R_i}, G_{A_i}, \gamma, g_i)$: e_i measures the efficacy of the placement service with regard to the unemployed workers of type *i*, μ_i and τ_i are the portions of the unemployed who are available for job placement by the PES and who are willing to work, y_i denotes the productivity of type-*i* workers, G_{R_i} is a hiring subsidy for firms that have filled their registered vacancy with an unemployed worker of type *i* sent by the PES, G_{A_i} is a (re-employment) bonus for workers who have found a job through the search market, γ represents the probability that an unemployed worker who does not engage in search is detected by the PES, and g_i is a penalty for the unemployed who are not searching actively.

Parameters and matching functions. To the extent that estimates for Germany exist, we base our choice of parameters on those values. Where we have degrees of freedom, the choice is guided by the intention of generating steady states with “interior solutions” and type-specific as well as aggregate rates of unemployment similar to the German rates for 1998. Table A1 in the Appendix shows the parameters of the basic scenario. Taking into account the

bargaining power of workers in Germany and other OECD countries in Europe, we assume that $\beta = 0.70$. As in Germany (OECD 1997), a match has an expected lifetime of $1/s = 10$ periods; an unskilled worker has 70% of the productivity, and UI benefits amount to 37.5% of the productivity of a skilled worker. In the basic scenario of the mixed economy (s. Table A2) with $b = 37.5$ the replacement ratio for the skilled is 39% and that for the unskilled is 56%; using the fractions of those groups in the labour force as weights we can calculate a weighted replacement ratio of 44%. According to Franz (1999, p. 266), replacement ratios in Germany are 41,9% for men and 38,8% for women. Unit costs for the advertisement of a vacancy are a linear function of the aggregate number of vacancies, $k(A) = k\,A$, where $k = 0.70$. The search costs for an active job seeker are $a_i c$, with $c = 30$. The intensity of the search depends on the position of the job seeker in the ranking order of the search market. First-rate job seekers make up to $a_{i_+} = 1.3$ and second-rate job seekers up to $a_{i\_} = 0.6$ applications per period. The matching functions of the PES and the search market are of the Cobb-Douglas type

$$Q(\Theta_i, \mu_i, e_i) = e_i (\mu_i / \Theta_i)^{1-\Phi}, \tag{24}$$

$$q(\theta_i, a_i) = f (a_i / \theta_i)^{1-\phi}, \; i = 1, 2, \tag{25}$$

with $\Theta_i = R_i / U_i$, and $\theta_i = S_i / A$. For the scale factor f of the matching function representing the search market it is assumed that $f = 0.45$. Within the PES technology, the unemployed dominate the number of contacts which the PES arranges with an elasticity of $1-\Phi = 6/7$. In the search market, on the contrary, the advertised vacancies with an elasticity of $\phi = 7/10$ determine the number of successful job fillings. By comparison: Burda and Wyplosz (1994) estimate elasticities of the number of unemployed between 0.70 and 0.80 for matching technologies with constant returns to scale, and Burda (1994) reports an estimate for western Germany of 0.88.

BASIC SCENARIO. The basic scenarios in Table A2 include the steady states of three regimes. (1) is a laissez-faire economy with a partially integrated PES responsible only for UI. Unemployed workers can find a job only through active search. In (2) there is no private search market. Only the PES registers jobs and vacancies and arranges matches between them. In this economy there is no ranking of the unemployed. The separation of types takes place ex ante when jobs and workers are assigned to different registers. (3) represents the mixed economy with a fully integrated PES and a search market where workers who have not been placed by the PES randomly search for a job.

Under the regimes (2) and (3), job seekers base their wage demands not only on the UI benefits but also on the placement activity of the PES. Compared to the laissez-faire economy, the placement service obviously causes a redistribution from profit to wage income. In the mixed economy, the wage for skilled workers ($w_1 = 96.2$) is 18.3% higher and the wage for the unskilled ($w_2 = 67.3$) is 11.6% higher than in the laissez-faire economy. The search rates in the laissez-faire economy are $\sigma_1 = 90\%$ and $\sigma_2 = 60\%$, where $\sigma_i = S_i / U_i$, since in this economy *all* unemployed who are willing to work prefer to search actively, such that $\sigma_i = 1 - \tau_i$. A completely integrated PES with job placement activities curbs the incentive to engage in active job search. In the mixed economy the search rate of type-1 workers is only 48% and that of type-2 workers is 32.2%. Since the number of job seekers has a positive influence on the number of advertised vacancies via search externalities, a fully integrated PES also reduces the number of advertisements from $A = 85$ under the laissez-faire regime to $A = 21.4$ in the mixed economy.

If we deduct private and public search and placement costs from the gross product of the economy we can take the resulting per capita consumption *C* as a welfare measure

$$C = \sum_{i=1}^{2} \lambda_i \left[(1 - u_i) y_i - \sigma_i u_i a_i c - k_R R_i / L_i \right] - k A^2 / L - k_P u . \qquad (26)$$

With placement costs of the PES equal to $k_P = 40$ per unemployed worker we have a per capita consumption of 77.2 in the mixed economy and 75.5 in the PES-administered economy. Under the laissez-faire regime, on the other hand, per capita consumption is only 66.7. The placement costs of the PES would have to more than double ($k_P = 90$) in order for the per capita consumption in the mixed economy to drop to the level observed in the laissez-faire regime.

The last columns of Tables A2 and A3 contain indices for the active and passive measures of labour market policy. Here, *PLMP* is defined as UI benefits per unemployed worker divided by the gross product per capita of the working population. The gross product is

$$BP = L \sum_{i=1}^{2} \lambda_i (1 - u_i) y_i . \qquad (27)$$

Finally, the expenses per unemployed worker for *ALMP* are measured as a percentage of the gross product per capita of the labour force and the sum of

the expenses for active and passive labour market policies are measured as a percentage of the gross product, $(P + A)/BP$. The expenses for PLMP amount to 5.9% in the laissez-faire economy, 5.5% in the mixed economy, and 7.5% in the PES economy. By way of comparison, in the years 1996-97 Denmark's expenses for PLMP were 4% of GDP, in Germany the rate was 2.5% (OECD 1998). Unlike the GDP, the gross product as defined in (27) does not include public expenditures or investments. *PLMP* is 46.4% in the mixed economy, and 46.9% in the laissez-faire economy; in the PES economy, due to a higher rate of unemployment among the unskilled, the percentage is 48.3%.

> ***Result 1:*** *Not only the UI benefits but also the public placement service per se considerably strengthens the workers' bargaining position and causes a redistribution from profit to wage income. Moreover, the placement service curbs the incentives to engage in active job search, and reduces the search rates and the aggregate number of advertised vacancies. Nevertheless, the per capita consumption may be higher, and the aggregate rate of unemployment as well as the expenditure ratio may be lower in the mixed economy than in the laissez-faire regime.*

PES PLACEMENT, JOB SEARCH ASSISTANCE AND EMPLOYMENT TRAINING. The placement effort of the PES is the most important instrument of ALMP. Tables A3.1 and A3.2 show variations of the placement efficacy manifesting in the match probability e_i. e_i denotes the probability that a contact between a registered worker of type *i* and a registered vacancy will lead to a job contract.

With growing e_1 the tightness between the registers for type 1 increases and so does the PES transition rate P_1. For example for $e_1 = 1$ we find an increase in the tightness between the registers of $\Delta R_1/R_1 - \Delta U_1/U_1 = -3.2 - (-5.2) = 2.0\%$. The PES and the search market are competing matching devices. With higher efficacy, the PES crowds out active job seekers and advertised vacancies. With the probability of a match increasing to $e_1 = 1$, the number of type-1 job seekers falls by 19.1%, $\Delta S_1/S_1 = -19.1$. The smaller number of active job seekers reduces the incentive to advertise vacancies. Thus, compared to the basic scenario, there are 8.4% fewer ads. During the adjustment, active job seekers of type 2 are subject to two opposing forces. On the one hand, the search market becomes more attractive for workers of type 2 because the congestion externality from the higher-ranking type 1 is reduced; on the other hand, the number of advertised vacancies drops. The negative effect dominates, and the number of active job seekers of type 2 decreases by 4.6%. The number of unemployed type-1 workers is reduced because both the transition

rate of the PES and the transition rate of the search market increase, $\Delta U_1 / U_1 = -5.2$. While the PES transition rate for type-2 workers remains unchanged, their transition rate in the search market is reduced, and the number of unemployed of type 2 grows, $\Delta U_2 / U_2 = 1.4$. The unemployment rate for type 1 decreases by 0.5 percentage points to 8.5%, while the unemployment rate for type 2 increases by 0.3 percentage points to 18.7%. Nevertheless, the aggregate rate of unemployment is slightly reduced, since type 1 at 70% represents the larger part of the labour force. Both search rates decrease. That of type 1 is reduced by 7 percentage points when the placement efficacy reaches $e_1 = 1$, and that of type 2 by 1.9 percentage points. The higher efficacy of the PES placement enables type-1 applicants to demand wages that are 0.3% higher than those in the basic scenario. Per capita consumption grows by 1%, and *PLMP* decreases by 0.2 percentage points to 46.2%, while the expenditure ratio $(P + A) / BP$ falls by 0.1 percentage points to 5.4%.

If the PES expands its placement capacity for unemployed type-2 workers, this reorganisation has no influence on the transition and arrival rates of type-1 job seekers. This is because the PES has separate registers for the two types, and in the ranking order of the search market, type 1 is preferred over type 2. With growing e_2 the number of active job seekers decreases since the chance of being offered a job through the PES increases. For $e_2 = 0.80$, the number of active type-2 job seekers decreases by 16.1%, and the search rate σ_2 falls by 2.8 percentage points to 29.4%. Due to the search externalities, the number of advertised vacancies decreases, which prompts type-1 job seekers to reduce their search activities. The number of unemployed workers of type 1 increases by 1.1%, and their unemployment rate u_1 reaches 9.1%. By contrast, the unemployment rate of type-2 workers falls by 1.5 percentage points to 16.1%, and the aggregate rate decreases by 0.4 percentage points to 11.4%.

Layard et al. (1991) give two arguments for the positive employment effects of ALMP. The *competition argument* says that the participants in training programmes become more competitive, thus intensifying competition in the labour market and reducing the upward pressure on wages. According to the *productivity argument*, active policies augment the productivity of the participants, thus increasing the demand for labour. To test these hypotheses we conduct the following experiments. First we increase the portion of unskilled workers participating in ALMP programmes (μ_2 decreases, s. Tab. A3.3). Second we assume that schooling programmes of the PES, the training of

prosocial behaviour, the improvement of search strategies etc., enlarge the number of unskilled who are able and willing to work and, through that channel, increase labour supply (τ_2 increases, s. Tab. A3.4). Third active measures raise the productivity of the unskilled (y_2 increases, s. Tab. A3.5). Finally we can compare the consequences of the productivity effect generated by PES programmes with an educational strategy which would increase not the productivity of the unskilled but instead the portion of skilled workers among the labour force (λ_1 increases, s. Tab. A3.6).

If the PES increases the number of unemployed in ALMP programmes, μ_2 decreases and – as shown in Section 2 – so does the transition rate of unemployed type-2 workers who are available for job placement P_2. Therefore, the rate $\mu_2 P_2$ must fall as well. Thus, we can infer from equation (23) that the unemployment rate of the unskilled increases. In our simulation it increases by 1.5 percentage points to 19.9%, if $\mu_2 = 0.90$. With $\mu_2 = 0.90$, 10% of the unskilled unemployed participate in ALMP programmes, that is 0.6% of the labour force. By comparison, in Germany in 1997 the inflow into ALMP programmes amounted to 3.6% of the labour force (OECD 1998).

If ALMP increases the portion of unskilled who are willing and able to work, then the tightness between the registers for type 2 increases, and so do the PES transition rate P_2 and the rate $\mu_2 P_2$. However, the growing attractiveness of the PES placement at the same time reduces the number of active job seekers among the type-2 unemployed, an effect that has a negative impact on the number of advertised vacancies and finally also on the number of active type-1 job seekers. Nevertheless, the tightness in the submarkets for type 1 remains unchanged so that with respect to equation (12) the increased tightness in the search market for type-2 workers increases their transition rate p_2. Since the search rate σ_2 also increases, u_2 decreases. In our simulation u_2 decreases by 2.3 percentage points to 16.1%, if $\tau_2 = 0.70$. Simultaneously the per capita consumption C grows by 1%, while the expenditure ratio decreases by 0.4 percentage points to 5.2%. Thus we see, that – contrary to the received *competition argument* – it is not a lower wage which stimulates the demand for type-2 workers but the increased arrival rate of the unemployed at the registered vacancies, $\tau_2 Q_2$. With growing τ_2 all three rates P_2, $\mu_2 P_2$ and $\tau_2 Q_2$ increase and, due to the growing tightness, there is even a small wage increase for type-2 workers.

If ALMP increases the productivity of type-2 workers, the numbers of both registered and advertised vacancies for type-2 increase. The increase in advertisements also prompts the first-ranking unemployed to intensify their search so that the unemployment rates for both types drop. For $y_2 = 80$ in the steady state, the unemployment rates reach values of 8.7% for type 1 and 16.7% for type 2, s. Tab. A3.5. At the same time, per capita consumption grows by 4%, while the expenditure ratio for active and passive measures falls by 0.5 percentage points to 5%.

Result 2: *The probability of a match, e_i, and the percentage of unemployed who are able and willing to work, τ_2, produce crowding out effects. Increasing the labour supply through active measures which raise τ_2 causes a higher transition rate into employment as well as a higher arrival rate at the registered vacancies such that the type-specific and the aggregate rate of unemployment decline, although contrary to the competition argument the transitions are accompanied by a higher wage w_2. Table 1 shows the elasticities of the unemployment rates and the per capita consumption with respect to the different active measures calculated as unweighted averages of the simulation results. If, for example, the probability e_2 that a contact between an unskilled worker and a registered vacancy leads to a match increases by one percent, the unemployment rate for type-2 workers decreases by 0.63%, the aggregate rate falls by 0.24% and per capita consumption increases by 0.05%.*

Table 1: Elasticities of unemployment rates and per capita consumption with respect to the probability of a match e_i, the population portions μ_2, τ_2, y_2, and the productivity λ_2.

	u_1	u_2	u	C
e_1	– 0.50	0.13	– 0.20	0.10
e_2	0.08	– 0.63	– 0.24	0.05
μ_2	0	– 0.76	– 0.36	0.06
τ_2	0.01	– 0.86	– 0.37	0.06
y_2	– 0.24	– 0.70	– 0.45	0.29
λ_1	0.33	– 1.24	– 0.78	0.38

HIRING SUBSIDIES. Hiring subsidies, G_{R_i}, are paid only to firms that register their vacancies with the PES and employ workers sent by the PES. Hiring subsidies augment the placement success of the PES, curb the dynamics of the search market, crowd out job seekers and advertised vacancies, increase unemployment, drive a wedge between the bargained wage of the PES-administered labour market and the wage of the search market, and reduce

per capita consumption. The PES improves its placement success through wage subsidies, because the latter have a positive effect on the transition rate of subsidised workers P_i, on the number of unemployed workers U_i, and thus also on the number of new job contracts. However, the PES competes with the search market, where the dynamic is weakened as soon as the PES subsidises the wage costs of firms with registered vacancies. Especially among those workers who are eligible for subsidies, the number of active job seekers decreases and the search rates drop. Then, due to negative externalities, the suppliers of advertised vacancies withdraw, and the number of active job seekers decreases even among those unemployed who are not eligible for subsidisation. In addition, subsidised workers negotiate over higher wages, thus acquiring a share of the hiring subsidies the size of which depends on their bargaining power.

Although hiring subsidies are paid only to registered firms, they can influence the ranking order in the search market (Table A3.7). With a subsidy $G_{R_1} = 35$, unemployed type-1 workers who have not been offered a job through the PES but have found one through their own search effort, achieve a wage increase of 1.3% compared to the basic scenario. This increase of wage costs for jobs that are filled through the search market is sufficient to change the ranking order in favour of type-2 workers. The new ranking order prompts a sharp increase in unemployment for workers of type 1 who now rank second and a corresponding decrease in unemployment for type-2 workers who in the new steady state, are preferred by employers as a consequence of the wage cost effects of the hiring subsidy.

In the *ALMP* column, the tables show the hiring subsidy per unemployed worker as a percentage of the gross product per capita of the labour force. In the OECD countries between 1989 and 1994, *ALMP* varied between 3.0% in the US and 59.3% in Sweden; the corresponding value for western Germany was 25.7% (Nickell 1997). In our simulation, *ALMP* is 14.9% for a hiring subsidy $G_{R_1} = 30$ but only 5.7% for $G_{R_2} = 30$. Tables A3.7 and A3.8 also show the expenditure ratio for active and passive labour market measures which, for example, for $G_{R_2} = 30$ is 6.5%, one percentage point higher than in the basic scenario. Finally, the tables indicate that hiring subsidies are concomitant with declining per capita consumption. With $G_{R_1} = 30$, for example, C is 0.9% lower than in the basic scenario.

Result 3: *Hiring subsidies augment the placement success of the PES, but on the aggregate level taking into account the effects of search externalities they*

crowd out active job seekers and advertised vacancies, drive a wedge between the wage of the PES-administered labour market and the wage of the search market, reduce per capita consumption, and increase the aggregate unemployment rate and the expenditure ratio.

(RE-EMPLOYMENT) BONUSES. A (re-employment) bonus paid by the PES to active job seekers who have found a new job through their own search effort is an often recommended but rarely implemented instrument of active labour market policy. Bonuses improve the dynamics of the search market at the expense of the central placement service, reduce aggregate unemployment, increase per capita consumption, and decrease the expenditure ratio for active and passive labour market policies, thus financing themselves. A bonus paid only to active job seekers has no effect on the tightness between the PES registers. Therefore, the transition rates P_i of the registered unemployed as well as their arrival rates $\tau_i Q_i$ at the registered vacancies remain unaltered. In the search market, the number of advertisements grows with the bonus, and positive externalities increase the number of active job seekers. For $G_{A_1} = 15$ the search rate of type 1 is already 30 percentage points higher than in the basic scenario so that $\sigma_1 = 78\%$. In spite of the greater number of advertised vacancies, there is only a slight increase in the number of active job seekers of type 2; this is due to the ranking order that job seekers are confronted with in the search market. More vacancies also improve the chances for type 2, but the growing number of type-1 job seekers produces congestion externalities, the positive and negative externalities almost compensating each other.

Promoting active job search among the unskilled through a bonus G_{A_2} produces similar adjustments; in contrast to G_{A_1}, G_{A_2} initially has no negative external effects on type-1 workers, since the ranking order protects unemployed workers of type 1 against competition from type-2 workers. However, with an increasing bonus, the wage ω_2 negotiated in the search market is reduced; with $G_{A_2} = 25$ the bonus has almost reached the level where the ranking order is reversed, and, because of the bonus, firms prefer to employ type-2 workers.

Result 4: *In a labour market with several states which are interconnected by positive and negative externalities from search, the instruments of ALMP cause not only deadweight losses and substitution effects but also positive employment effects on unemployed workers and vacancies not directly supported by the PES. The effects of the bonus payments substantiate this result. In addition, the bonus for type-2 workers finances itself. For $G_{A_2} = 25$, the number of active job seekers among the subsidised almost doubles, their rate of unemploy-*

ment decreases by 1.7 percentage points to 16.7%, and the expenditure ratio is 5.4%, which is 0.1 percentage points lower than in the basic scenario.

ASSISTANCE FOR PROBLEM GROUPS. There is a theorem in labour market research that subsidies are more effective the more precisely they are tailored to particular "problem groups". The following experiments do not provide an all-out confirmation of this theorem. In the usage of labour market research, the unskilled unemployed do constitute a "problem group": the rate of unemployment (18.4%) and the number of workers who are unable or not willing to take up work (40%) are higher than average, while the productivity (70%) and the number of active job seekers (32.2%) are comparatively low.

If the PES subsidises the unskilled with a combination of hiring subsidies and bonuses, the tightness between the registers for type 2 increases so that the PES-generated transition rate of the unskilled and the number of matches increase (see Table A3.11). In addition, the bonus for active job seekers among the unskilled provides an incentive for firms to advertise more vacancies, and, due to positive externalities, also increases the number of active job seekers among workers of type 1. On the other hand, the subsidy $G_2 = 15$ reduces the unemployment rate of the problem group by only 0.4 percentage points to 18%, and the aggregate rate of unemployment by 0.2 percentage points to 11.6%. *C* grows by 0.1%, *ALMP* reaches 3.9%, and the expenditure ratio increases by 0.4 percentage points to 5.9%. If, instead, active job search is promoted with $G_A = 15$ (see Table A3.12) the unemployment rate of the problem group falls to 16.9%, that of the skilled workers is reduced to 7.9%, and the aggregate rate of unemployment is 10.6%. *C* grows by 0.8%, and *ALMP* increases to 5.9%, but the expenditure ratio for passive and active policy measures is practically unchanged, because the bonus payments are covered by saved UI benefits.

Result 5: *Considering the unemployment rates, the expenses for PLMP, the expenditure ratio for active and passive labour market policies, and per capita consumption, it turns out that promoting active job search instead of subsidising the "problem group" of unskilled worker is the more effective strategy.*

SEARCH RULE. Apart from the bonuses, the PES can use the probability that shirking is detected, γ, and the penalty, g_i, to increase the search rates and to decrease the unemployment rates. Considering their effect on the rates of unemployment, on per capita consumption, and on the expenditure ratio, penalties against unemployed type-2 workers who violate the search rule are more effective. If unemployed type-1 workers who are not searching actively

are fined, the search rate σ_1 increases, but the negative externalities on the gains from search of the second-rate group generated by a higher search rate of the first-rate group can even reduce the search rate among type-2 workers thereby augmenting the rate of unemployment. Compared to type-specific penalties, general penalties with $g_i = g, i = 1, 2$ are most effective, but, in an environment with risk-neutral agents, their consequences are comparable to those of an increase in the probability of a check γ.

With higher penalties, the endogenous reservation income of the workers is reduced, profits are increased and so are the market values of filled jobs. New vacancies are registered and new jobs are advertised in the search market. With a 10% probability that shirking is detected and a penalty $g_2 = 10$ for violations of the search rule (see Table A3.13) the search rate for type 2 increases to 33.1% and the unemployment rate decreases to 18.3%. If the penalty is increased to $g_2 = 100$ – that is, 150% of the wage for employed workers of type 2 – u_2 is reduced to 17.6%, the aggregate rate of unemployment decreases by 0.3 percentage points to 11.5%, and the steady state expenditure ratio for labour market measures amounts to 5.2%, 0.3 percentage points less than in the basic scenario. For the PES such penalties mean savings because it actually pays less in UI benefits to the workers. Those savings can be calculated as follows: $\sum_i (U_i - S_i)(1 - P_i)\gamma g_i$. There are $U_i - S_i$ unemployed workers of type *i* who are not searching actively thus violating the search rule. Of those, a fraction $1 - P_i$ is not offered a job through the PES, while a fraction γ of the violations are detected through PES checks and fined with a penalty g_i.

A 10% probability of a check combined with a penalty of 10 units of output for both types of unemployed increases the tightness between the registers, the number of active job seekers, and the number of advertised vacancies, thus reducing the rates of unemployment. Even if the probability of a check is raised to 100%, the search rates increase by only 10.1 percentage points for type-2 and 7.2 percentage points for type-1 workers compared to the basic scenario. In the steady state, only 42.3% of the unemployed type-2 workers and 55.2% of the unemployed type-1 workers are actively looking for a job. Per capita consumption is 0.4% higher than in the basic scenario, and the expenditure rate for labour market policies less the savings due to withheld UI benefits is reduced by 0.5 percentage points to 5% of the gross product.

> ***Result 6:*** *Considering their effect on the rate of unemployment, on per capita consumption, and on the expenditure ratio, general penalties against unem-*

ployed workers who violate the search rule are more effective than type-specific sanctions, and fines against shirkers of the second-rate group are more successful than fines against members of the first-rate group. Sanctioning violations of the search rule generates crowding-in effects. But even if the probability of a check is 100%, only a fraction of the unemployed who have not been placed by the PES actively search for a job.

5. SUMMARY

A fully integrated PES strengthens the bargaining power of the job applicants, increases the bilaterally negotiated wages, reduces the incentive to engage in active job search, and decreases both the search rates and the number of advertised vacancies. Nevertheless, compared with the laissez-faire regime the implementation of the job placement function of the PES decreases the aggregate rate of unemployment and increases per capita consumption. Of all the instrument variables of ALMP, (1) the probabilities of a match, (2) the number of unskilled workers who are not interested in a job, and (3) the hiring subsidies generate crowding-out effects. The portion of unemployed type-2 workers who participate in programmes of the ALMP and are not available for the placement service is neutral with respect to the employment situation of type-1 workers. Due to positive externalities from search, (4) higher productivity of the unskilled, (5) (re-employment) bonuses as a reward for active job search, (6) penalties for violations of the search rule, and (7) the probability of shirking being detected by the PES reduce the unemployment rate not only of the target group but also of the competing group of unemployed workers. Finally, (8) assisting specific “problem groups” is less effective than promoting active job search, if the effects on unemployment rates, per capita consumption, and expenditure ratios are considered.

Hiring subsidies and (re-employment) bonuses drive a wedge between the wages in the PES-administered labour market and the wages on the search market. Hiring subsidies improve the placement success of the PES. But they also paralyse the dynamics of the search market, since with the subsidies and the growing number of registered vacancies, the unemployed become less interested in active job search, and the number of advertised vacancies drops. Contrary to the well-known *competition effect,* an increasing fraction of unskilled workers who after taking part in measures of ALMP are able or willing to work reduce type-specific and aggregate unemployment as a consequence of a simultaneous increase in the transition rate and the expected arrival rate

of workers of type 2 at the registered vacancies. The elasticities of the unemployment rates and per capita consumption with respect to the instruments of ALMP are relatively low. This result mirrors the ambiguity found in the macroeconometric regressions cited in the introduction, where the correlation between specific ALMP instruments and the aggregate rate of unemployment often is not significant.

In order to further extend the theoretical analysis of ALMP, the model can be supplemented with the labour market segment where unemployed and employed workers who are not registered with the PES search for new jobs. Furthermore, the influence of ALMP on the reservation productivity and the separation rate should be integrated into the model.

APPENDIX

Table A1: The parameter of the model

β	r	s	y_1	y_2	b	k_R	k	k_P	c	a_{i+}	a_{i-}	μ_1	μ_2	τ_1	τ_2	e_1	e_2	f	Φ	ϕ	λ_1	L
0.70	0.04	0.10	100	70	37.5	45	0.70	40	30	1.30	0.60	1.00	1.00	0.90	0.60	0.90	0.70	0.45	1/7	7/10	0.70	500

Table A2: Basic scenarios of the laissez-faire economy (1), the centrally administrated labor market (2), and the mixed economy (3)

	R_1	R_2	U_1	U_2	A	S_1	S_2	S	u_1 (%)	u_2 (%)	u (%)	σ_1 (%)	σ_2 (%)	σ (%)	w_1	ω_1	w_2	ω_2	C	$PLMP$ (%)	$ALMP$ (%)	$(P+A)/BP$ (%)
(1)	–	–	37.2	25.7	85.0	33.5	15.4	48.9	10.6	17.2	12.6	90.0	60.0	77.7	–	81.3	–	60.3	66.7	46.9	–	5.9
(2)	18.3	4.7	42.8	34.7	–	–	–	–	12.2	24.1	15.8	–	–	–	96.2	–	67.3	–	75.5	48.3	–	7.5
(3)	13.4	3.7	31.3	27.5	21.4	15.1	8.9	23.9	9.0	18.4	11.8	48.0	32.2	40.6	96.2	96.2	67.3	67.3	77.2	46.4	–	5.5

Table A3: The effects of ALMP instruments on the steady state of the mixed economy

Tab. A3.1: The probability of a match e_1

	$\frac{\Delta R_1}{R_1}$	$\frac{\Delta R_2}{R_2}$	$\frac{\Delta U_1}{U_1}$	$\frac{\Delta U_2}{U_2}$	$\frac{\Delta A}{A}$	$\frac{\Delta S_1}{S_1}$	$\frac{\Delta S_2}{S_2}$	$\frac{\Delta S}{S}$	Δu_1	Δu_2	Δu	$\Delta \sigma_1$	$\Delta \sigma_2$	$\Delta \sigma$	$\frac{\Delta w_1}{w_1}$	$\frac{\Delta \omega_1}{\omega_1}$	$\frac{\Delta w_2}{w_2}$	$\frac{\Delta \omega_2}{\omega_2}$	$\frac{\Delta C}{C}$	$\Delta PLMP$	$ALMP$	$\Delta \frac{P+A}{BP}$
$e_1 = 0.92$	– 0.6	0.3	– 1.0	0.3	– 1.8	– 4.3	– 1.0	– 3.1	– 0.1	0.1	0.0	– 1.6	– 0.4	– 1.1	0.1	0.1	–	–	0.2	0.0	–	0.0
$e_1 = 1.00$	– 3.2	1.4	– 5.2	1.4	– 8.4	– 19.1	– 4.6	– 13.7	– 0.5	0.3	– 0.2	– 7.0	– 1.9	– 4.8	0.3	0.3	–	–	1.0	– 0.2	–	– 0.1

Tab. A3.2: The probability of a match e_2

$e_2 = 0.72$	0.2	– 0.9	0.2	– 1.7	– 0.6	– 0.6	– 3.6	– 1.7	0.0	– 0.3	– 0.1	– 0.4	– 0.6	– 0.4	–	–	0.1	0.1	0.2	0.0	–	0.0
$e_2 = 0.80$	1.1	– 4.8	1.1	– 8.2	– 2.9	– 2.9	– 16.1	– 7.8	0.1	– 1.5	– 0.4	– 1.9	– 2.8	– 1.9	–	–	0.4	0.4	0.7	– 0.1	–	– 0.2

Tab. A3.4: The portion of unskilled unemployed who participate in ALMP programs $1-\mu_2$

	$\frac{\Delta R_1}{R_1}$	$\frac{\Delta R_2}{R_2}$	$\frac{\Delta U_1}{U_1}$	$\frac{\Delta U_2}{U_2}$	$\frac{\Delta A}{A}$	$\frac{\Delta S_1}{S_1}$	$\frac{\Delta S_2}{S_2}$	$\frac{\Delta S}{S}$	Δu_1	Δu_2	Δu	$\Delta\sigma_1$	$\Delta\sigma_2$	$\Delta\sigma$	$\frac{\Delta w_1}{w_1}$	$\frac{\Delta\omega_1}{\omega_1}$	$\frac{\Delta w_2}{w_2}$	$\frac{\Delta\omega_2}{\omega_2}$	$\frac{\Delta C}{C}$	$\Delta PLMP$	$ALMP$	$\Delta\frac{P+A}{BP}$
$\mu_2 = 0.98$	–	– 0.5	–	1.5	–	–	–	–	–	0.3	0.1	–	– 0.5	– 0.3	–	–	–	–	– 0.1	0.0	–	0.0
$\mu_2 = 0.90$	–	– 2.6	–	8.2	–	–	–	–	–	1.5	0.5	–	– 2.4	– 1.5	–	–	–	–	– 0.7	0.2	–	0.2

Tab. A3.5: The percentage of active and passive job seekers among the unskilled unemployed τ_2

$\tau_2 = 0.62$	0.0	0.6	0.0	– 2.8	– 0.1	– 0.1	– 0.6	– 0.3	–	– 0.5	– 0.1	– 0.1	0.7	0.4	–	–	0.0	0.0	0.2	– 0.1	–	– 0.1
$\tau_2 = 0.70$	0.2	2.7	0.2	– 12.5	– 0.5	– 0.5	– 2.8	– 1.4	–	– 2.3	– 0.7	– 0.3	3.5	1.9	–	–	0.1	0.1	1.0	– 0.3	–	– 0.3

Tab. A3.6: The productivity of the unskilled y_2

$y_2 = 72$	– 0.6	4.4	– 0.6	– 1.9	1.7	1.7	9.7	4.7	– 0.1	– 0.4	– 0.1	1.1	3.8	2.4	–	–	2.8	2.8	0.8	– 0.3	–	– 0.1
$y_2 = 80$	– 3.2	20.1	– 3.2	– 9.2	8.7	8.7	53.0	25.1	– 0.3	– 1.7	– 0.7	5.9	22.0	13.4	–	–	13.8	13.8	4.0	– 1.7	–	– 0.5

Tab. A3.7: The percentage of the skilled among the labor force λ_1

$\lambda_1 = 0.72$	3.9	– 8.7	3.9	– 8.7	–	–	–	–	0.1	– 0.4	– 0.2	– 1.8	3.1	0.8	–	–	–	–	1.1	– 0.4	–	– 0.2
$\lambda_1 = 0.80$	19.5	– 43.7	19.5	– 43.7	–	–	–	–	0.4	– 2.9	– 1.2	– 7.8	25.0	4.5	–	–	–	–	5.3	– 1.9	–	– 0.8

Tab. A3.8: The hiring subsidy G_{R_1}

$G_{R_1} = 5$	3.4	0.8	2.2	0.8	– 4.6	– 10.8	– 2.5	– 7.8	0.2	0.1	0.2	– 6.1	– 1.0	– 3.7	0.7	0.2	–	–	– 0.1	0.1	2.4	0.4
$G_R = 15$	10.1	2.3	6.4	2.3	– 13.5	– 30.1	– 7.5	– 21.7	0.6	0.4	0.5	– 16.5	– 3.1	– 10.2	2.1	0.5	–	–	– 0.4	0.3	7.3	1.2
$G_R = 30$	19.8	4.7	12.0	4.7	– 25.9	– 53.3	– 15.0	– 39.1	1.1	0.9	1.0	– 28.0	– 6.1	– 17.8	4.1	1.1	–	–	– 0.9	0.5	14.9	2.4
$G_{R_1} = 35$	34.2	– 19.6	24.1	– 19.6	– 28.5	– 55.0	– 24.8	– 43.8	2.2	– 3.6	0.4	– 30.6	– 2.1	– 18.6	4.8	1.3	–	–	– 0.3	0.4	20.2	2.7

Tab. A3.9: The hiring subsidy G_{R_2}

$G_{R_2} = 5$	0.6	3.4	0.6	1.1	– 1.8	– 1.8	– 9.9	– 4.8	0.1	0.2	0.1	– 1.2	– 3.5	– 2.3	–	–	1.0	0.2	– 0.1	0.0	0.9	0.2
$G_{R_2} = 15$	1.9	10.2	1.9	3.2	– 5.2	– 5.2	– 28.2	– 13.7	0.2	0.6	0.3	– 3.3	– 9.8	– 6.4	–	–	2.9	0.7	– 0.3	0.1	2.8	0.5
$G_{R_2} = 30$	3.6	20.8	3.6	6.4	– 9.9	– 9.9	– 51.8	– 25.4	0.3	1.2	0.6	– 6.3	– 17.6	– 11.7	–	–	5.8	1.4	– 0.6	0.3	5.7	1.0

Tab. A3.10: The (re-employment) bonus G_{A_1}

	$\frac{\Delta R_1}{R_1}$	$\frac{\Delta R_2}{R_2}$	$\frac{\Delta U_1}{U_1}$	$\frac{\Delta U_2}{U_2}$	$\frac{\Delta A}{A}$	$\frac{\Delta S_1}{S_1}$	$\frac{\Delta S_2}{S_2}$	$\frac{\Delta S}{S}$	Δu_1	Δu_2	Δu	$\Delta\sigma_1$	$\Delta\sigma_2$	$\Delta\sigma$	$\frac{\Delta w_1}{w_1}$	$\frac{\Delta\omega_1}{\omega_1}$	$\frac{\Delta w_2}{w_2}$	$\frac{\Delta\omega_2}{\omega_2}$	$\frac{\Delta C}{C}$	$\Delta PLMP$	$ALMP$	$\Delta\frac{P+A}{BP}$
$G_{A_1}=5$	– 3.0	– 0.9	– 3.0	– 0.9	5.8	14.3	3.0	10.1	– 0.3	– 0.2	– 0.2	8.6	1.3	5.1	–	– 0.2	–	–	0.1	– 0.1	1.1	0.0
$G_{A_1}=15$	– 9.5	– 2.8	– 9.5	– 2.8	17.9	47.1	9.0	32.9	– 0.8	– 0.5	– 0.7	30.0	3.9	17.0	–	– 0.7	–	–	0.4	– 0.4	3.9	0.0

Tab. A3.11: The (re-employment) bonus G_{A_2}

$G_{A_2}=5$	– 0.9	– 1.8	– 0.9	– 1.8	2.4	2.4	14.0	6.7	– 0.1	– 0.3	– 0.2	1.6	5.2	3.3	–	–	–	– 0.3	0.1	– 0.1	0.4	0.0
$G_{A_2}=15$	– 2.7	– 5.5	– 2.7	– 5.5	7.5	7.5	45.2	21.5	– 0.2	– 1.0	– 0.5	5.1	17.3	10.8	–	–	–	– 0.9	0.4	– 0.2	1.4	– 0.1
$G_{A_2}=25$	– 4.7	– 9.3	– 4.7	– 9.3	12.9	12.9	80.0	38.0	– 0.4	– 1.7	– 0.8	8.8	32.0	19.6	–	–	–	– 1.6	0.7	– 0.4	2.6	– 0.1

Tab. A3.12: The promotion of unskilled workers with $G_{R_2}=G_{A_2}=G_2$

$G_2=5$	– 0.2	1.5	– 0.2	– 0.7	0.6	0.6	3.4	1.6	0.0	– 0.1	– 0.1	0.4	1.3	0.8	–	–	1.0	– 0.1	0.0	0.0	1.3	0.1
$G_2=15$	– 0.6	4.6	– 0.6	– 2.0	1.8	1.8	10.2	4.9	– 0.1	– 0.4	– 0.2	1.2	4.0	2.5	–	–	2.9	– 0.2	0.1	– 0.1	3.9	0.4
$G_2=30$	– 1.3	9.0	– 1.3	– 4.0	3.6	3.6	20.9	10.0	– 0.1	– 0.7	– 0.3	2.4	8.3	5.2	–	–	5.8	– 0.5	0.3	– 0.1	8.0	0.8

Tab. A3.13: The promotion of active job seekers with $G_{A_1}=G_{A_2}=G_A$

$G_A=5$	– 3.9	– 2.7	– 3.9	– 2.7	8.2	16.9	17.3	17.0	– 0.4	– 0.5	– 0.4	10.4	6.6	8.6	–	– 0.2	–	– 0.3	0.3	– 0.2	1.5	0.0
$G_A=15$	– 12.2	– 8.2	– 12.2	– 8.2	24.8	55.7	55.9	55.8	– 1.1	– 1.5	– 1.2	37.1	22.4	29.9	–	– 0.7	–	– 0.9	0.8	– 0.6	5.9	0.0

Tab. A3.14: The penalty g_2 for violations against the search requirement, if $\gamma=0.1$

$g_2=10$	– 0.1	1.0	– 0.1	– 0.5	0.4	0.4	2.3	1.1	0.0	– 0.1	0.0	0.3	0.9	0.6	–	–	– 0.1	– 0.1	0.0	0.0	–	0.0
$g_2=100$	– 1.4	9.9	– 1.4	– 4.4	4.0	4.0	23.2	11.1	– 0.1	– 0.8	– 0.3	2.6	9.3	5.8	–	–	– 0.5	– 0.5	0.3	– 0.1	–	– 0.3

Tab. A3.15: The probability that shirking is detected γ, if $g_1=g_2=10$

$\gamma=0.1$	0.0	1.0	– 0.3	– 0.5	0.7	1.1	2.4	1.6	0.0	– 0.1	0.0	0.7	0.9	0.8	0.0	0.0	– 0.1	– 0.1	0.0	0.0	–	– 0.1
$\gamma=1.0$	– 0.2	9.3	– 3.3	– 4.8	6.8	11.1	24.9	16.2	– 0.3	– 0.9	– 0.5	7.2	10.1	8.6	– 0.1	– 0.1	– 0.5	– 0.5	0.4	– 0.2	–	– 0.5

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