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# Effective Active Labor Market Policies

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**Abstract**

We present a theoretical and empirical analysis of different types of active labor market policies (ALMP). In our empirical analysis we use data on 20 OECD countries covering the time period 1985-1999. We find that labor market training is the most effective program to bring down unemployment. Public employment services have some impact while subsidized jobs are not effective at all. Our theory considers ALMP in the context of a search-matching model.

JEL codes: H55, J65, J68
Keywords: unemployment, active labor market programs, training, subsidized jobs, public employment services.

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# 1. Introduction

Active labor market policies (ALMP) aim at bringing unemployed back to work by improving the functioning of the labor market in various ways. ALMP include programs such as public employment services, labor market training and subsidized employment. The 1994 OECD Jobs study recommends governments to "strengthen the emphasis on active labor market policies and reinforce their effectiveness" (OECD, 1994). Recent studies however are not very optimistic about the benefits of many of these programs. Heckman et al. (1999) give a detailed overview of several microeconometric evaluation studies. They conclude that labor market programs have at best a modest impact on participants' labor market prospects. Furthermore, there is considerable heterogeneity in the impact of these programs, so for some groups of workers the programs are more effective than for other groups of workers. Finally, when programs are implemented on a large scale displacement and general equilibrium effects may be sizeable. This means that without incorporating them in a macro framework micro treatment effect evaluations will provide poor guides to public policy. Calmfors, Forslund and Hemström (2001) conclude that the evidence on the effectiveness of Swedish ALMP is rather disappointing. Labor market retraining for example has no or negative employment effects. Martin and Grubb (2001) draw similar conclusions in their overview on what works and what does not work among ALMP in OECD countries. They conclude for example that subsidies to employment and direct job creation have been of little success in helping unemployed get permanent jobs. Kluve and Schmidt (2002) also present an overview of evaluation studies concluding that job search assistance can be useful, private sector subsidies are better than public sector programs and training programs can help to improve the labor market prospects of unemployed workers.

If one would draw a general conclusion from the empirical studies based on micro data it would be that the effects of ALMP on the job finding rates are rather small. An important drawback of a lot of ALMP is that they stimulate workers to reduce their search efforts instead of increasing them. This is due to the so-called locking-in effect (see for example Van Ours, 2004). Other effects are important too. What is effective for an individual unemployed worker may not be effective in terms of the aggregate level of unemployment. One reason for this may be crowding out. If a training program brings an unemployed worker back to work more quickly at the expense of another unemployed worker finding a job more slowly the training program is not very efficient. Another reason for the differences between individual and aggregate effects is that a training program may increase the effectiveness of labor supply, which stimulates job creation. Or it may be that a training program induces a better match between a worker and a job. In that case job tenure will increase causing a reduction of unemployment through a reduced inflow into unemployment.

This paper investigates the effectiveness of active labor market policies on an aggregate level both from an empirical and a theoretical point of view. In our empirical analysis we analyze the effects of ALMP on both unemployment rates and employment-population rates using aggregate time series - cross section data from 20 OECD countries. We investigate the effects of specific categories of ALMP focusing on training, public employment services and subsidized jobs. Our contribution to the empirical literature on the macro-effects of ALMP is threefold. First, we base our analysis on more recent data than previous studies did. Second, we investigate the effects of separate expenditure categories while almost all previous studies focused on total ALMP-expenditures. Third, instead of focussing on one particular method of analysis we use a variety of methods. We analyze the effects of ALMP using annual data and 5-years averages of variables, accounting for random country effects. We also use expenditure shares for different ALMP categories accounting for country fixed effects. As dependent variables we use the unemployment rate, but also the employment population rates. Finally, we make a distinction between labor market performance indicators for males and for females. We find that expenditures on labor market training have the largest impact on both the unemployment rate and the employment-population rate. Public employment services seem to be able to reduce the unemployment rate but do not affect the employment-population rate. Finally, subsidized jobs do not seem to have any effect on labor market outcomes.

In our theoretical search-matching model we analyze the effects of subsidized jobs, public employment services and labor market training. In this model we introduce some parameters capturing active labor market policies by the government. Training increases the expected productivity of the worker. The government can stimulate training by subsidizing training costs. We also take into account an alternative route to higher productivity. This is through learning on-the-job. The government can stimulate the on-the-job training route by subsidizing the creation of vacancies. Simply because there are more vacancies, unemployed will flow more quickly into jobs and through learning by doing they flow from low productivity to high-productivity jobs (hence the transition from unemployment to high-productivity jobs happens more quickly). Finally, the functioning of the labor market can be influenced through public employment services. These services can influence the labor market because matching becomes more efficient. We find that our model explains the empirical results best if (i) the job finding rate is hardly affected by ALMP, which is consistent with micro studies (see below), and (ii) the main effect of ALMP on unemployment is via job duration. The training component of ALMP scores best because it directly affects this channel while the other measures have only an indirect effect on job duration.

The set-up of the paper is as follows. In Section 2 we discuss previous studies on ALMP focusing on macro-studies. In Section 3 we discuss our data, the set-up of our analysis and we present parameter estimates. In Section 4 we present our theoretical model. Section 5 concludes.

## 2. Empirical evaluation studies

### 2.1. General overview

Calmfors (1995) distinguishes four basic functions of ALMP: raise output and welfare by putting unemployed to work or have them invest in human capital, maintain the size of the effective labor force by keeping up competition for available jobs, help to reallocate labor between different sub-markets, and alleviate the moral-hazard problem of unemployment insurance. ALMP may eliminate mismatch in the labor market, promote more active search behavior on the part of the job seekers and have a screening function because they substitute for regular work experience in reducing employer uncertainty about the employability of job applicants. Placements in labor market programs may provide an alternative work test to the eligibility of unemployment benefits, since some of those who are not genuinely interested in work will prefer to lose registration rather than to participate in a program. An adverse side effect of ALMP is that workers are locked-in training and job-creation programs: because of their participation they reduce their search intensity.

Not only direct effects are important when assessing the effectiveness of ALMP. Calmfors (1994) distinguishes a number of indirect effects. First there are displacement effects since jobs created by one program are at the expense of other jobs. Then there are deadweight effects because labor market programs subsidize hiring that would have occurred anyway in the absence of the program. There are also substitution effects because jobs created for a certain category of workers replace jobs for other categories because relative wage costs have changed. Finally, there are the effects of taxation required to finance the programs on the behavior of everyone in society.

In line with the previous distinction between micro and macro effects there are two main types of evaluation studies of ALMP (Martin and Grubb, 2001): The first type uses micro data to measure the impact of program participation on individuals' employment and earnings. The second type uses aggregate data to measure the net effects of programs on aggregate employment and unemployment. Micro studies have the advantage of a very large number of observations. Drawbacks are the selection bias and the fact that they provide only estimates of partial-equilibrium effects. Macro studies are few. Drawbacks of macro studies are that they are based on few observations, they often lump together various types of training and job creation schemes and they have to deal with a simultaneity bias.

There are many evaluation studies. A lot of them are done in Sweden, a country that has used ALMP extensively. In their overview of Swedish studies Calmfors, Forslund and Hemström (2001) conclude that ALMP have probably reduced unemployment but also reduced regular employment. According to Martin and Grubb (2001) the lessons from the evaluation studies in OECD countries are the following. Public training programs are among the most expensive active measures. Some programs have yielded low or even negative rates of return for participants, some public training programs work. These programs appear to work for some target groups (adult women) but not for others (prime-age men, youth). Four crucial features can increase effectiveness: tight targeting on participants, relative small scale, need to result in a qualification or certificate that is recognized and valued by the market, strong on-the-job component (establishing strong links with local employers). Job search assistance is usually the least costly active labor market program but must be combined with increased monitoring of the job-search behavior of the unemployed and enforcement of work tests. Subsidies to employment involve large dead weight losses and substitution effects. Finally, direct job creation has been of little success in helping unemployed get permanent jobs in the open labor market. Most jobs provided through direct job creation schemes typically have a low marginal product, they should be short in duration and not become a disguised form of heavily subsidized permanent employment.

Kluve and Schmidt (2002) use the outcomes of 53 recent evaluation studies to perform a regression where each program represents 1 datapoint. The effects of ALMP are explained by the type of program, the study design (experimental versus non-experimental), the timing (1980s versus 1990s) and the macroeconomic environment. The authors conclude that programs with a large training content seem to be most likely to improve employment probability. Furthermore, they conclude that both direct job creation and employment subsidies in the public sector almost always seem to fail. The overview studies by Martin and Grubb (2001), Calmfors et al. (2001) and Kluve and Schmidt (2002) indicate that there is hardly any empirical research on the relationship between ALMP and job durations. An important empirical problem is that job tenure is usually quite long so that the data have to cover a lot of calendar time to be suitable for an analysis of separation rates.[1]

[1]Rare examples of studies that address the relationship between ALMP and job durations are Bonnal et al. (1997) and Van Ours (2001). Bonnal et al. analyze the effects of various programs on the labor market position of low skilled young workers and conclude that private sector training courses may generate better matches and longer subsequent employment durations than programs in the public sector (training or community jobs). Van Ours (2001) finds that short-term subsidized jobs have a positive effect on the job finding rate and a negative effect on the job separation rate. Long-term subsidized jobs reduce the job finding rate due to a locking-in effect. Training has a positive effect on the job finding rate, but this is specific for the labor market studied, the Slovak labor market. Here attending a training program is often a prerequisite for starting on a new job so there is no real treatment effect. Neither long-term subsidized jobs nor training affect the job separation rate.

### 2.2. Macro studies on ALMP

Empirical work on the macroeconomic effects of ALMP is rare. And, often no distinction is made between types of ALMP. Instead, the focus is on total ALMP-expenditures. The equation of interest usually exploits cross-country variation in unemployment and ALMP-expenditures:

$$u_{it} = \beta_0 + \beta_1 x_{it} + \beta_2 y_{it} + \beta_3 \Delta^2 p_{it} + \varepsilon_{it} \tag{1}$$

where $u_{it}$ is the unemployment rate (unemployment as a percentage of the labor force) in country $i$ and calendar year (or time period) $t$. Furthermore, $x$ is a vector of labor market institutions, $y$ refers to ALMP-expenditures and $\Delta^2 p$ is the change in inflation rate. Finally, $\varepsilon_{it}$ is the error term, which in most of the studies is assumed to have a random effects specification. With one exception, which will be discussed below none of the empirical studies uses a fixed effects specification.[2]

One of the problems related to estimating equation (1) is that if unemployment goes up the ALMP-expenditures are also likely to increase. To account for this, ALMP-expenditures are normalized as expenditures per unemployed person as a percentage of GDP per member of the labor force (ignoring for simplicity the subscripts $i$ and $t$) :

$$y = \frac{\frac{ALMP}{U}}{\frac{GDP}{N}} = \frac{\frac{ALMP}{GDP}}{\frac{U}{L}\frac{L}{N}} = \frac{almp}{u.l} \tag{2}$$

where $ALMP$ represents total expenditures on active labor market policies, $U$ is total unemployment, $GDP$ is total gross domestic product, $N$ is the population and $L$ is the labor force. Finally, $almp$ is ALMP-expenditures as a percentage of GDP, and $l$ is the labor force participation rate (labor force as a fraction of the population).

There is a limited number of empirical studies using cross-country time series information to establish the effects of ALMP. Scarpetta (1996) uses annual data from 17 countries over the 1983-1993 period. As ALMP-variable he uses the expenditures on active measures per unemployed person relative to GDP per capita. He finds that ALMP have a negative impact on the

[2]Equation (1) is mainly used to study the unemployment effects of labor market institutions. In this setting fixed country effects are used in for example Belot and Van Ours (2001, 2004) and Nickell et al. (2002). These studies do not consider the effects of ALMP because relevant data are only available from 1985 onwards.

unemployment rate but there are also indications of large substitution and displacement effects on employment. There is a positive correlation between ALMP and the employment-population rates, which indicates that these policies have a positive effect on labor force participation by keeping otherwise discouraged workers in the labor force. Elmeskov et al. (1998) analyze annual data from 19 countries over the period 1983-95. Again the ALMP variable is the public spending on ALMP per unemployed person relative to GDP per capita. The authors conclude that ALMP have a significant negative effect on the unemployment rate. Nickell and Layard (1999) analyze 6 years period averages from 20 OECD countries over the period 1983-1994.[3] The ALMP-variable is the ALMP spending per unemployed person as a percentage of GDP per member of the labor force. The authors find that ALMP have a negative effect on long-term unemployment but no significant effect on the employment-population rate. Blanchard and Wolfers (2000) have 5 years averages data on 20 OECD countries and analyze the period 1960-95. As they use a time-invariant country-specific average ALMP-variable and include country fixed effects they cannot identify the direct effect of ALMP on the unemployment rate. Instead they study the interaction between ALMP and shocks concluding that higher expenditures on ALMP reduce the effects of shocks on unemployment.

One on the main problems in the analysis is the endogeneity problem. It is not only ALMP that affect unemployment but it is also unemployment that affects ALMP-expenditures. Previous studies treat this problem in different ways. Scarpetta (1996) and Elmeskov et al. (1998) use the time-invariant average ALMP spending over the period of availability of the data (1985-1993) as explanatory variable. This of course is only possible by assuming that country-specific effects are randomly distributed. Nickell and Layard (1999) renormalized the current percentage of GDP spent on ALMP measures on the lagged unemployment rate to create an instrument for the ALMP-variable.[4] Blanchard and Wolfers (2000) use country fixed effects and use time-invariant information about labor market institutions.[5] Thus, as indicated before they cannot determine the direct relationship between ALMP and unemployment because this is absorbed by the fixed country effects. However, because they have time invariant labor market

[3] Contrary to other studies the log of the unemployment rate is used as the dependent variable.

[4] So, the instrumental variable is: $z_{it} = \frac{almp_{it}}{u_{i,t-1} . l_{i,t-1}}$

[5] ALMP data of Nickell (1997) are used to calculate country-specific average over the period 1983-1994.

institutions, including ALMP-expenditures, they don't have to deal with the endogeneity issue.

The studies that have been performed do not all point in the same direction. Scarpetta (1996), Elmeskov et al. (1998), and Nickell and Layard (1999) find that ALMP reduce the unemployment rate. Only Scarpetta (1996) finds that ALMP increase the employment-population rate.

## 3. Empirical analysis

### 3.1. Data

In the analysis the main variables of interest are the unemployment rate and the employment-population rate (employment as a percentage of the population) as dependent variable in our analysis. There is a simple relationship between employment-population rate $ep$, labor force participation rate $l$ and unemployment rate $u$:

$$ep = l(1 - u) \tag{3}$$

This relationship can be considered from two perspectives. The first perspective is the point of view of a definition. Then, conditional on a constant labor force participation rate a fall in the unemployment rate by definition implies a rise in the employment-population rate. If the unemployment rate goes down and the employment-population rate remains constant then by definition the labor force participation rate must have gone down. The second perspective on this equation is the point of view of measurement. If unemployment refers to 'open' unemployment and excludes unemployment in active labor market policies then a fall in unemployment might concern a spurious fall (Scarpetta, 1996). In this case the employment-population rate is a better indicator of labor market performance. The OECD has systematic information about ALMP since 1985. Therefore, in the analysis we use data from 20 OECD countries on the period 1985-99. An overview of the dependent variables in our analysis, the unemployment rate and the employment-population rate, is given in Table 1. As shown over the period of analysis there is a wide variation in the unemployment rate ranging from a low 2% in Switzerland to as high as 15.4% in Spain. Also in terms of employment-population rate there are big differences across countries from as low as 66.7% in Belgium to as high as 95.8% in Switzerland.

We estimate the parameters of equation (1), where we investigate the effects of the two labor market institutions, namely union density and unemployment benefits.[6] Table 1 gives an overview of country averages for these labor market institutions. Union density has a wide range from a low 10.7% in France to a high 86.9% in Sweden. As shown unemployment benefits - in terms of replacement rate - vary from a low 10.4% in Japan to a high 56.9% in Denmark. Finally, tax rates vary from a low 29.6% in the United States to a high 57% in Sweden. Table 1 also gives an overview of expenditures on ALMP. Here too, there is a wide variation going from a low 0.21% of GDP in the US to a high 2.26% of GDP in Sweden.

In the OECD statistics concerning ALMP the following categories of expenditures are distinguished:

1. Labor market training: training for unemployed adults and those at risk, training for employed adults; includes both course costs and subsistence allowances, but special training programs for youth and disabled are excluded.

2. Subsidized employment: targeted measures to promote or provide employment for the unemployed and other priority groups (but not youth and the disabled); concerns wage subsidies paid to private sector firms to encourage the recruitment of targeted workers or continued employment of those whose jobs are at risk and concerns support of unemployed persons starting enterprizes and direct job creation (in public or non-profit organizations) to benefit the unemployed.

3. Public employment services (PES) and administration: placement, counselling and vo-

[6] As will be described below we also investigated the effects of taxes but did not find any effect on our variables of interest. Furthermore, we investigated the effects of employment protection and coverage of collective bargaining but found no significant results either. This may be due to the fact that employment protection and coverage do not change much over time while the cross-sectional variation is picked up by country fixed effects. Studies like for example Belot and Van Ours (2001, 2004) and Nickell et al. (2002) do find significant effects of employment protection and bargaining variables, but they consider a much longer calendar time period (from 1960 onwards).

cational guidance, job-search courses, assistance with displacement costs, administering unemployment benefits, all other administration costs of labor market agencies including running labor market programs.

4. Youth measures: special programs concerning measures for unemployed and disadvantaged youth, support of apprenticeship and related forms of general youth training.

5. Measures for the disabled: special programs concerning vocational rehabilitation and work for the disabled.

The last two categories refer to specific groups of workers. Therefore, we focus on the first three categories: training, PES and subsidized jobs. The expenditures are measured as a percentage of GDP and as shown in Table 2 there are clear differences between countries. Whereas Japan only spends 0.30% of GDP on labor market training, Sweden spends 0.63%. While the US spends 0.7% of GDP on PES and countries like Greece, Portugal and Spain spend 0.9% of GDP on this ALMP, The Netherlands spend 0.36% of their GDP on PES. Also with respect to expenditures on subsidized jobs the differences between countries are quite large. The US spend 0.1% of GDP on subsidized jobs, while Belgium spends 0.72 % of their GDP on subsidized jobs. These differences appear both in terms of levels as well as developments. In Denmark for example public expenditures on labor market training went up from 0.37% in the second half of the 1980s to 0.99% in the second half of the 1990s. In the same time in Ireland these expenditures went down from 0.53% to 0.21%. In Sweden the expenditures first went up from 0.51% in the second half of the 1980s to 0.82% in the early 1990s and went back again to 0.55% in the second half in the 1990s. At the lower end for example is Japan where the expenditures on labor market training stayed constant at a low level of 0.03%. Similar differences occur with respect to the public expenditures on subsidized jobs. In Belgium these expenditures were always at a high 0.6-0.8% of GDP while in Ireland and Sweden there was a major increase from about 0.25% in the second half of the 1980s to 0.8-0.85% in the second half of the 1990s.

### 3.2. Parameter estimates

As indicated before, in the analysis of how ALMP affect the unemployment rate (and the employment-population rate) an important problem, perhaps the main problem, is the possible endogeneity of ALMP. ALMP may have a negative effect on the unemployment rate but increasing unemployment may induce the government to expand expenditures on ALMP. The endogeneity problem also arises from the normalization of the ALMP-expenditures. If unemployment increases and there is a less than proportional increase in ALMP-expenditures a spurious negative correlation between the normalized ALMP-variable and the unemployment rate is introduced. As is clear from the literature overview there is no standard solution to the endogeneity problem. We will use two different solutions. First, we use country-specific averages of the ALMP-variable (over the period of analysis). Since these are time invariant there is no endogeneity bias. Second, we use the shares of separate ALMP categories in total expenditures as explanatory variables. Whereas the level of expenditures may be subject to an endogeneity bias the shares are not.

We start our analysis using ALMP-variables that are time invariant in order to avoid the endogeneity problem.[7] As explanatory variables we use normalized expenditures as in (2). These normalized total expenditures on ALMP are shown in Table 3. Again there are clear differences between countries, which are even larger than before normalization. We investigate the effects of labor market training, PES, and subsidized jobs separately. Because the ALMP expenditures are constant and country-specific we cannot use fixed effects. Using random effects might lead to biased parameter estimates in case the random effects are correlated with the other explanatory time varying explanatory variables. To investigate whether it is efficient to use random effects we use the Hausman test.

The first parameter estimates are shown in the upper part of Table 3. The first column shows that union density and unemployment benefits have a positive effect on the unemployment rate. The Hausman-test indicates that we cannot reject the hypothesis that the random effects and the time varying explanatory variables are uncorrelated. This allows us to estimate the effects

[7]Note that in this case country specific differences in other policies that are correlated with the ALMP-policies will influence the estimated parameters. In other words, for countries that spend a lot of money on general education and on labor market training part of the estimated effect of training may be due to expenditures on general education

of the ALMP categories. The effect on unemployment of labor market training and PES is negative, the effect of subsidized jobs is small and insignificantly different from zero. As expected the change in inflation has a negative effect on the unemployment rate. The second column of Table 3 shows the parameter estimates for the employment-population rate. By and large, they show the mirror image of the upper part. Now, unemployment benefits and union density have a negative effect, while labor market training has a clear positive effect. The effects of PES and subsidized jobs are also positive but insignificantly so. The parameter estimates indicate that expenditures on labor market training have a significant negative effect on the unemployment rate as well as a significant positive effect on the employment-population rate. For the expenditures on PES the results are less clear. There is a significant negative effect on unemployment and no effect on the employment-population rate. This means that expenditures on PES have a negative effect on the labor force participation rate. The decline in open unemployment is due to transition of unemployed to ALMP. An alternative explanation is that there is no true effect of expenditures on PES because the employment-population rate is a better indicator of labor market slack than the unemployment rate. For subsidized jobs we find that they do not have a negative effect on the unemployment rate, nor do they have a positive effect on the employment-population rate.

It is sometimes advocated that ALMP serve as an incentive mechanism in case the replacement rate is high (Nickell and Layard, 1999). This could explain why in Nordic countries where the replacement rate is high also a lot of money is spend on ALMP.[8] To investigate this in more detail we allow for an interaction term between unemployment benefits and ALMP-expenditures to affect the variables of interest. Because this interaction term is time varying we use country-specific fixed effects in our estimates. It turns out that this interaction is not significantly different from zero for expenditures on PES and subsidized jobs. However, as shown in the third and fourth column of Table 3 the interaction between unemployment benefits and expenditures on labor market training does affect the labor market outcomes. For the unemployment rate the interaction term of labor market training and unemployment benefits has a

[8]As Kluve and Schmidt (2002) indicate a high unemployment benefit replacement rate is typical for countries with intense ALMP in operation.

negative effect. This implies that the unemployment reducing effect of labor market training is larger when unemployment benefits are high. For the employment-population rate we again find the mirror image; the effect of labor market training is larger when unemployment benefits are high.

As an alternative way to account for the potential endogeneity of ALMP-expenditures we introduce the shares of expenditures as explanatory variables and use the time invariant expenditures on the sum of training, PES and subsidized jobs to scale the expenditure shares. The share of expenditures on labor market training is defined as:

$$str_{i,t} = \frac{tr_{i,t}}{al_{i,t}}\overline{al}_i \tag{4}$$

where $al$ is the sum of the expenditures on training, employment services and subsidized jobs and $\overline{al}_i$ is the average of this variable over the period. The share of expenditures on PES is defined accordingly. By nature the share of expenditures is not influenced by any endogeneity bias. And, the time series variation allows us to use country-specific fixed effects.[9] The lower part of Table 3 shows the parameter estimates. The effects of unemployment benefits and union density are similar as before. The first column shows that the share of expenditures on labor market training has a negative effect on the unemployment rate. For the share of expenditures on PES we also find a negative effect, but the relevant parameter is insignificantly different from zero. The parameter estimates for the employment-population rate show the mirror image; the effect of labor market training is significantly positive while the effect of PES is not significantly different from zero, at a 5% level of significance. So, again the parameter estimates indicate that labor market training is the most effective ALMP in terms of the aggregate labor market outcome. The expenditures on PES are less effective, but better than those on subsidized jobs. Introducing the interaction between the share of expenditures on labor market training and unemployment benefits we again find a significant negative effect. Here too, the parameter estimates for the employment-population rate show the mirror image; the interaction between training and unemployment benefits is significantly positive.

[9]Note that by definition the sum of the expenditure shares is equal to 1, so we cannot estimate the separate effects of all three shares. What we estimate is the relative effects of training and PES, relative to subsidized jobs.

To give some idea about the size of the effects we use the parameters in the first column of the upper part of Table 3 as basis for some calculations. The starting point is a labor market where the unemployment rate is 8.0%, the labor force participation rate is 70% and expenditures on labor market training are 0.25% of GDP.[10] If the expenditures on labor market training increase to 0.25% of GDP the unemployment rate goes down to 7.7% in the short run. And, because the decline in unemployment increases the effect of the labor market training expenditures in the long run the unemployment rate goes down to 6.8%. This is quite a large effect and could have to do with country specific correlation between training expenditures and other policy measures that reduce unemployment. If we take the parameters in the first column of the lower part of Table 3 as basis for the same calculations we find that an increase in the training expenditures from 0.2% to 0.25% of GDP reduces the unemployment rate from 8.0% to 7.7% in the short run and to 7.6% in the long run.[11]

### 3.3. Sensitivity analysis

The general results of the estimates are clear. To investigate the sensitivity of the parameter estimates we performed additional analyses.[12] In addition to the analysis with country specific ALMP-averages based on yearly data we also used 5-years averages to perform the same analysis. In the literature this is done to smoothen the cyclical effects. Table 4 shows the parameter estimates. This additional analysis basically confirms the estimation results based on annual data; labor market training is influencing both the unemployment rate and the employment-population rate, PES influence only the unemployment rate and expenditures on subsidized jobs do not seem to have an effect.

[10]Note that the sample averages are 8.1% for the unemployment rate, 71.8% for the labor force participation rate and 0.25% of GDP for labor market training expenditures.

[11]Because the ALMP variables in the lower part of Table 3 are time varying they are less sensitive to country-specific correlations in different types of policies affecting unemployment. Therefore, the latter estimates are probably more reliable than the previous estimates.

[12]In addition to the analyses presented here we also checked whether accounting for autocorrelation affects the parameter estimates. While this has some influence on the parameter estimates for union density and unemployment benefits it basically does not alter the parameter estimates for the ALMP-categories. We also checked whether the exclusion of some countries (in particular Sweden) alters our estimation results. This turns out not to be the case.

We also investigated whether unemployment rates and employment rates of males and females are affected in a different way. Table 5 shows the parameter estimates for males; Table 6 shows the parameter estimates for females. The basic set-up of these tables is the same as Table 3. The main differences between males and females are the following. The effect of unemployment benefits on the unemployment rate is larger for females than for males. Union density has a negative effect on the employment-population rate of females and no significant effect for males. Concerning the ALMP training seems to be more efficient for females than for males. Expenditures on public employment services lower the unemployment rate for both males and females but only have a positive effect on the employment-population rate of males.[13]

## 4. The model

In the empirical analysis, we have focused on three types of ALMP: training of unemployed workers (TU), subsidized employment (SE) and public employment services (PES). This section introduces a theoretical model that helps in understanding the following main results from the empirical analysis. First, the observation that TU does very well in reducing unemployment and increasing the employment-population rate. Second, the observation that SE and PES are not so effective in reducing unemployment and rather ineffective in raising the employment-population rate. Finally, the model gives an explanation for the interaction effect of unemployment benefits and TU on the unemployment rate.

The relationships between specific types of ALMP and parameters in the theoretical model are the following. The effect of training is modelled as a subsidy to training costs of unemployed workers. The effect of employment services is modelled as a subsidy to search costs of workers. Finally, the subsidized employment is modelled as a subsidy for the value of the match of low productive jobs.

[13] Martin and Grubb (2001) indicate that the effect of different ALMP are gender-specific. They indicate for example that formal class-room training and on-the-job training appears to help for female entrants to the labor market but does not seem to help for prime-age men. They also indicate that job-search assistance appears to help most unemployed but in particular, women and sole parents.

The model introduces two channels through which ALMP can potentially reduce unemployment. First, government measures can increase the job finding rate, that is the speed with which the unemployed flow into employment. Second, through training the unemployed can get better jobs. In particular, we assume that high skilled jobs pay a higher wage and are less likely to be destroyed. Hence if ALMP causes more unemployed to end up in high skilled jobs, it reduces unemployment by decreasing the flow from employment to unemployment. It turns out that the effects of ALMP on the job finding rate are ambiguous theoretically. Moreover, we know from micro studies that the effects on the job finding rate are very small indeed. Hence we focus on the mechanism via the quality of the job and the flow from employment to unemployment. Focussing on this effect, we can explain the three basic empirical findings mentioned above including the interaction effect of unemployment benefits and TU on the unemployment rate.

In our model, an agent who is unemployed has to decide on two things: search intensity $s$ and training intensity $e$. Search intensity $s$ for a worker yields a disutility of $\gamma(s)$ and a probability of finding a job of $sm(\theta)$, where $m(\theta)$ denotes the rate with which a worker is matched with a firm as a function of labor market tightness. Labor market tightness $\theta$ is defined as the ratio of vacancies $v$ over effective search by the unemployed $u$: $\theta \equiv \frac{v}{su}$. Training intensity $e$ yields a disutility $\chi(e)$ and (conditional on finding a job) a high productivity job with probability $e \in \langle 0, 1 \rangle$ and a low productivity job with probability $1-e$, where $\chi(0) = 0, \chi'(e) > 0, \chi''(e) > 0$ and $\chi'(0) = 0$. The search effort function $\gamma(s)$ features $\gamma(0) = 0, \gamma'(s) > 0, \gamma''(s) > 0$ and $\gamma'(0) = 0$. These are fairly standard assumptions for disutility functions.

Let $y_h$ ($y_l$) denote a worker's output in the high (low) productivity job. Further, let $\delta_l$ denote the exogenous rate by which a low skilled match dissolves. We assume that the corresponding rate for a high skilled job is smaller, $\delta_h < \delta_l$.[14] Finally, $\varepsilon \geq 0$ denotes the exogenous probability that a worker in a low productivity job, through learning by doing, ends up in a high productivity job.

[14]This is consistent with empirical evidence that job separation rates decline with the skill of workers (see for example OECD (1997)).

The Bellman equations for workers in this case become:

$$\rho V_u = \max_{s,e} \left\{ \begin{array}{c} b - \kappa - (1-\sigma_\gamma)\,\gamma(s) - (1-\sigma_\chi)\,\chi(e) \\ + sm\,(\theta)\,[eV_h + (1-e)\,V_l - V_u] \end{array} \right\} \tag{5}$$

$$\rho V_h = w_h + \delta_h\,(V_u - V_h) \tag{6}$$

$$\rho V_l = w_l + \varepsilon\,(V_h - V_l) + \delta_l\,(V_u - V_l) \tag{7}$$

where $V_u$ denotes the value of being unemployed, $V_h$ $(V_l)$ the value of having a high (low) productivity job. The policy instruments $\sigma_\gamma, \sigma_\chi \in [0,1]$ denote the reduction in search costs due to PES and the reduction in workers' training costs due to TU. The parameter $\kappa \geq 0$ denotes the negative effect of being in an ALMP programme. This can be a stigma effect or the disutility of being monitored in a training or PES programme. Hence $\kappa = 0$ if the worker does not participate in such programmes.

The value of being unemployed $\rho V_u$ equals the sum of four terms. There is unemployment benefit level $b$ reduced by the effort costs of search and training and the stigma disutility if the worker participates in ALMP. Then there is the probability $sm(\theta)$ of finding a job and leaving unemployment. With probability $e$ $(1-e)$ the worker finds a high (low) productivity job with corresponding expected discounted profits $V_h$ $(V_l)$. The value of having a high productivity job $\rho V_h$ equals the wage $w_h$ you earn until (with probability $\delta_h$) the match is dissolved and you become unemployed again. The value of a low productivity job $\rho V_l$ is comparable except that now there is a probability $\varepsilon$ that by learning by doing the low productivity job turns into a high productivity job.

The participation of agents in the labor market is determined by the value of their outside opportunities $\omega$. Outside opportunities include value of leisure, home production, taking care of the children etc. We assume that $\omega$ is distributed on $[\underline{\omega}, \bar{\omega}]$ with distribution function $F(\omega)$ and we normalize the size of the population at 1 (i.e. $F(\bar{\omega}) = 1$). An agent only joins the labor market if the value of doing so exceeds the outside opportunity of staying at home: $\rho V_u \geq \omega$.[15] It follows that the participation rate (fraction of the population participating in the labor market) is given by $l = F(\rho V_u)$. Further total unemployment is given by $F(\rho V_u)\,u$ and the

[15] Hence we assume that people cannot find a job right away when they are outside of the labor force. If an agent wants to work, he first becomes unemployed and then finds a job. Because of this assumption, the relevant comparison is between $\omega$ and $\rho V_u$.

employment population rate equals $ep = F(\rho V_u)(1-u)$.

Turning to the other side of the labor market, the Bellman equations for firms can be written as follows.

$$\rho J_v = -c + \frac{m(\theta)}{\theta}\left(eJ_h + (1-e)J_l - J_v\right) \tag{8}$$

$$\rho J_h = y_h - w_h + \delta_h (J_v - J_h) \tag{9}$$

$$\rho J_l = y_l + \sigma_{y_l} - w_l + \varepsilon (J_h - J_l) + \delta_l (J_v - J_l) \tag{10}$$

where $J_v$ is the value for a firm of posting a vacancy, $J_h$ ($J_l$) denotes the value of the firm matched with a worker in the high (low) productivity state. The cost of opening a vacancy equals $c$. The probability that the firm's vacancy is matched with a worker equals $\frac{m(\theta)}{\theta}$ and is decreasing in tightness $\theta$. The probability that a vacancy is matched with a high (low) skilled worker equals $\frac{m(\theta)}{\theta}e$ ($\frac{m(\theta)}{\theta}(1-e)$). The probabilities $\delta_l, \delta_h$ and $\varepsilon$ are the same as the ones above in the worker's problem. The job subsidy given by the government takes the form here of increasing the value of the match in the low productivity state by $\sigma_{y_l}$. We assume that the government does not subsidize high productivity jobs, as indeed governments target such subsidies at the bottom of the labor market. As usual, we assume that there is free entry in posting vacancies and hence $J_v = 0$.

Finally, we have the following equations of motion for the unemployment rate, percentage of participating workers in high productivity jobs and low productivity jobs.

$$\dot{u}_t = \delta_h n_{ht} + \delta_l n_{lt} - s_t m(\theta_t) u_t \tag{11}$$

$$\dot{n}_{ht} = -\delta_h n_{ht} + \varepsilon n_{lt} + s_t m(\theta_t) e_t u_t \tag{12}$$

$$n_{lt} = 1 - (u_t + n_{ht}) \tag{13}$$

Note that because of the assumption of linear vacancy costs, the size of the labor market $F(\rho V_u)$ has no effect on the unemployment and employment rates. In steady state the unemployment rate is given by

$$u = \frac{1}{1 + \frac{sm(\theta)}{\delta_h(\varepsilon+\delta_l)}\left(\delta_h + \varepsilon + e(\delta_l - \delta_h)\right)}$$

Hence an increase in the job finding rate $sm(\theta)$ and in the training effort $e$ reduce the steady state unemployment level. The former through increasing the flow from unemployment to employment, the latter through reducing the flow in the opposite direction.

### 4.1. Solving the model

In this section we solve the model for search effort $s$, training effort $e$ and the participation rate $F(\rho V_u)$. To do this we start by deriving the wages for high and low productivity jobs.

We assume that workers and firms Nash bargain about the wage in each state. That is $w_h$ and $w_l$ solve respectively

$$\max_{w_h} (V_h - V_u)^{1-\beta} (J_h)^{\beta}$$
$$\max_{w_l} (V_l - V_u)^{1-\beta} (J_l)^{\beta}$$

This leads to the following well known expressions for the wage rates.

**Lemma 1** *The wages equal*

$$w_h = (1-\beta) y_h + \beta\rho V_u \quad (14)$$
$$w_l = (1-\beta)(y_l + \sigma_{y_l}) + \beta\rho V_u \quad (15)$$

With these wages, we can determine $V_u, V_h, V_l, J_h$ and $J_l$. The next result shows the equations determining $s, e, \rho V_u$ and $\theta$.

**Lemma 2** *The first order conditions for training and search intensity of an individual can be written as*

$$(1-\sigma_\chi)\chi'(e) = sm(\theta)(1-\beta)\left[\begin{array}{c}\frac{\frac{\rho+\delta_l}{\rho+\delta_h} y_h - \left(y_l+\sigma_{yl}\right)}{\rho+\delta_l+\varepsilon} - \\ \frac{V_u}{1-\beta}\frac{\beta\rho+\delta_h}{\rho+\varepsilon+\delta_l}\left(\frac{\beta\rho+\delta_l}{\beta\rho+\delta_h} - \frac{\rho+\delta_l}{\rho+\delta_h}\right)\end{array}\right] \quad (16)$$

$$(1-\sigma_\gamma)\gamma'(s) = (1-\beta)m(\theta)\left[\frac{y_h - \rho V_u}{\rho+\delta_h} + (1-e)\left[\begin{array}{c} -\frac{\frac{\rho+\delta_l}{\rho+\delta_h} y_h - \left(y_l+\sigma_{yl}\right)}{\rho+\delta_l+\varepsilon} + \\ \frac{V_u}{1-\beta}\frac{\beta\rho+\delta_h}{\rho+\varepsilon+\delta_l}\left(\frac{\beta\rho+\delta_l}{\beta\rho+\delta_h} - \frac{\rho+\delta_l}{\rho+\delta_h}\right)\end{array}\right]\right] \quad (17)$$

*The value of being unemployed is determined by*

$$\rho V_u = \max_{s,e} \left\{ \begin{array}{c} b - (1-\sigma_\gamma)\,\gamma(s) - (1-\sigma_\chi)\,\chi(e) - \kappa + \\ sm(\theta)\,(1-\beta)\left[\frac{y_h - \rho V_u}{\rho+\delta_h} + (1-e)\left[\begin{array}{c} -\frac{\frac{\rho+\delta_l}{\rho+\delta_h} y_h - (y_l + \sigma_{yl})}{\rho+\delta_l+\varepsilon} + \\ \frac{V_u}{1-\beta}\frac{\beta\rho+\delta_h}{\rho+\varepsilon+\delta_l}\left(\frac{\beta\rho+\delta_l}{\beta\rho+\delta_h} - \frac{\rho+\delta_l}{\rho+\delta_h}\right) \end{array}\right]\right] \end{array} \right\} \tag{18}$$

*Finally, labor market tightness is determined by*

$$\theta = \frac{\beta\,(1-\sigma_\gamma)}{(1-\beta)\,c}\gamma'(s) \tag{19}$$

As one can verify, these equations follow from the Bellman equations above. First, consider the effects of the instruments $\sigma_\gamma, \sigma_\chi$ and $\sigma_{yl}$ on the job finding rate $sm(\theta)$. We argue that these effects are theoretically ambiguous and therefore presumably not particularly strong. As $\sigma_\gamma$ is raised, the marginal costs of search go down. Thus there is a tendency for the unemployed to search more. However, the rise in $\sigma_\gamma$ also reduces the level of search costs and hence raises the value of being unemployed. This leads to a locking in effect. As being unemployed is not so bad anymore, there is less incentive to escape unemployment through search and/or training. The locking in effect leads to lower search and training intensities which both tend to raise unemployment. A similar ambiguity is found in the case of TU. On the one hand, a rise in $\sigma_\chi$ reduces marginal training costs and hence stimulates training effort. Since this raises the probability of finding a high wage job, it also stimulates search. On the other hand, the following locking in effect is present. By reducing the level of training costs, the value of being unemployed goes up. This reduces the incentive to find a job. Finally, consider SE, parameterized here as a rise in $\sigma_{yl}$. This raises the pay off in low wage jobs and hence stimulates search. But by reducing the wage differential between high and low skilled jobs, it reduces training intensity. This decreases the probability of getting a high wage job, an effect that reduces search and the job finding rate.

These ambiguous theoretical effects of ALMP instruments on the job finding rate are reminiscent of empirical studies on micro data which do not find strong effects either of ALMP on the job finding rate.[16] Beside the ambiguous theoretical results above, another reason for such

[16] See for example Calmfors et al. (2001) and Martin and Grubb (2001). As indicated in the introduction there is hardly any evidence on the effects of ALMP on the job separation rate. Bonnal et al. (1997) find that some training courses reduce the job separation rate. Van Ours (2001) finds that short term wage subsidies reduce the job separation rate.

empirical findings can be that search is rather inelastic (i.e. $\gamma''(s)$ is big).

Since we do find in the data that some ALMP instruments reduce unemployment, but do not wish to rely on a theoretical explanation that is contradicted by micro evidence, we analyze the model above under the assumption that the effects on $sm(\theta)$ are small. Put differently, we assume that the effects of ALMP on the job finding rate are dominated by the effects outlined below which focus on the quality of the job found by the unemployed. To do this, we assume that search $\bar{s}$, tightness $\bar{\theta}$ and thus the job finding rate $\bar{s}m\left(\bar{\theta}\right)$ are exogenously fixed. The following proposition characterizes the effects of ALMP and unemployment benefits in this case. Proof of the proposition can be found in the appendix.

**Proposition 1** *For given job finding rate $\bar{s}m\left(\bar{\theta}\right)$, we find the following effects in the model:*
$\frac{\partial V_u}{\partial \sigma_\gamma}, \frac{\partial V_u}{\partial \sigma_\chi}, \frac{\partial V_u}{\partial \sigma_{yl}} > 0, \frac{\partial V_u}{\partial \kappa} < 0$ *and* $\frac{\partial V_u}{\partial b} > 0$;
$\frac{\partial e}{\partial \sigma_\gamma}, \frac{\partial e}{\partial \sigma_{yl}} < 0, \frac{\partial e}{\partial \sigma_\chi} > 0, \frac{\partial e}{\partial \kappa} > 0$ *and* $\frac{\partial e}{\partial b} < 0$;
$\frac{\partial u}{\partial \sigma_\gamma}, \frac{\partial u}{\partial \sigma_{yl}} > 0, \frac{\partial u}{\partial \sigma_\chi} < 0, \frac{\partial u}{\partial \kappa} < 0$ *and* $\frac{\partial u}{\partial b} > 0$;
$\frac{\partial((1-u)F(\rho V_u))}{\partial \sigma_\chi} > 0$;
*finally,* $\frac{\partial^2 u}{\partial \sigma_\chi \partial b} < 0$ *if* $\chi'''(e) > 0$ *is big enough.*

Hence all three programmes increase the value of being unemployed. However, if the programme causes a stigma effect, it reduces the value of being unemployed. Similarly, an increase in the unemployment benefit raises the value of being unemployed. These effects of $\sigma_\gamma$ and $\sigma_\chi$ on $V_u$ are the locking in effects described above.

Next consider the effects of the three instruments on training effort $e$ and thereby (since $\bar{s}m\left(\bar{\theta}\right)$ is given) on the unemployment rate. The effect on the unemployment rate has the opposite sign from the effect on training $e$ since more training leads to a higher probability of finding a high skilled job which has a lower separation rate. Hence unemployment goes down, as $e$ goes up by reducing the outflow from employment into unemployment.

An increase in $\sigma_\gamma$ does not directly affect the incentive to train, but it does raise the value of being unemployed. As the value of being unemployed is increased, getting a job with a higher separation rate is less of a problem. Hence the incentive to train is reduced. Via this mechanism PES raises unemployment. To the extent that participating in a PES programme introduces a stigma effect ($\kappa$ goes up), it tends to reduce unemployment by decreasing the value of being unemployed and therefore stimulating training.

Introducing SE for low skilled jobs, reduces the incentive to get a high skilled job by decreasing the wage differential. As shown in lemma 1, $w_h - w_l$ falls with $\sigma_{yl}$. Hence training effort goes down and unemployment goes up. It is not clear whether there would be a stigma ($\kappa$) effect in this case working in the opposite direction. Similarly, an increase in unemployment benefits reduces training and hence raises unemployment.

Further, consider the effect of TU on training intensity. By reducing the marginal costs of training, an increase in $\sigma_\chi$ raises training effort. On the other hand, $\sigma_\chi$ also reduces the level of training costs and hence raises the value of being unemployed. This tends to reduce training effort. As we show in the appendix, under the assumptions made above, the former effect always dominates the latter. The intuition for this is discounting ($\rho > 0$).[17] The direct reduction of marginal training costs due to the increase in $\sigma_\chi$ happens now and is not discounted. The increase in $V_u$ which reduces the future (after the worker has found a job) wage differential $w_h - w_l$ comes in in a discounted way and hence weighs less. Therefore the direct effect outweighs the indirect effect of $\sigma_\chi$. Hence, a rise in $\sigma_\chi$ stimulates training and reduces unemployment. And because $\sigma_\chi$ raises $V_u$ and thus the gross participation rate $F(\rho V_u)$, we find that TU unambiguously raises the employment population rate. In the other cases, we do not get such an unambiguous result. Not even if we use the stigma effect $\kappa$. The effect of $\kappa$ is to reduce $V_u$ and thereby stimulate training, but it also directly reduces participation $F(\rho V_u)$.

Summarizing, focussing on the quality of job and assuming that the effects of ALMP on the job finding rate are small, we find the following effects. First, TU by directly stimulating training effort and by raising the value of being unemployed unambiguously reduces the value of being unemployed and raises the employment-population rate. The direct effect of PES on training is to reduce it, thereby raising unemployment. If PES causes a stigma effect, it reduces the value of being unemployment, thereby stimulating training and reducing unemployment. However, the reduction in $V_u$ then reduces participation and hence we get an ambiguous effect

[17]Note that the proof in the appendix relies on the fact that $\frac{(1-\beta)\rho}{\rho+\delta_h} - \frac{\beta\rho+\delta_h}{\rho+\delta_l}\left(\frac{\beta\rho+\delta_l}{\beta\rho+\delta_h} - \frac{\rho+\delta_l}{\rho+\delta_h}\right) > 0$ which follows from $\rho > 0$.

on the employment-population rate. Indeed, in the data there is no strong positive effect of PES on the employment-population rate. The direct effect of SE on training is to reduce it and hence it tends to raise unemployment. But the effect on the employment-population rate is ambiguous, since SE raises $V_u$ and hence stimulates participation.

Finally, we find that an increase in $b$ makes the training subsidy more effective in reducing unemployment. The main effect is that by raising $b$, training effort goes down ($\frac{\partial e}{\partial b} < 0$) and therefore the unemployed moves to a part of the effort cost function $\chi(.)$ that is more elastic (here we use the assumption that $\chi'''(e) > 0$). This effect dominates other effects if $\chi'''(e)$ is big enough. The idea is that if the worker invests already a lot in training, a subsidy will increase this effort further but not by much. The marginal training costs are already so high, that further increases in effort are hard to realize. But higher unemployment benefits imply a lower training effort and hence there is more room to increase effort further. Another effect is that the effect of an increase in training $e$ on unemployment $u$

$$\frac{\partial u}{\partial e} = \frac{-\frac{sm(\theta)}{\delta_h(\varepsilon+\delta_l)}(\delta_l - \delta_h)}{\left(1 + \frac{sm(\theta)}{\delta_h(\varepsilon+\delta_l)}(\delta_h + \varepsilon + e(\delta_l - \delta_h))\right)^2}$$

is big in absolute value if the denominator is small. The denominator is small if $e$ is small, which is exactly what a high value of $b$ establishes. In other words, if $e$ is small, unemployment is rather high and reducing it is relatively easy. Hence for higher $b$ the increase in $e$ (due to a rise in $\sigma_\chi$) has a bigger effect on unemployment $u$.

The model does not distinguish between male and female agents, but in the data we find that the training programme is relatively more effective for women. The model suggests two ways in which we can interpret this difference. First, it may be the case that women have a low training effort level to start with. Then, as we showed above, there is more opportunity for an increase in effort and hence a training subsidy is more effective. One reason why women have a lower training effort may be because their job arrival rate $sm(\theta)$ is lower. If these women are re-entering the labor force, their lower work experience compared to men would reduce their job finding rate. Second, again using the idea that these women are re-entering the labor force, it may be the case that the women in the training programme are on average better educated than the men in the programme. For instance, women may use the training to get up to date again with their knowledge. This makes training very effective for them.

## 5. Conclusions

We present an empirical and a theoretical analysis of different types of active labor market policies intended to get unemployed back to work. In our empirical analysis we use data from 20 OECD countries on the period 1985-99 focusing on training, PES and subsidized jobs. We estimate the effects of these ALMP in the context of an equilibrium unemployment framework where other labor market institutions also affect unemployment. The results of our empirical analysis indicate that increases in union density and unemployment benefits cause a rise in unemployment. An increase in expenditures on both labor market training and PES cause unemployment to fall. To investigate the sensitivity of our results with respect to measurement problems concerning the unemployment rate we performed similar analyses using the employment-participation rate as dependent variable. We find that increases in union density and unemployment benefits cause the employment-population rate to fall while a rise in taxes has no significant effect. A rise in expenditures on PES has no significant effect on the employment-population rate while an increase in expenditures on labor market training causes the employment-population rate to increase. Expenditures on subsidized jobs do not affect the unemployment rate nor do they affect the employment-population rate. All in all, expenditures on labor market training seem to have a larger impact on the functioning of the labor market than expenditures on PES have. The effect of expenditures on labor market training is larger the higher unemployment benefits are. Expenditures on subsidized jobs seem a waste of money from the perspective of the aggregate labor market outcomes.

Our results are in line with previous studies on the effectiveness of ALMP based on macro studies. Other studies find that ALMP reduce unemployment. We add to this a distinction between different types of ALMP indicating that job training is most effective in reducing the unemployment rate and increasing the employment-population rate. In this respect there is a clear difference with micro based evaluation studies. To explain the dichotomy between empirical studies based on micro data that usually find small (if any) effects of training on the job finding rate and our empirical results we perform a theoretical analysis. In our theoretical search-matching model we investigate under which conditions it makes sense to introduce training programs and under which conditions alternative ways to build up human capital of unemployed workers should be preferred. We show that even if training does not influence the job finding rate it may still reduce the unemployment rate because of its effect on the job separation rate. By improving the quality of the match between worker and job the inflow into unemployment is reduced.

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## Appendix A. Data

All data are from the OECD labor market statistics.

1. Unemployment rate, employment population rate, labor force participation rate: concerns individuals aged 15 to 64 years.
2. (Trade) union density: For Australia, Canada, UK and US the numbers are based on surveys; for the other countries administrative data are used.
3. Unemployment benefits: OECD summary measure of benefit entitlements; this information is available every two years, for the years in between the average of the two adjacent years is used.
4. Taxes: General government current tax and non-tax receipts as a percent of nominal GDP.
5. Inflation: Consumer prices indices in percentage change from the previous period.
6. almp: public expenditures on labor market programs as a percentage of GDP.
7. Other information used concerns collective bargaining coverage, strictness of employment protection legislation.

## Appendix B. Proofs of the results in the main text

**Proof of proposition 1**

We derive here the results for the training subsidy $\sigma_\chi$, the other derivations are similar. We start with the effect of $\sigma_\chi$ on $V_u$ (for given $\bar{s}m\left(\bar{\theta}\right)$). Using the envelop theorem, we find the following expression

$$\frac{\partial V_u}{\partial \sigma_\chi} = \frac{\chi(e)}{\rho + \bar{s}m\left(\bar{\theta}\right)\left[\frac{(1-\beta)\rho}{\rho+\delta_h} - (1-e)\frac{\beta\rho+\delta_h}{\rho+\varepsilon+\delta_l}\left(\frac{\beta\rho+\delta_l}{\beta\rho+\delta_h} - \frac{\rho+\delta_l}{\rho+\delta_h}\right)\right]} > 0$$

The sign of this expression follows from the following inequalities:

$$\begin{aligned}
& \frac{(1-\beta)\rho}{\rho+\delta_h} - (1-e)\frac{\beta\rho+\delta_h}{\rho+\varepsilon+\delta_l}\left(\frac{\beta\rho+\delta_l}{\beta\rho+\delta_h} - \frac{\rho+\delta_l}{\rho+\delta_h}\right) \\
> \; & \frac{(1-\beta)\rho}{\rho+\delta_h} - \frac{\beta\rho+\delta_h}{\rho+\delta_l}\left(\frac{\beta\rho+\delta_l}{\beta\rho+\delta_h} - \frac{\rho+\delta_l}{\rho+\delta_h}\right) \\
= \; & \frac{(1-\beta)\rho}{\rho+\delta_h} - \left(\frac{\beta\rho+\delta_l}{\rho+\delta_l} - \frac{\beta\rho+\delta_h}{\rho+\delta_h}\right) \\
= \; & \frac{1}{\rho+\delta_h}\left[(1-\beta)\rho - (\beta\rho+\delta_l)\frac{\rho+\delta_h}{\rho+\delta_l} + \beta\rho + \delta_h\right] \\
= \; & \frac{\rho+\delta_h}{\rho+\delta_h}\left[1 - \frac{\beta\rho+\delta_l}{\rho+\delta_l}\right] > 0
\end{aligned}$$

Next we consider the effect of $\sigma_\chi$ on $e$.

$$(1-\sigma_\chi)\chi''(e)\frac{\partial e}{\partial \sigma_\chi} = \chi'(e) - \bar{s}m\left(\bar{\theta}\right)\frac{\beta\rho+\delta_h}{\rho+\varepsilon+\delta_l}\left(\frac{\beta\rho+\delta_l}{\beta\rho+\delta_h} - \frac{\rho+\delta_l}{\rho+\delta_h}\right)\frac{\partial V_u}{\partial \sigma_\chi}$$

Hence we find $\frac{\partial e}{\partial \sigma_\chi} > 0$ if and only if

$$\frac{\chi'(e)}{\chi(e)} > \frac{\bar{s}m\left(\bar{\theta}\right)\frac{\beta\rho+\delta_h}{\rho+\varepsilon+\delta_l}\left(\frac{\beta\rho+\delta_l}{\beta\rho+\delta_h} - \frac{\rho+\delta_l}{\rho+\delta_h}\right)}{\rho + \bar{s}m\left(\bar{\theta}\right)\left[\frac{(1-\beta)\rho}{\rho+\delta_h} - (1-e)\frac{\beta\rho+\delta_h}{\rho+\varepsilon+\delta_l}\left(\frac{\beta\rho+\delta_l}{\beta\rho+\delta_h} - \frac{\rho+\delta_l}{\rho+\delta_h}\right)\right]}$$

As shown above $\frac{(1-\beta)\rho}{\rho+\delta_h} > \frac{\beta\rho+\delta_h}{\rho+\varepsilon+\delta_l}\left(\frac{\beta\rho+\delta_l}{\beta\rho+\delta_h} - \frac{\rho+\delta_l}{\rho+\delta_h}\right)$ ,hence a sufficient condition for this inequality to hold is

$$\frac{\chi'(e)}{\chi(e)} > \frac{1}{1-(1-e)} = \frac{1}{e}$$

which holds because of the assumptions $\chi(0) = 0$ and $\chi''(e) > 0$ as can be seen as follows. Using a Taylor expansion we can write

$$\chi(0) = \chi(e) + \chi'(e)(0-e) + \frac{1}{2}\chi''(\zeta)(0-e)^2$$

for some $\zeta \in \langle 0, e\rangle$. Since $\chi(0) = 0$ and $\chi''(.) > 0$ we see that $\chi'(e)e > \chi(e)$ which is the required inequality.

Finally, consider the interaction effect. The effect of $b$ on $u$ can be written as

$$\frac{\partial u}{\partial b} = \frac{-\frac{sm(\theta)}{\delta_h(\varepsilon+\delta_l)}\left(\delta_l - \delta_h\right)}{\left(1 + \frac{sm(\theta)}{\delta_h(\varepsilon+\delta_l)}\left(\delta_h + \varepsilon + e\left(\delta_l - \delta_h\right)\right)\right)^2}\frac{\partial e}{\partial b} > 0$$

since $\frac{\partial e}{\partial b} < 0$. Differentiating this with respect to $\sigma_\chi$ yields

$$\begin{aligned}\frac{\partial^2 u}{\partial b \partial \sigma_\chi} &= 2u^3\left(\frac{sm\left(\theta\right)}{\delta_h\left(\varepsilon+\delta_l\right)}\left(\delta_l - \delta_h\right)\right)^2\frac{\partial e}{\partial b}\frac{\partial e}{\partial \sigma_\chi} \\ &\quad -u^2\frac{sm\left(\theta\right)}{\delta_h\left(\varepsilon+\delta_l\right)}\left(\delta_l - \delta_h\right)\frac{\partial^2 e}{\partial b \partial \sigma_\chi}\end{aligned}$$

since $\frac{\partial e}{\partial b} < 0$ and $\frac{\partial e}{\partial \sigma_\chi} > 0$ we find that a sufficient condition for $\frac{\partial^2 u}{\partial b \partial \sigma_\chi} < 0$ is that $\frac{\partial^2 e}{\partial b \partial \sigma_\chi} > 0$. This second (cross) derivative can be written as

$$\begin{aligned}\left(1-\sigma_\chi\right)\chi''\left(e\right)\frac{\partial^2 e}{\partial b \partial \sigma_\chi} &= \overbrace{\overbrace{\chi''\left(e\right)\frac{\partial e}{\partial b}}^{(a)}\overbrace{-\left(1-\sigma_\chi\right)\chi'''\left(e\right)\frac{\partial e}{\partial b}\frac{\partial e}{\partial \sigma_\chi}}^{(b)}} \\ &\quad \underbrace{-\bar{s}m\left(\bar{\theta}\right)\frac{\beta\rho+\delta_h}{\rho+\varepsilon+\delta_l}\left(\frac{\beta\rho+\delta_l}{\beta\rho+\delta_h} - \frac{\rho+\delta_l}{\rho+\delta_h}\right)\frac{\partial^2 V_u}{\partial b \partial \sigma_\chi}}_{(c)}\end{aligned}$$

where

$$\frac{\partial^2 V_u}{\partial b \partial \sigma_\chi} = -\left(\frac{\partial V_u}{\partial b}\right)^2 \bar{s}m\left(\bar{\theta}\right)\frac{\beta\rho+\delta_h}{\rho+\varepsilon+\delta_l}\left(\frac{\beta\rho+\delta_l}{\beta\rho+\delta_h} - \frac{\rho+\delta_l}{\rho+\delta_h}\right)\frac{\partial e}{\partial \sigma_\chi} < 0$$

because $\frac{\partial e}{\partial \sigma_\chi} > 0$. Hence the sign of $\frac{\partial^2 e}{\partial b \partial \sigma_\chi}$ is determined by three terms. The first, labelled $(a)$ is negative as $\frac{\partial e}{\partial b} < 0$. The second and third ($(b)$ and $(c)$ resp.) are positive. A sufficient condition for $(b)$ to dominate $(a)$ is that $\chi'''\left(e\right)$ is big. *Q.E.D.*

## Appendix C. Tables

**Table 1 Characteristics of labor markets; averages 1985-99 (%)[a)]**

| | $u$ | $ep$ | $ud$ | $ub$ | $\tau$ | $almp$ |
|---|---|---|---|---|---|---|
| **1. Australia** | 8.3 | 77.9 | 37.4 | 25.5 | 32.3 | 0.48 |
| **2. Austria** | 3.5 | 77.9 | 43.1 | 29.2 | 47.5 | 0.35 |
| **3. Belgium** | 8.2 | 66.7 | 51.7 | 40.9 | 45.6 | 1.31 |
| **4. Canada** | 9.4 | 75.3 | 34.2 | 28.8 | 39.4 | 0.55 |
| **5. Denmark** | 6.4 | 81.5 | 75.1 | 56.9 | 54.7 | 1.46 |
| **6. Finland** | 9.8 | 71.5 | 74.9 | 38.0 | 49.4 | 1.31 |
| **7. France** | 8.9 | 68.6 | 10.7 | 36.9 | 46.2 | 1.05 |
| **8. Germany** | 6.5 | 75.8 | 30.6 | 28.2 | 42.4 | 1.18 |
| **9. Greece** | 5.8 | 70.7 | 28.3 | 15.7 | 34.6 | 0.33 |
| **10. Ireland** | 13.3 | 69.5 | 56.1 | 28.8 | 37.8 | 1.47 |
| **11. Japan** | 2.9 | 86.9 | 25.1 | 10.4 | 30.3 | 0.28 |
| **12. Netherlands** | 5.9 | 75.3 | 25.4 | 50.6 | 44.9 | 1.40 |
| **13. New Zealand** | 7.0 | 78.4 | 38.9 | 30.6 | 42.4 | 0.81 |
| **14. Norway** | 4.3 | 81.3 | 56.4 | 39.3 | 50.0 | 0.88 |
| **15. Portugal** | 4.8 | 79.1 | 32.6 | 34.2 | 35.9 | 0.66 |
| **16. Spain** | 15.4 | 66.6 | 15.1 | 32.7 | 36.5 | 0.62 |
| **17. Sweden** | 6.3 | 77.3 | 86.9 | 28.2 | 57.0 | 2.26 |
| **18. Switzerland** | 2.0 | 95.8 | 23.5 | 26.4 | – | 0.38 |
| **19. United Kingdom** | 9.6 | 76.8 | 36.1 | 18.3 | 37.5 | 0.58 |
| **20. United States** | 5.8 | 80.6 | 15.2 | 12.4 | 29.6 | 0.21 |

[a)] $u$ = unemployment rate (% of labor force), $ep$ = employment-population rate, $ud$ = union density, $ub$ = unemployment benefits, $\tau$ = tax rate, $almp$ = total expenditures on ALMP (% of GDP).

[b)] Taxes in Spain 1995-99; ALMP expenditures for Denmark, Portugal, and United States 1986-99; for Greece 1985-98, for Ireland 1985-91 and 1994-96, for Japan 1987-99, for Sweden 1985-95, 1997-99.

**Table 2 Public expenditures on categories of ALMP; averages 1985-99 (% of GDP)[a]**

| | $tr$ | $pe$ | $sj$ | $ot$ | $almp$ | $almp*$[b] |
|---|---|---|---|---|---|---|
| **1. Australia** | 0.08 | 0.16 | 0.14 | 0.11 | 0.48 | 7.9 |
| **2. Austria** | 0.12 | 0.12 | 0.05 | 0.06 | 0.35 | 13.6 |
| **3. Belgium** | 0.24 | 0.19 | 0.72 | 0.16 | 1.31 | 18.6 |
| **4. Canada** | 0.26 | 0.21 | 0.04 | 0.03 | 0.55 | 7.9 |
| **5. Denmark** | 0.61 | 0.10 | 0.31 | 0.43 | 1.46 | 25.9 |
| **6. Finland** | 0.37 | 0.13 | 0.57 | 0.24 | 1.31 | 22.4 |
| **7. France** | 0.33 | 0.14 | 0.23 | 0.33 | 1.05 | 14.4 |
| **8. Germany** | 0.37 | 0.22 | 0.31 | 0.28 | 1.18 | 23.5 |
| **9. Greece** | 0.10 | 0.09 | 0.08 | 0.06 | 0.33 | 6.4 |
| **10. Ireland** | 0.40 | 0.20 | 0.42 | 0.46 | 1.47 | 16.2 |
| **11. Japan** | 0.03 | 0.18 | 0.07 | 0.01 | 0.28 | 13.4 |
| **12. Netherlands** | 0.25 | 0.36 | 0.13 | 0.66 | 1.40 | 31.3 |
| **13. New Zealand** | 0.37 | 0.12 | 0.20 | 0.12 | 0.81 | 17.5 |
| **14. Norway** | 0.19 | 0.14 | 0.14 | 0.41 | 0.88 | 26.9 |
| **15. Portugal** | 0.21 | 0.09 | 0.08 | 0.28 | 0.66 | 16.8 |
| **16. Spain** | 0.12 | 0.09 | 0.33 | 0.08 | 0.62 | 5.4 |
| **17. Sweden** | 0.63 | 0.25 | 0.50 | 0.88 | 2.26 | 70.1 |
| **18. Switzerland** | 0.06 | 0.10 | 0.16 | 0.18 | 0.38 | 27.0 |
| **19. United Kingdom** | 0.11 | 0.18 | 0.09 | 0.21 | 0.58 | 8.9 |
| **20. United States** | 0.07 | 0.17 | 0.01 | 0.07 | 0.21 | 4.8 |

[a] $tr$ = training, $pe$ = public employment services, $sj$ = subsidized jobs, $ot$ = other; see also footnote b of Table 1; the $sj$ expenditures for Switzerland: 1991-95, 1997-99

[b] Spending per unemployed person as a percentage of GDP per member of the labor force

**Table 3 Estimation results unemployment rate and employment-population rate, 1985-1999**[a)]

a. ALMP period averages

| | u | ep | u | ep |
|---|---|---|---|---|
| $ub$ | 0.083 (2.1) | -0.204 (3.7) | 0.414 (5.1) | -0.358 (3.3) |
| $ud$ | 0.041 (1.8) | -0.175 (5.6) | 0.096 (3.9) | -0.212 (6.9) |
| $\overline{tr}$ | -0.648 (2.0) | 1.916 (2.7) | - | - |
| $\overline{pe}$ | -1.027 (2.5) | 1.112 (1.2) | - | - |
| $\overline{sj}$ | 0.169 (0.5) | 0.266 (0.4) | - | - |
| $\overline{tr} * ub$ | - | - | -0.053 (4.3) | 0.031 (2.0) |
| $\Delta^2 p$ | -0.236 (3.3) | 0.129 (1.4) | -0.240 (3.4) | 0.155 (1.7) |
| | RE | RE | FE | FE |
| | $\chi^2$= 1.2 | $\chi^2$= 4.7 | | |

b. ALMP shares

| | u | ep | u | ep |
|---|---|---|---|---|
| $ub$ | 0.126 (2.8) | -0.270 (4.7) | 0.212 (4.0) | -0.360 (5.2) |
| $ud$ | 0.054 (2.2) | -0.194 (6.1) | 0.068 (2.7) | -0.208 (6.6) |
| $str$ | -0.328 (3.4) | 0.469 (3.8) | - | - |
| $spe$ | -0.134 (1.3) | 0.166 (1.3) | - | - |
| $str * ub$ | - | - | -0.010 (3.9) | 0.011 (3.5) |
| $\Delta^2 p$ | -0.257 (3.6) | 0.156 (1.7) | -0.249 (3.6) | 0.142 (1.6) |
| | FE | FE | FE | FE |

[a)] 300 observations for ALMP period averages and 278 observations for ALMP shares; RE = country random effects, FE = country fixed effects; absolute t-values in parentheses; the $\chi^2$-value represents the Hausman-test

**Table 4 Estimation results unemployment rate and employment-population rate; 5-year averages; 1985-1999[a)]**

a. ALMP period averages

| | u | ep | u | ep |
|---|---|---|---|---|
| $ub$ | 0.104 (1.7) | -0.199 (1.8) | 0.512 (2.8) | -0.426 (1.6) |
| $ud$ | 0.026 (0.7) | -0.097 (1.4) | 0.103 (1.9) | -0.228 (3.0) |
| $\overline{tr}$ | -0.589 (1.7) | 1.656 (2.2) | - | - |
| $\overline{pe}$ | -0.985 (2.4) | 1.112 (1.2) | - | - |
| $\overline{sj}$ | 0.153 (0.5) | 0.521 (0.1) | - | - |
| $\overline{tr} * ub$ | - | - | -0.0006 (2.4) | 0.0003 (1.0) |
| $\Delta^2 p$ | -1.235 (2.1) | 0.978 (1.1) | -1.372 (2.4) | 1.087 (1.3) |
| | RE | RE | FE | FE |
| | $\chi^2$= 4.0 | $\chi^2$= 4.1 | | |

[a)] 60 observations; RE = country random effects, FE = country fixed effects; absolute t-values in parentheses; the $\chi^2$-value represents the Hausman-test

**Table 5 Estimation results unemployment rate and employment-population rate; males, 1985-1999[a)]**

a. ALMP period averages

| | u | ep | u | ep |
|---|---|---|---|---|
| $ub$ | 0.056 (1.4) | -0.189 (3.3) | 0.355 (3.7) | -0.401 (3.2) |
| $ud$ | 0.036 (1.5) | -0.028 (0.8) | 0.064 (2.4) | -0.046 (1.3) |
| $\overline{tr}$ | -0.428 (1.5) | 0.541 (0.9) | - | - |
| $\overline{pe}$ | -0.854 (2.3) | 1.593 (2.0) | - | - |
| $\overline{sj}$ | 0.085 (0.3) | -0.087 (0.1) | - | - |
| $\overline{tr} * ub$ | - | - | -0.046 (3.5) | 0.032 (1.8) |
| $\Delta^2 p$ | -0.280 (3.7) | 0.245 (2.5) | -0.264 (3.5) | 0.321 (2.3) |
| | RE | RE | FE | FE |
| | $\chi^2$= 0.4 | $\chi^2$= 0.4 | | |

b. ALMP shares

| | u | ep | u | ep |
|---|---|---|---|---|
| $ub$ | 0.110 (2.3) | -0.254 (4.1) | 0.206 (3.6) | -0.346 (4.6) |
| $ud$ | 0.041 (1.6) | -0.023 (0.7) | 0.058 (2.2) | -0.048 (1.4) |
| $str$ | -0.400 (3.9) | 0.530 (4.0) | - | - |
| $spe$ | -0.204 (1.9) | 0.459 (3.3) | - | - |
| $str * ub$ | - | - | -0.011 (4.1) | 0.011 (3.2) |
| $\Delta^2 p$ | -0.307 (4.1) | 0.277 (2.9) | -0.296 (4.0) | 0.258 (2.6) |
| | FE | FE | FE | FE |

[a)] 300 observations for ALMP period averages and 278 observations for ALMP shares; RE = country random effects, FE = country fixed effects; absolute t-values in parentheses; the $\chi^2$-value represents the Hausman-test

**Table 6 Estimation results unemployment rate and employment-population rate; females, 1985-1999[a)]**

a. ALMP period averages

| | u | ep | u | ep |
|---|---|---|---|---|
| $ub$ | 0.125 (3.1) | -0.225 (3.3) | 0.473 (5.4) | -0.685 (5.5) |
| $ud$ | 0.058 (2.4) | -0.322 (8.2) | 0.098 (4.0) | -0.330 (8.2) |
| $\overline{tr}$ | -1.031 (2.4) | 3.304 (3.6) | - | - |
| $\overline{pe}$ | -1.303 (2.3) | 0.587 (0.5) | - | - |
| $\overline{sj}$ | 0.274 (0.6) | 0.608 (0.7) | - | - |
| $\overline{tr} * ub$ | - | - | -0.055 (4.5) | 0.081 (5.1) |
| $\Delta^2 p$ | -0.180 (2.5) | 0.004 (0.0) | -0.159 (2.3) | -0.025 (0.2) |
| | RE | RE | FE | FE |
| | $\chi^2$= 3.2 | $\chi^2$= 22.3 | | |

b. ALMP shares

| | u | ep | u | ep |
|---|---|---|---|---|
| $ub$ | 0.157 (3.4) | -0.298 (4.1) | 0.234 (4.4) | -0.388 (4.5) |
| $ud$ | 0.074 (3.0) | -0.367 (9.2) | 0.084 (3.4) | -0.368 (9.2) |
| $str$ | -0.237 (2.4) | 0.402 (2.6) | - | - |
| $spe$ | -0.003 (0.3) | -0.204 (1.2) | - | - |
| $str * ub$ | - | - | -0.008 (3.4) | 0.012 (2.9) |
| $\Delta^2 p$ | -0.194 (2.7) | 0.025 (0.2) | -0.190 (2.7) | 0.017 (0.2) |
| | FE | FE | FE | FE |

[a)] 300 observations for ALMP period averages and 278 observations for ALMP shares; RE = country random effects, FE = country fixed effects; absolute t-values in parentheses; the $\chi^2$-value represents the Hausman-test