Online appendix: active labour market policies in Germany: do regional labour markets benefit?

ARTICLE HISTORY
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Appendix A. Theoretical model

A.1. *Matching function*

As microeconometric evaluation studies have unanimously shown, (see e.g. Kluve 2006) there is a pronounced lock-in-effect whereby programme participants' search effectiveness decreases greatly (relative to that of the unemployed) during programme participation as they have much less time to actively look for a job. However, this may change towards the end of the programme and shortly after completion of the programme, when they should be more successful than similar non-programme participants in finding a job – at least if the programme is successful. For these reasons, we augment the standard matching function and define it as:[1]

$$M = m(U + sP, V_u + V_p), \qquad P = \sum_{z=1}^{Z} P_z \tag{A1}$$

with V_u and V_p as the vacancies posted for the unemployed and programme participants respectively. On the one hand, if a programme participant becomes unemployed directly after programme completion, he or she presumably has at least the same amount of time and effort which he or she can devote to searching for a job as an unemployed individual who has not completed such a measure. On the other hand, he or she obviously differs from an unemployed individual who has not participated in a programme due to the training he or she has received. Therefore, we interpret the search effectiveness s as an average search effectiveness which is valid for the time span from the beginning of programme participation until shortly after programme completion.

Although the unemployed have a higher search intensity, we assume that they also have a lower on-the-job productivity and, as they are presumably less flexible in a job, a higher probability of losing their job. Therefore, firms must decide whether to open up a vacancy V_u for the currently unemployed (and not about to enter an ALMP) or for those who are either currently in a programme or have just completed a programme V_p.[2] Hence, there are actually two types of job-seekers: first, those who are not about to complete or have not recently completed a programme (U); second, those who are either currently in a programme and those who are unemployed but have recently completed a programme (P).[3] It is assumed that the unemployed U have a higher search effectiveness but lower productivity, whereas the programme participants P have a lower average search effectiveness but are more productive and can be employed more flexibly within a firm in case the firm receives a negative shock.

[1] In order to simplify the notation and where no information is lost, we suppress the time index t.

[2] Obviously, firms will not write this in the job advertisement. However, it seems realistic to assume that firms will screen applications and only pick those that seem suitable for the job that they are offering.

[3] In the empirical analysis in Section 4 we differentiate between three groups and additionally distinguish between current and former programme participants.

The matching function (A1) is strictly increasing in its arguments. Labour market tightness is defined as $\theta = (v_u + v_p)/(u + sp)$, where variables in small letters are simply the stock variables relative to the size of the labour force L, e.g. $u = U/L$. The mass of job-seekers relative to the size of the labour force is the weighted sum of unemployed and programme participants, i.e. $u + sp$. The proportion of unemployed amongst this mass is denoted by $\phi = u/(u + sp)$, from which follows that the share of programme participants is given by $1 - \phi$. Given this and the above matching technology, firms will fill their vacancies with previously unemployed at the rate:

$$\frac{m\phi}{v_u + v_p} = m\left(\frac{1}{\theta}, 1\right) = \phi q(\theta) \tag{A2}$$

and at the rate

$$\frac{m(1-\phi)}{v_u + v_p} = m\left(\frac{1}{\theta}, 1\right) = (1-\phi) q(\theta) \tag{A3}$$

with people who are or were participating in a programme.

Denoting the share of vacancies for the unemployed by $\eta = v_u/(v_u + v_p)$ means that they find jobs at the rate:

$$\frac{m\eta}{u + sp} = \eta\theta q(\theta) \tag{A4}$$

and similarly, the rate for the programme participants is:

$$\frac{m(1-\eta)}{u + sp} = (1-\eta)\theta q(\theta) \tag{A5}$$

The properties of the matching function imply that the matching rate of workers (firms) is increasing (decreasing) in labour market tightness θ and further that $\lim_{\theta \to 0} q(\theta) = \lim_{\theta \to \infty} \theta q(\theta) = \infty$ and $\lim_{\theta \to \infty} q(\theta) = \lim_{\theta \to 0} \theta q(\theta) = 0$.

A.2. *Job creation*

Firms create new jobs as long as the expected returns are at least as high as the expected costs. It is assumed that output from a position that is occupied by a person coming directly out of unemployment is $y_u > 0$. When former programme participants are hired, output is y_p with $y_p > y_u$. To fill a new position, firms must first post a vacancy and engage in (costly) search equal to $c > 0$ per unit time. From above, the rate at which jobs find new workers is given by $q(\theta)$ with each firm taking labour market conditions, i.e. θ, as given.

Profit-maximization requires that the profit from an additional vacancy is zero. If $V_k, k \in \{p, u\}$ denotes the present discounted value of the expected profit from a vacancy and J_k the same value from an occupied job, then the intertemporal optimization solution for the vacancy-supply decisions is given by:

$$\rho V_u = -c + \phi q(\theta)(J_u - V_u) \tag{A6}$$

$$\rho V_p = -c + (1-\phi) q(\theta)(J_p - V_p) \tag{A7}$$

with ρ as the interest rate. As can be seen, this equation implies that the capital cost (l.h.s.) is equal to the expected return (r.h.s). Since in equilibrium all profit opportunities are exploited, the value of a vacancy must be zero, which implies:

$$J_u = \frac{c}{\phi q(\theta)} \tag{A8}$$

$$J_p = \frac{c}{(1-\phi)q(\theta)} \tag{A9}$$

i.e. that the expected profit from a new job equals the expected costs of hiring a new worker.

It is assumed that per unit time there is a constant probability that a job needs to be terminated due to negative idiosyncratic shocks. However, it is further assumed that people who were in a training programme are more skilled and therefore also more flexible as to which tasks they can perform within a firm. Therefore, if a job needs to be terminated, it is easier to transfer these people within the company than it is for those who were never in such a programme. Therefore, $\lambda_u > \lambda_p$ with $\lambda_k, k \in \{p, u\}$ as the respective job-destruction rate. Using this, the optimal asset value of an occupied job (again under the condition that the value of a vacancy is zero in equilibrium) is

$$\rho J_u = y_u - w_u - \lambda_u J_u \tag{A10}$$

$$\rho J_p = y_p - w_p - \lambda_p J_p \tag{A11}$$

where $w_k, k \in \{p, u\}$ is the wage paid to a worker of type k. Equations (A10) and (A11) imply that the capital costs of maintaining the job (l.h.s) are equal to the returns, which is the difference between the output the worker produces, his or her wage $w_k, k \in \{p, u\}$ and the probability that the job needs to be terminated.

From (A8), (A9), (A10) and (A11) it follows

$$y_u - w_u - \frac{(\rho + \lambda_u)c}{\phi q(\theta)} = 0 \tag{A12}$$

$$y_p - w_p - \frac{(\rho + \lambda_p)c}{(1-\phi)q(\theta)} = 0 \tag{A13}$$

A.3. *Workers*

Workers bargain with the firms they encounter over the wage level. The wage level they are willing to accept will depend on the income they receive during the search period and the expected income at other firms. It is assumed that a worker earns a fixed amount of (unemployment) benefits b whilst unemployed or in a programme. U_u and U_p denote the respective present discounted value of being unemployed or being in a programme. $W_k, k \in \{p, u\}$ is the value of being employed. From this, an equilibrium is characterized by

$$\rho U_u = b + \eta\theta q(\theta)(W_u - U_u) \tag{A14}$$

and similarly for programme participants

$$\rho U_p = b + (1-\eta)\theta q(\theta)(W_p - U_p) \tag{A15}$$

Employed workers earn a wage $w_k, k \in \{p, u\}$ but at each moment in time face the probability $\lambda_k, k \in \{p, u\}$ of losing their job. Of those laid off, a proportion ψ join the pool of unemployed and $(1-\psi)$ start an active labour market programme. However, the individual cannot influence this decision as the labour market institution which finances the programme determines who becomes a participant and who does not. Hence, the equilibrium conditions are:

$$\rho W_u = w_u + \lambda_u[\psi(U_u - W_u) + (1-\psi)(U_p - W_p)] \tag{A16}$$

and

$$\rho W_p = w_p + \lambda_p[\psi(U_u - W_u) + (1-\psi)(U_p - W_p)] \tag{A17}$$

Equations (A14) and (A16) can be combined to yield

$$\rho U_u = \frac{b(\rho + \psi\lambda_u) + \eta\theta q(\theta)[w_u + \lambda_u(1-\psi)(U_p - W_p)]}{\rho + \psi\lambda_u + \eta\theta q(\theta)} \tag{A18}$$

By analogy, the net difference in being employed as a former programme participant is

$$\rho U_p = \frac{b(\rho + (1-\psi)\lambda_p) + (1-\eta)\theta q(\theta)[w_p + \lambda_p\psi(U_u - W_u)]}{\rho + (1-\psi)\lambda_p + (1-\eta)\theta q(\theta)} \tag{A19}$$

A.4. *Wage determination*

Once a firm and suitable worker meet, they must agree on a wage. Each job-match yields an economic rent equal to the sum of the expected search costs of the firm and worker, respectively. This rent is shared according to the Nash-bargaining solution.

The wage rate will differ depending on the previous status of the worker as the time it takes to search for a new worker, the productivity of the worker and the expected job-termination date all depend on whether the worker was previously unemployed or in a programme.

The wage given by the Nash-bargaining solution maximizes the weighted product of the firms's and worker's net return from the match, where the weights are determined by the respective bargaining power of the negotiating parties, i.e.

$$w_k = \arg\max_{w_k} (W_k - U_k)^{\beta}(J_k - V_k)^{1-\beta}, \qquad k \in \{p, u\}$$

with β as the workers' bargaining power. From this it follows that

$$W_k - U_k = \beta(J_k - V_k + W_k - U_k), \qquad k \in \{p, u\} \tag{A20}$$

Inserting equations (A10), (A11) as well as (A16) and (A17) into the above equation yields:

$$w_u = \beta y_u + (1-\beta)\rho U_u + \frac{(1-\psi)\lambda_u[(1-\beta)\rho U_p + \beta y_p - w_p]}{\psi\lambda_p} \tag{A21}$$

for the unemployed and

$$w_p = \beta y_p + (1-\beta)\rho U_p + \frac{\psi\lambda_p[(1-\beta)\rho U_u + \beta y_u - w_u]}{(1-\psi)\lambda_u} \tag{A22}$$

for programme participants.

Inserting equations (A8) and (A14) into equation (A20) and noting that $V_k = 0$ in equilibrium yields

$$\rho U_u = b + \frac{\beta c\eta\theta}{\phi(1-\beta)} \tag{A23}$$

Similarly, from (A9), (A15) and (A20) it follows that

$$\rho U_p = b + \frac{\beta c(1-\eta)\theta}{(1-\phi)(1-\beta)} \tag{A24}$$

Combining (A21) with (A23) and (A24) means that the wage for the previously unemployed can be rewritten as:

$$w_u = \frac{1}{(1-\phi)\phi(\lambda_p(\beta\rho\psi-(1-\beta)\lambda_u-\rho)-\rho(\rho+\lambda_u(1-\beta(1-\psi))))}\times$$
$$\Big\{(\rho+\lambda_u)(\beta\phi\lambda_u(1-\psi)(c\beta\theta(1-\eta)-(y_p-b)(1-\phi)(1-\beta))-$$
$$(1-\phi)(c\beta\eta\theta+b\phi(1-\beta))((1-\beta\psi)\lambda_p+\rho)\big)-$$
$$\beta(1-\phi)\phi y_u(\rho(\rho+\psi\lambda_u)+\lambda_p(\rho(1-\beta\psi)+(1-\beta)\psi\lambda_u))\Big\} \quad \text{(A25)}$$

Similarly, the wage of former programme participants is

$$w_p = \frac{1}{\lambda_p(\rho+\lambda_u(1-\beta)-\beta\rho\psi)+\rho(\rho+\lambda_u(1-\beta(1-\psi)))}\times$$
$$\Big\{\beta y_p\big((1-\psi)\lambda_p(\rho+\lambda_u-\beta\lambda_u)+\rho(\rho+\lambda_u(1-\beta(1-\psi)))\big)+$$
$$\frac{(\rho+\lambda_p)\big(c\beta\theta(1-\eta)+b(1-\beta)(1-\phi)\big)(\rho+\lambda_u(1-\beta(1-\psi)))}{1-\phi}-$$
$$\frac{(\rho+\lambda_p)\beta\psi\lambda_p\big(c\beta\eta\theta-\phi(1-\beta)(y_u-b)\big)}{\phi}\Big\} \quad \text{(A26)}$$

A.5. *Labour market equilibrium*

The number of unemployed who find jobs in any arbitrary short time interval δt is given by $\eta\theta q(\theta)uL\delta t$. Due to adverse shocks, during the same time interval, a worker faces the exogenous probability of $\lambda_k\delta t, k \in \{p, u\}$ of losing his or her job. Therefore, per unit time the average number of workers who found a job directly out of unemployment but are now dismissed is

$$\phi(1-u-p)\lambda_u L\delta t \quad \text{(A27)}$$

In a steady-state equilibrium, these two flows must be equal, hence

$$\eta\theta q(\theta)uL = \phi(1-u-p)\lambda_u L$$

from which follows

$$u = \frac{\phi(1-p)\lambda_u}{\phi\lambda_u+\eta\theta q(\theta)} \quad \text{(A28)}$$

The analogous steady-state condition for programme participants is

$$p = \frac{(1-\phi)(1-u)\lambda_p}{(1-\phi)\lambda_p+(1-\eta)\theta q(\theta)} \quad \text{(A29)}$$

A.6. *Steady-State equilibrium*

The general equilibrium must simultaneously satisfy the job-creation conditions (A12) and (A13), the wage equations (A25) and (A26) and the labour market equilibrium conditions (A28) and (A29).

Of central interest here is what happens to the equilibrium unemployment rate if the (relative) number of programme participants is increased, i.e. ϕ decreases. This rate can be derived by first inserting (A29) into (A28) and solving for u, which yields:

$$u = \frac{(1-\eta)\phi\lambda_u}{\phi\lambda_u + \eta\lambda_p - \phi\eta(\lambda_p + \lambda_u) + (1-\eta)\eta\theta q(\theta)} \tag{A30}$$

from which the aggregate unemployment rate $\tilde{u} = \phi u + (1-\phi)p$ is determined as:

$$\tilde{u} = \frac{\eta\lambda_p(1-2\phi) + \phi^2(\eta(\lambda_p - \lambda_u) + \lambda_u)}{\phi\lambda_u + \eta\lambda_p - \phi\eta(\lambda_p + \lambda_u) + (1-\eta)\eta\theta q[\theta]} \tag{A31}$$

This equation symbolizes the Beveridge curve.

In the equilibrium, the share of unemployed amongst all job-seekers must be equal to the share of workers who are dismissed and subsequently do not participate in a programme, i.e. $\phi = \psi$. Noting this, the job-creation curve is derived by eliminating w_u and w_p from equations (A12), (A13), (A25) and (A26), which results in:

$$\begin{aligned}
&\frac{1}{q[\theta]\big(\lambda_p(\rho + (1-\beta)\lambda_u - \beta\rho\phi) + \rho(\rho + (1-\beta(1-\phi))\lambda_u)\big)} \times \\
&\Bigg\{\Big(\rho + \lambda_u\Big)\Big((c\rho + q[\theta](c\beta\eta\theta - \phi(1-\beta)(y_u - b)))(\rho + (1-\beta\phi)\lambda_p) + \\
&(c\rho(1-\beta(1-\phi)) + \beta\phi q[\theta]((1-\phi)(1-\beta)(y_p - b) - c\beta\theta(1-\eta)) + c(1-\beta)\lambda_p)\lambda_u\Big) - \\
&\Big(\rho + \lambda_p\Big)\Big(c\big(\lambda_p(\rho - \beta\rho\phi + (1-\beta)\lambda_u) + \rho(\rho + (1-\beta(1-\phi))\lambda_u)\big) + \\
&q[\theta]\big(\beta(1-\phi)(\phi(1-\beta)(y_u - b) - c\beta\eta\theta)\lambda_p + \\
&(c\beta\theta(1-\eta) + (1-\beta)(1-\phi)b)(\rho + (1-\beta(1-\phi))\lambda_u) - \\
&(1-\beta)(1-\phi)y_p(\rho + (1-\beta(1-\phi))\lambda_u)\big)\Big)\Bigg\} = 0
\end{aligned} \tag{A32}$$

The general equilibrium is found in the intersection of the Beveridge curve (A31) and the steady-state job-creation condition (A32). Unfortunately, there is no unique solution for labour market tightness θ. Hence, at least theoretically it is not possible to say whether putting more (unemployed) people into active labour market programmes will actually reduce the (local) unemployment rate or not.

Appendix B. Full results

Table B1.: Full estimation results – long-run coefficients

Dep. Variable: Log Matches	Model 1	Model 2	Model 3	Model 4
Lagged no. of matches	0.106***	0.105***	0.104***	0.077***
	(0.024)	(0.024)	(0.023)	(0.024)
Log no. of job-seekers	0.832***	0.827***	0.838***	0.877***
	(0.055)	(0.054)	(0.054)	(0.052)
Log no. of vacancies	0.064***	0.065***	0.070***	0.066***
	(0.015)	(0.015)	(0.014)	(0.014)

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Dep. Variable: Log Matches	Model 1	Model 2	Model 3	Model 4
Share of P and Q		-0.089		
		(0.122)		
Share of P			-0.580***	
			(0.144)	
Share of Q			0.837***	
			(0.227)	
Share of short-term voc. training P				-0.841***
				(0.288)
Share of short-term voc. training Q				-0.178
				(0.372)
Share of long-term voc. training P				-0.215
				(0.375)
Share of long-term voc. training Q				1.873**
				(0.299)
Share of wage subsidies P				-0.263
				(0.226)
Share of wage subsidies Q				4.225***
				(0.493)
Share of classroom training measures				0.063
				(0.284)
Share of in-firm training measures				2.611**
				(1.275)
Share of females amongst job-seekers	-1.026***	-1.018***	-0.983	-0.998***
	(0.194)	(0.191)	(0.188)	(0.182)
Share of under 25s amongst job-seekers	0.092	0.083	0.150	0.056
	(0.212)	(0.213)	(0.216)	(0.209)
Share of aged 50+ amongst job-seekers	-1.413***	-1.425***	-1.440***	-1.371***
	(0.261)	(0.262)	(0.261)	(0.248)
Share of non-natives amongst job-seekers	-2.857***	-2.855***	-2.874***	-2.685***
	(0.399)	(0.396)	(0.399)	(0.416)

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Dep. Variable: Log Matches	Model 1	Model 2	Model 3	Model 4
Share of workforce in establishments with 10–249 employees	1.591	1.581	1.580	1.139
	(1.437)	(1.436)	(1.411)	(1.318)
Share of workforce in establishments with 250+ employees	2.190*	2.196*	2.182*	1.767
	(1.281)	(1.278)	(1.261)	(1.201)
Share of females in workforce	-3.574***	-3.521***	-3.071**	-3.184**
	(1.353)	(1.342)	(1.309)	(1.244)
Share of employees in tertiary sector	2.006**	1.949**	1.707**	1.610**
	(0.871)	(0.861)	(0.852)	(0.814)
Share of (high-)skilled in workforce	2.966***	3.005***	2.764***	2.086***
	(0.685)	(0.691)	(0.669)	(0.680)
Share of unemployed receiving unemp. benefit II	-0.822***	-0.794***	-0.781***	-0.800***
	(0.149)	(0.156)	(0.151)	(0.143)
Share of employees in short-time work	-0.858***	-0.847***	-0.848***	-0.826***
	(0.256)	(0.254)	(0.248)	(0.233)
Unemployment growth rate in past 12 months	-0.190***	-0.194***	-0.207***	-0.195***
	(0.045)	(0.046)	(0.046)	(0.044)
Employment growth rate in past 12 months	0.016**	0.016**	0.016**	0.015**
	(0.007)	(0.007)	(0.007)	(0.006)
Current employment level relative to annual moving average	-8.518***	-8.478***	-8.385***	-8.035***
	(0.759)	(0.759)	(0.751)	(0.721)
Sargan test statistic	148.140	147.074	143.745	141.132
Sargan (p-value)	0.875	0.887	0.921	0.942
AR1 (p-value)	0.000	0.000	0.000	0.000
AR2 (p-value)	0.686	0.719	0.829	0.951

Note: Results are robust, one-step System GMM estimates. The standard errors (in parentheses) are calculated by the delta method. *** Significant at the 1%-level; ** Significant at the 5%-level; * Significant at the 10%-level. All models also include time and regional fixed-effects. For all regressions $N = 3168$.

Appendix C. Interpretation of the control variables

As the negative effect of the share of women among the job-seekers shows, women have more difficulties than men in finding new jobs. This could be due to the fact that, with the exception of the recession in 2009, our time span is characterized by a strong economic upturn in which men are traditionally more likely to find jobs (just as their chances of losing their jobs during a downturn are also higher). Older job-seekers and non-natives both have significantly lower chances of finding new jobs.

With regard to the regional economic structure, we find large (and significant) positive effects for the tertiary sector, (high-)skilled workers as well as for large establishments, (i.e. 250 or more employees). In the first two cases, this is plausible as both the tertiary sector and (high-)skilled employment have been growing steadily in the last years. The number of employees in the tertiary sector went down only slightly during the recession. With regard to large establishments, by definition they are likely to hire more people in a given time interval simply because of their large size. In contrast, we find a strong negative effect for the share of females employed in a region. This somewhat surprising result may be driven by the large differences in the female labour-force participation between eastern and western Germany. It seems plausible that within these two regions there is relatively small regional variation and that, hence, this variable is highly correlated with our regional structure.

The German labour market benefit system is divided into two main parts. We expect regions with a higher share of unemployed people subject to unemployment benefit II to also exhibit fewer matches as this is a sign of bad regional labour market conditions. This is confirmed by our regression results.

Germany's labour market proved to be very robust during the recession in 2009. One of the reasons for this was that many firms used short-time work measures which were heavily subsidized by the government and made it attractive for employers to reduce the number of hours a person worked without having to dismiss them. Although this measure helped keep many people in work, at the same time during the recession it was particularly difficult for an unemployed individual to find a new job. Again, this microeconomic finding is also confirmed at the regional level.

Not surprisingly, regions with high growth rates of unemployment in the past twelve months exhibit lower job-finding rates, and the opposite is true if a region exhibited net employment growth in that time. Finally, the deviation of actual employment from the seasonally adjusted level shows a strong and significant negative coefficient. Hence, if employment growth was relatively strong in the recent past, then fewer jobs are started in the current quarter.

C.1. *References*

References

Kluve, Jochen. 2006. "The Effectiveness of European Active Labor Market Policy." IZA Discussion Paper No. 2018.