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On the Speed of Transition in Central and Eastern Europe: Does On-the-Job Search Matter?

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Abstract

This paper examines how the on-the-job search of workers in the state sector who are seeking jobs in the private sector affects private sector employment, the unemployment level, and the unemployment duration in the transition economies of Central and Eastern Europe. The main finding is that on-the-job searching can account for the coexistence of a quickly growing private sector and a high unemployment level of long duration. The paper also addresses the issue of the optimal (output maximizing) rate of state sector closure and finds that the rate is slower when workers are simultaneously job hunting than when they are not.

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SUMMARY

The relocation of labor from the state sector to the private sector and the speed of state sector closure are major issues in a rapidly growing theoretical literature on the transition of economies in Central and Eastern Europe from central planning to market orientation. These issues are important because negative consequences of labor relocation, such as the initial decline in output and the increase in the unemployment level, could slow the transition and possibly bring it to a halt. The literature views the unemployment pool in transition economies as a primary source of labor for the emerging private sector. The conclusion is that the labor market transition will be characterized either by a quickly emerging private sector and short-lived unemployment or by a slowly emerging private sector and persistent unemployment.

Contrary to the conclusions in the theoretical literature, countries in Central and Eastern Europe have experienced quickly emerging private sectors and persistent unemployment. One possible explanation is that firms in these countries would rather hire workers from the state sector than hire the unemployed.

This paper studies labor relocation from the state sector to the private sector when workers in the state sector are simultaneously searching for a job in the private sector. It models the allocation of workers as a job-matching process, using the framework of Mortensen and Pissarides. The main difference from the previous literature is that the model incorporates the on-the-job search of the state workers. The model is broadly consistent with the observed coexistence of initially high and subsequently declining unemployment rates, long durations of unemployment, and quickly emerging private sectors in Central and Eastern Europe.

The model has several policy implications. The interaction of private sector development with the rate of state sector closure has welfare implications because it affects (1) the length of transition, (2) the level of unemployment, and (3) the transition path of aggregate output, and therefore the expected utility of the representative agent in the model.

I. INTRODUCTION

1. The relocation of labor from the state sector to the private sector and the speed of state sector closure are major issues in a rapidly growing theoretical literature on the process of the transition from centrally planned economies to market economies in Central and Eastern Europe.[2] These issues are important because negative consequences of labor relocation, such as the initial decline in output and the increase in unemployment level, could slow down the transition and possibly bring it to a halt. The literature viewed the unemployment pool in transition economies as a primary source of labor for the emerging private sector. The conclusion was that the labor market transition would be characterized either by quickly emerging private sector and low duration of unemployment or by a slowly emerging private sector and high duration of unemployment.

2. Contrary to the conclusions in the theoretical literature, countries of Central Europe have experienced quickly emerging private sectors and high duration of unemployment (Borish and Noel (1996), EBRD (1996) and OECD (1997)). One possible explanation is that firms in these countries would rather hire workers from the state sector, than hiring the unemployed. Boeri (1995) states that household surveys in Hungary, the Czech Republic and Slovakia suggest that most shifts of workers from the state to the private sector occurred as job-to-job movement. Bilsen and Konings (1996) provide similar evidence for Bulgaria and Hungary, but find that in Romania the relocation process takes place mainly through unemployment.

3. This paper studies the impact of the on-the-job search of state sector workers using a model in which the relocation from the state sector into the private sector requires matching a searching worker with a vacancy in the private sector. The matching approach to labor markets was developed by Pissarides (1990) and Mortensen (1992) and its application to transition economies in Central and Eastern Europe proposed by Burda (1993). By modifying the model of Burda (1993), this paper incorporates the on-the-job search in the state sector.[3]

4. The results are broadly consistent with the coexistence of a quickly emerging private sector and a high unemployment level and duration. The private sector grows quickly because the pool of workers available for private employment increases. At the same time, the unemployment duration increases with the presence of on-the-job search because unemployed workers compete for jobs with state sector workers. Furthermore, when workers search for a job in the private sector while working in the state sector, the optimal speed of the state sector closure decreases because the state sector workers can search and produce output at the same time.

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[2]Examples include Aghion and Blanchard (1994), Gavin (1993), Katz and Owen (1993), and Burda (1993).

[3]Another interesting problem would be to examine the relationship between the loss of skills of the unemployed and unemployment duration. This topic is left for further research.

5. The paper is organized as follows. In the next section, the facts on unemployment rates, durations and private sector employment in Central Europe are summarized. Section 3 examines whether the matching model with the on-the-job search support these facts. The issue of the optimal speed of state sector closure is addressed in Section 4. Section 5 concludes.

II. Unemployment Rates, Unemployment Duration and Private Sector Employment[4]

6. This section and Tables 1 and 2 summarize the patterns of aggregate variables in Bulgaria, the Czech Republic, Hungary, Poland, Romania, and Slovakia that the model of this paper focuses on. In all countries, the state sector employment has fallen since 1989 while private sector employment has increased (in 1995, the share of private sector employment exceeded 50 percent in all countries). Since the increase of private sector employment has been smaller than the fall in the state sector employment, unemployment has risen. Unemployment rates have generally declined since 1993-94, but continue to be high in 1996. With the exception of the Czech Republic and Romania, all countries had unemployment rates above 10 percent in 1996.[5]

Table 1: Unemployment Rates (as percentage of labor force), 1990–96

	1990	1991	1992	1993	1994	1995	1996
Bulgaria	1.5	11.5	15.6	16.4	12.8	10.5	12.5
Czech Rep.	0.8	4.1	2.6	3.6	3.2	2.9	3.5
Hungary	1.9	7.5	12.3	12.1	10.4	10.4	10.5
Poland*	6.1	11.8	13.6	15.7	16.0	14.9	14.3
Romania	na	3.0	8.1	10.2	11	8.9	6.1
Slovakia	1.5	11.8	10.3	14.4	14.8	13.1	12.8

Source: EBRD Transition Report Update, 1997.
* 1996 is taken from OECD (1997).

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[4]Sources of data are: Borish and Noel (1996) and EBRD (1996) for state and private sector employment, EBRD (1997) for unemployment and Layard and Richter (1995) for inflows into and outflows from the unemployment pool.

[5]More precisely, the decrease in the state sector employment was not fully absorbed by the private sector or by exits from the labor force, and hence unemployment has emerged. The Czech Republic has an exceptionally low unemployment rate, but there is a decline in the labor force, which may be considered as a substitute for an increase in unemployment.

7. High unemployment rates were accompanied by large unemployment durations. As Table 1 illustrates, in 1995, in all countries more than half of the unemployed were unemployed for 7 or more months. Even though unemployment rates stabilized after 1994, unemployment durations continue to be high due to the low outflows from the unemployment pool.

Table 2: Percentage of unemployed for 7 or more months, 1992–95

	1992	1993	1994	1995
Bulgaria	...	67.1	74.6	77.8
Czech Republic	38.5	38.7	39.9	53.8
Hungary	43.8	57.2	62.9	68.0
Poland	59.7	63.2	66.9	66.1
Romania	...	...	58.8	70.3
Slovakia	57.8	65.4	66.1	71.4

Source: Allison and Ringold (1996).

III. Model of Labor Relocation with the On-the-Job Search

8. In developing a framework to account for the coexistence of rapidly increasing private sector employment and high unemployment rates and durations, the paper emphasizes the on-the-job search in transition economies, because it is relatively under-studied despite its importance. The model draws on Pissarides (1990 and 1995) and Burda (1993). Consider a continuous time economy producing a single good. The labor force is normalized to 1. All agents live forever and have an identical risk-neutral preference:

$$V_0 = E_0 \int_0^{\infty} e^{-rt} c(t) dt \qquad (1)$$

where $c(t)$ is consumption at date t, $r>0$ is the rate of time preference and E_0 denotes expectations formed at date 0. Each agent receives an endowment of one flow unit of labor. Agents can be in one of the following states: employed in the private sector (and receive private sector wage, $w_p(t)$), employed in the state sector (and receive state sector wage, $w_s(t)$), or unemployed (and receive unemployment benefits, $z(t)$). At every t, agents consume their entire income. The transition consists of relocating workers from the state sector into the private sector. During the transition, some state sector workers become unemployed and search for employment in the private sector. State sector workers still employed also search for employment in the private sector.

9. The production process in the state sector is described by the production function $F(S(t))=q_s S(t)$, where $S(t)$ = the proportion of workers who are working in the state sector and $1-S(t)$ = the proportion of workers who are either unemployed or working in the private sector. We assume that workers in the state sector receive a wage equivalent to the fraction φ of their output, i.e. $w_s=\varphi q_s$. If they become unemployed, workers receive unemployment benefit z. At the beginning of transition at date 0, all workers are working in the state sector, i.e. $S(0) = 1$. In order to focus on how the on-the-job search affects the duration of unemployment and the creation of private sector employment, we take the rate at which the state sector lays off workers into unemployment as exogenously given in this section. We address the issue of the optimal rate of the state sector closure in Section 4.

10. The private sector consists of a continuum of firms; each firm consists of one worker. Firms cannot hire a worker instantaneously, but must get involved in a costly process of posting vacancies. When posting a vacancy, the firm cannot produce output and incurs costs. Firms are heterogeneous in their cost of posting vacancies. The total cost of vacancy supply for the entire private sector is $k(V(t))=V(t)^2/2\gamma$ where $V(t)$ is the number of vacancies in the entire private sector and γ is the coefficient of effectiveness of filling the vacancy. We use the same functional form for posting vacancies as Snower (1996). The implication of this functional form is that vacancies are more costly to create, the more vacancies already exist. Our interpretation is that first entrants into the market have the easiest time posting vacancies.[6] Since the firm posting a vacancy knows only the total cost function for the sector, its expected marginal cost of posting a vacancy is $V(t)/\gamma$.

11. Firms can hire a worker directly from the state sector or from the unemployment pool. After hiring a worker, the firm produces output q_p. As in the state sector, workers receive a wage equivalent to their contribution to output, i.e. $w_p=\varphi q_p$. Jobs in the private sector are eliminated at an exogenously given rate δ. Unemployment emerges in this framework because, due to the cost of posting vacancies, it takes time for a private firm with a vacancy and a searching worker to be matched. More specifically, the effectiveness of the matching process depends on the aggregate matching function

$$x((U(t)+\mu S(t),V(t))=(U(t)+\mu S(t))^{\alpha}V(t)^{1-\alpha} \qquad (2)$$

where x is the instantaneous number of private sector jobs formed for a given level of unemployment $U(t)$, $\mu S(t)$ denotes state sector workers conducting an effective job search, and $V(t)$ is the aggregate level of private sector vacancies. The effective measure of searching state sector workers depends on the state sector employment $S(t)$ and search effectiveness, μ,

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[6]This assumption views creating a vacancy as equivalent to creating a firm. For an explicit model of private firm creation in transition economies see Brixiova and Kiyotaki (1997).

of the state sector workers.[7] Denoting $\theta(t)=V(t)/(U(t)+\mu S(t))$ to be the ratio of job vacancies to job seekers, the rate of finding a job for a searching worker becomes $h(\theta(t))=\theta(t)^{1-\alpha}$ and the rate of filling a vacancy for a searching firm becomes $d(\theta(t))=\theta(t)^{-\alpha}$. Individual workers and firms take these rates as given.

12. Although the individual worker faces uncertainty, there is no uncertainty at the aggregate level of the labor force. Since the workers are either employed in the state sector, private sector or unemployed, their respective populations $(S(t), N(t), U(t))$ satisfy:

$$1=N(t)+S(t)+U(t) \tag{3}$$

The number of workers employed in the private sector and unemployed workers changes according to

$$\dot{N}(t)=d(\theta(t))V(t)-\delta N(t), \tag{4}$$

$$\dot{U}(t)=\lambda(1-N(t)-U(t))+\delta N(t)-h(\theta(t))U(t) \tag{5}$$

Equation (4) states that the change in private sector employment is the difference between the formation of new private jobs, $d(\theta(t))V(t)$, and the destruction of existing ones, $\delta N(t)$. Changes in unemployment in equation (5) are equal to the inflow from private and state sectors, $\lambda S(t)+\delta N(t)$ minus the outflow into the private sector, $h(\theta(t))U(t)$. Since at the beginning of transition all workers are employed in the state sector, $N(0)=U(0)=0$.

13. The *equilibrium* of this economy is defined as the allocation of workers and vacancies such that: (1) each worker chooses the allocation of labor and consumption to maximize the expected discounted utility, (2) each firm chooses the allocation of vacancies to maximize profits, and (3) the markets for labor and product clear.

14. In characterizing the optimization of workers and firms, we use the dynamic programming approach. Let E_u, E_s, and E_p be the values of workers being in three different states: unemployed, working in the state sector, and working in the private sector, respectively.

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[7] In the numerical solutions below, we examine a range of values for μ from the situation when workers in the state sector do not search while working ($\mu=0$) to the situation when workers in the state sector are as effective as unemployed ($\mu=1$). Cases when $0<\mu<1$ are considered because workers in the state sector produce output while searching, and therefore are less effective in job searching than the unemployed.

Suppressing the time t subscript from now on, the corresponding Bellman equations for workers are:

$$rE_p=w_p+\delta(E_u-E_p)+\dot{E}_p \tag{6}$$

$$rE_u=z+h(\theta)(E_p-E_u)+\dot{E}_u \tag{7}$$

$$rE_s=w_s+\lambda(E_u-E_s)+h(\theta)\mu(E_p-E_s)+\dot{E}_s \tag{8}$$

where $\dot{E}_i$ is the change of the value E_i over time.[8] In equation (6), the return on being employed in the private sector includes private sector wage, expected loss from losing the job and the change in the value of being in the private sector over time. Equation (7) implies that the return on being unemployed is equal to the unemployment benefits plus the expected gain from becoming employed in the private sector plus the change in the value of being unemployed over time. Equation (8) states that the return on being employed in the state sector is equal to the state sector wage plus the expected gain from changing to the private sector minus the expected loss from becoming unemployed plus the change in the value of being employed in the state sector over time. In order for workers to move from unemployment or the state sector into the private sector, it must be the case that $E_p>E_s>E_u>0$. In this case, workers in the state sector do not want to become unemployed and are involved in the on-the-job search when direct job-to-job switching is possible ($\mu>0$). However, workers in the private sector do not want to become unemployed nor do they look for employment in the state sector.

15. To describe the optimization problem of the firms, let J_s, J_v, and J_p be the values of a job for the firm in the state sector, private sector vacancy, and a job for the firm in the private sector, respectively.[9] Then the corresponding Bellman equations are:

$$rJ_s=q_s-w_s-\lambda J_s-h(\theta)\mu J_s+\dot{J}_s \tag{9}$$

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[8]This "value" is the expected value of discounted utility (equation (1)) from the time t forward for a worker in each state. See Bellman, Richard (1957).

[9]These "values" are expected discounted values of profits for the state and private firms employing workers and expected discounted value of return on vacancy for a private firm searching for a worker.

$$rJ_p = q_p - w_p + \delta(J_v - J_p) + \dot{J}_p \tag{10}$$

$$rJ_v = -\frac{V}{\gamma} + d(\theta)(J_p - J_v) + \dot{J}_v \tag{11}$$

where $\dot{J}_i$ is again the change of the value J_i over time. Equation (9) states that the rate of return on the state sector job equals the operating profits minus the expected loss from exogenous destruction and from the workers moving to the private sector plus change in the value of the state sector job over time. Equation (10) states that the return to the private sector firm equals the profit minus loss from destruction plus change in the value of a private sector job over time. Equation (11) states that the return on posting vacancies is equal to the expected average cost of posting a vacancy plus the expected gain from filling the vacancy plus capital gains. Since there is free entry of vacancies, (11) implies that in equilibrium $J_v=0$ and $J_p=V/(\gamma d(\theta))$. Combining the value functions (10) and (11) and using the equilibrium condition $J_v=0$ yields:

$$d(\theta)\frac{q_p - w_p}{r+\delta} = \frac{V}{\gamma} \tag{12}$$

Equation (12) states that the marginal cost of posting a vacancy, V/γ, equals to the expected discounted profit, $d(\theta)(q_p - w_p)/(r+\delta)$.

16. The *transition equilibrium path* then can be described by equation (12), the laws of motion on unemployment and private sector employment (4) and (5), and the initial conditions $N(0)=U(0)=0$. The system is in the *steady state equilibrium* when in addition to satisfying (12), (4) and (5), $\dot{U}=\dot{N}=0$.

17. Before solving the case with a gradual closure of the state sector, it is helpful to consider a *simple special case* in which the state sector is immediately closed down to *0* at the initial date, i.e. $U(0) = 1$. In this case, the conditions (4) , (5) and (12) reduce to:

$$\dot{N} = (1-N)^{\frac{2\alpha}{\alpha+1}} \left(\frac{\gamma(q_p - w_p)}{(r+\delta)} \right)^{\frac{1-\alpha}{\alpha+1}} - \delta N, \tag{13}$$

N(0) = 0. In this special case, the private sector draws entirely on unemployment for hiring labor and the private sector employment therefore grows at the same rate at which unemployment declines until the steady state is reached. The rate of private job formation is the highest at the beginning of transition when the private sector employment is low, unemployment is high and it is therefore easy for a private firm to find a worker.

18. In the case of a *gradual closure of the state sector*, the conditions describing the equilibrium transition path can be reduced to:

$$\dot{N}=(U+\mu(1-N-U))^{\frac{2\alpha}{\alpha+1}}\left(\frac{(q_p-w_p)\gamma}{r+\delta}\right)^{\frac{1-\alpha}{\alpha+1}}-\delta N \tag{14}$$

$$\dot{U}=\lambda(1-N-U)+\delta N-(U+\mu(1-N-U))^{\frac{\alpha-1}{\alpha+1}}\left(\frac{(q_p-w_p)\gamma}{r+\delta}\right)^{\frac{1-\alpha}{\alpha+1}}U \tag{15}$$

with the initial conditions $U(0)=N(0)=0$. Denoting $K=\left(\frac{(q_p-w_p)\gamma}{r+\delta}\right)^{\frac{1-\alpha}{\alpha+1}}$, the duration of unemployment becomes:

$$h(\theta)^{-1}=K^{-1}(U+\mu(1-N-U))^{\frac{1-\alpha}{\alpha+1}} \tag{16}$$

As can be seen from equation (16) , for a given private sector employment, N, and unemployment, U, the duration of unemployment increases with the effectiveness of the on-the-job search of the state sector workers, μ. The higher duration of unemployment for the case of higher μ occurs because the pool of searching workers increases, as the unemployed searching for private sector employment now compete with more state sector workers The numerical solutions below illustrate the impact of the on-the-job search of state workers during the transition.

Numerical Solutions of the Model

19. In the numerical analysis below we compare three cases. In the first case (Figure 1), the job-to-job switching is not possible and in order to find employment in the private sector, state sector workers must first become unemployed. In this case, we assume that μ = coefficient of effectiveness of the on-the-job search = *0*. In the second and the third cases (Figures 2 and 3) workers in the state sector can find employment in the private sector without becoming unemployed. In the second case, state sector workers are less effective in job searching than the unemployed, i.e. $\mu=0.1$ (Figure 2). In the third case, state sector workers are as effective in job searching as the unemployed, i.e. $\mu=1$ (Figure 3).

Figure 1: Transition paths of private and state employment levels, unemployment level, and unemployment duration when $\mu = 0$.

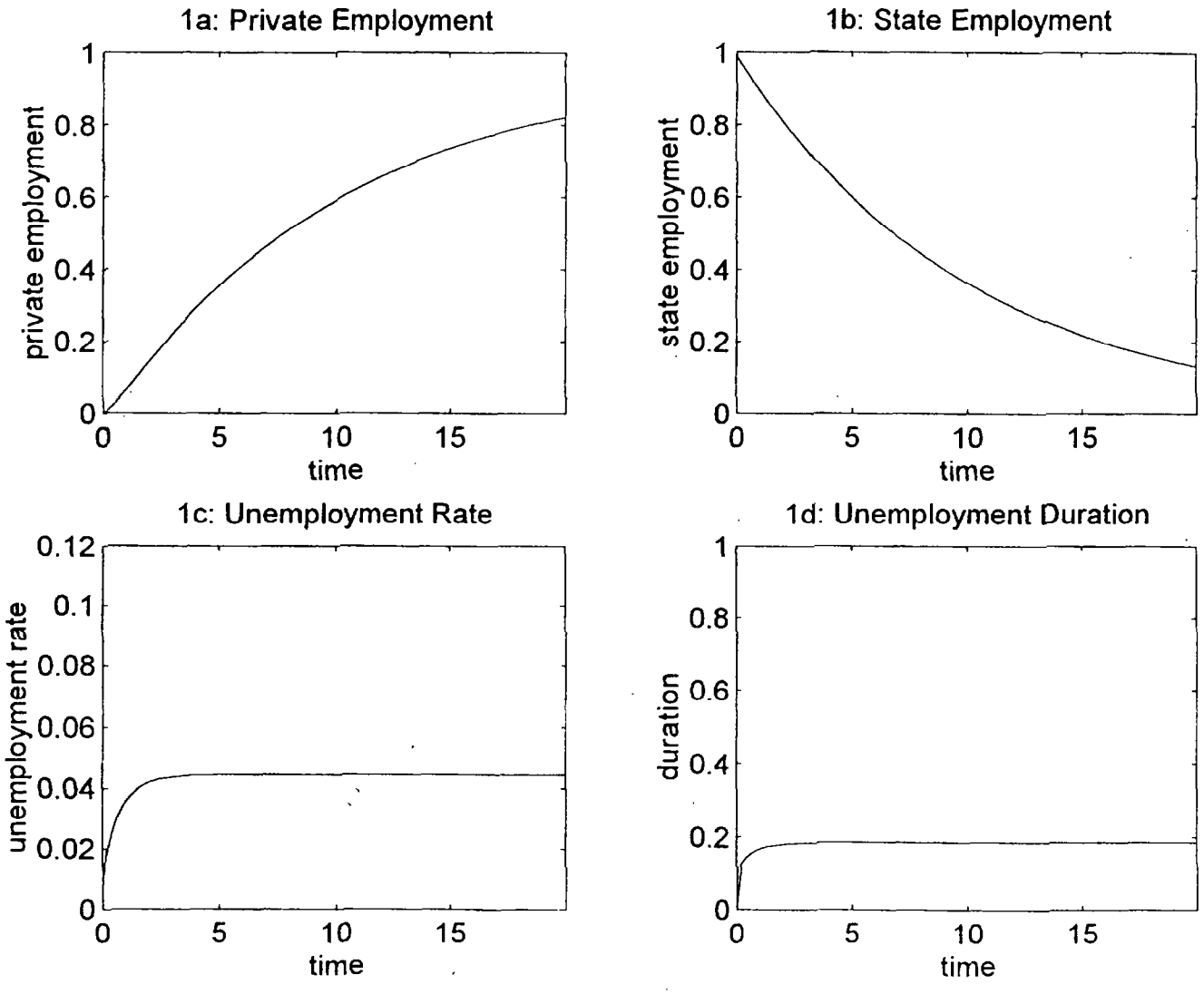
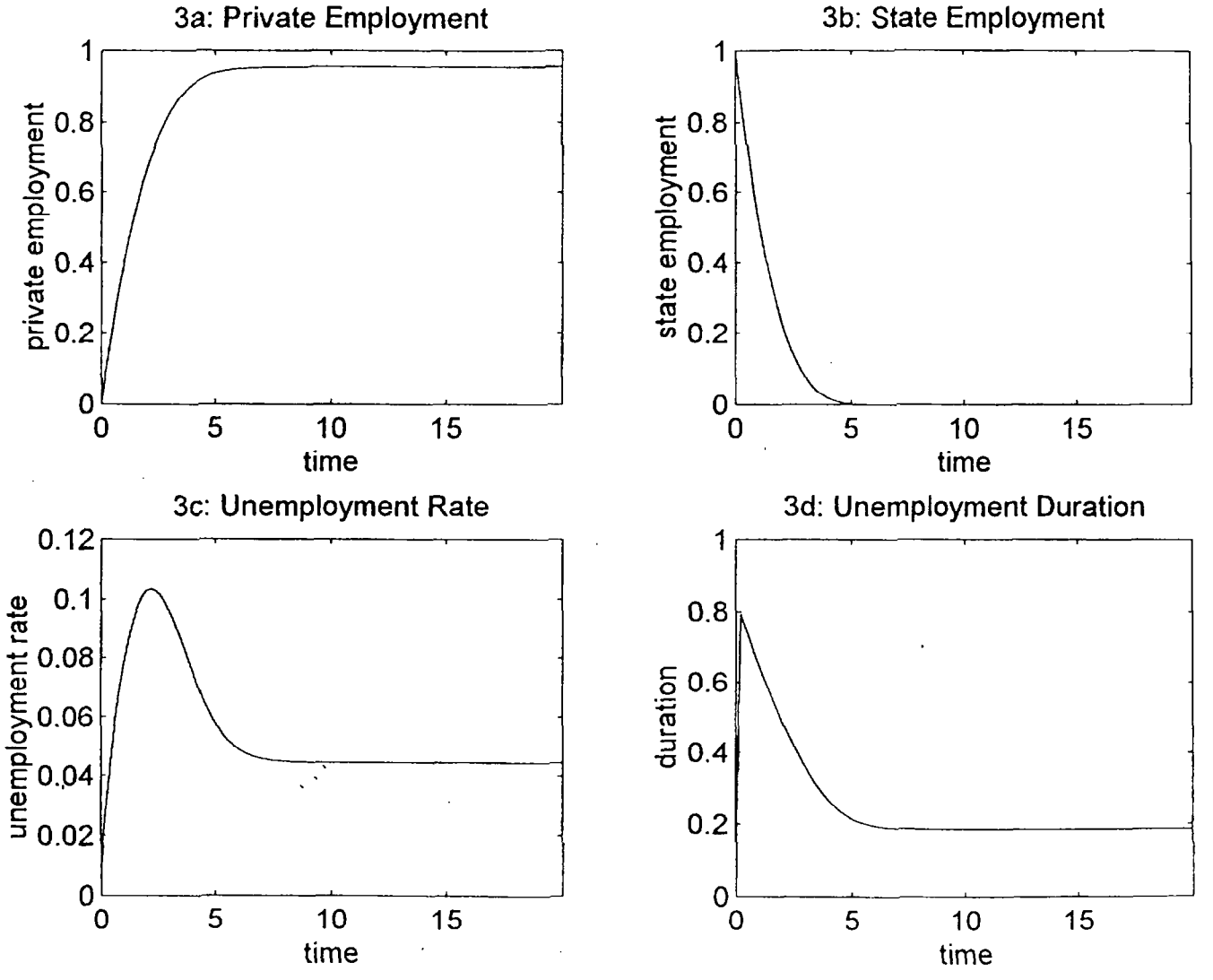


Figure 2: Transition paths of private and state employment levels, unemployment level, and unemployment duration when $\mu = 0.1$.

Figure 3: Transition paths of private and state employment levels, unemployment level, and unemployment duration when $\mu = 1$.



20. The remaining parameters are identical in all three cases. Two parameter values are taken from the job creation and job destruction literature: r = the real interest rate = *0.04*, and δ = rate of destruction of private jobs = *0.1*.[10] The remaining parameter values are: (i) α = the search elasticity of matching = *0.35*, (ii) γ = coefficient of the efficiency of filling a vacancy = *0.1*, (iii) q_p = marginal product of labor in the private sector = *2.05*, (iv) q_s = marginal product of labor in the state sector = *1*, (v) A = coefficient of the efficiency of matching = *0.4*, (vi) φ = the worker's share of output = *0.5*, and (vii) λ = rate at which state sector workers are laid off = *0.1*. The time period is one year. Using these parameters, we examine the impact of changes in the effectiveness of the on-the-job search of state workers on the employment in the private and state sectors, the unemployment rate and the duration of unemployment.

21. As Figures 1, 2 and 3 illustrate, the state sector declines faster the more effective is the on-the-job search of state workers. This is because in addition to the exogenously given rate of the state sector closure (where state sector workers are released into the unemployment pool), workers leave the state sector voluntarily for employment in the private sector. As the pool of workers searching for private sector employment increases, the rate at which private vacancies are filled increases, and private sector employment therefore grows faster. Both the unemployment level and unemployment duration are higher when workers in the state sector search on-the-job. This is because the unemployed workers searching for private sector employment now "compete" with the workers employed in the state sector. However, while in the data presented in Table 2 the unemployment duration remains persistently high, in the results of the model presented in Figures 1, 2 and 3 it does not.

IV. The Optimal Rate of State Sector Closure

22. This section examines whether the presence of the on-the-job search has an impact on the optimal rate for the state sector closure and/or the steady state value of the state sector employment. An efficient allocation of state and private sector employment and vacancies $\{V, N, S\}$ maximizes the discounted expected utility of the representative agent subject to the goods and labor markets clearing constraints and the law of motion of private sector employment. Since the representative agent has risk neutral preference in consumption, this is equivalent to maximizing the discounted value of the aggregate output net of the cost of posting vacancies. The social planner's problem then takes the following form:

$$\max \int_0^{\infty} e^{-rt}\left(q_s S + q_p N - \frac{V^2}{2\gamma}\right) dt \qquad (17)$$

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[10]See Bilsen and Konings (1996), and Mortensen and Pissarides (1994).

subject to the law of motion on the employment in the private sector:

$$\dot{N}=(1-(1-\mu)S-N)^{\alpha}V^{1-\alpha}-\delta N \qquad (18)$$

and the boundary conditions N(0) = 0 , S(0) = 1, and $\lim_{t\to\infty} e^{-rt}\Phi(t)=0$, where Φ is the shadow value of private sector employment. The solution to this problem is elaborated in the appendix.

Numerical Solutions

23. In the simulations below, two cases are compared: (1) $\mu=0.05$ (Figure 4) and (2) $\mu=0.1$ (Figure 5). All parameters with the exception of the intensity of the on-the-job search remain the same as in Section 3 and are identical in both cases. It can be seen from Figures 4 and 5 that the optimal (output maximizing) steady state value of state sector employment can be positive. This is because in the steady state, the state sector jobs are not destroyed, and hence do not have to be replaced through a costly search. It might therefore be optimal to keep some workers employed in the state sector even though productivity is higher in the private sector. Furthermore, when workers in the state sector search for jobs in the private sector, state sector employment serves as a pool of potential workers for the private sector. The optimal steady state value of state sector employment is therefore higher in the case of more effective on-the-job search ($\mu=0.1$).

24. Figures 4 and 5 also show that the optimal rate of state sector closure is slower in case of more effective on-the-job search ($\mu=0.1$) because workers in the state sector can search and produce output at the same time. Furthermore, unemployment increases at a slower rate in the beginning of transition and its steady state value is lower the more effective is the on-the-job search.

V. CONCLUSIONS

25. This paper studied labor relocation from the state sector to the private sector where workers in the state sector are engaged in the on-the-job search. Workers' allocation is modeled as a job matching process, using the framework of Mortensen and Pissarides. The main difference from the previous literature (Aghion and Blanchard 1994 and Burda 1993) is to incorporate the on-the-job search of the state workers. The model is broadly consistent with observed coexistence of initially high and recently declining unemployment rates, long durations of unemployment and quickly emerging private sectors in countries of Central and Eastern Europe.

26. There are several policy implications of the model. The interaction of private sector development with the rate of state sector closure has welfare implications because it affects (i) the length of transition, (ii) the level of unemployment, and (iii) the transition path of aggregate output, and therefore the expected utility of the representative agent in the model.

Figure 4: Optimal transition paths of unemployment level, and private and state employment levels when $\mu=0.05$.

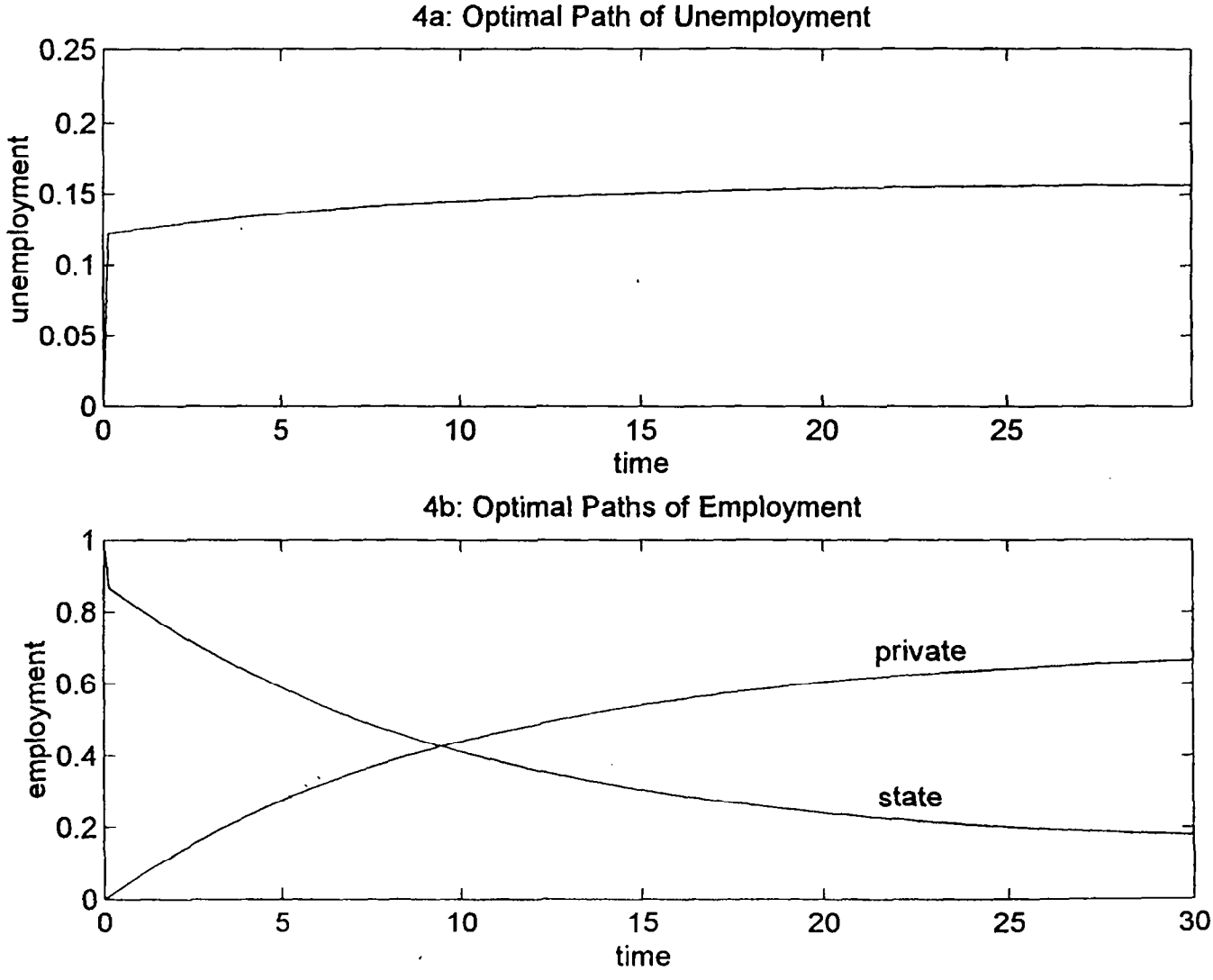
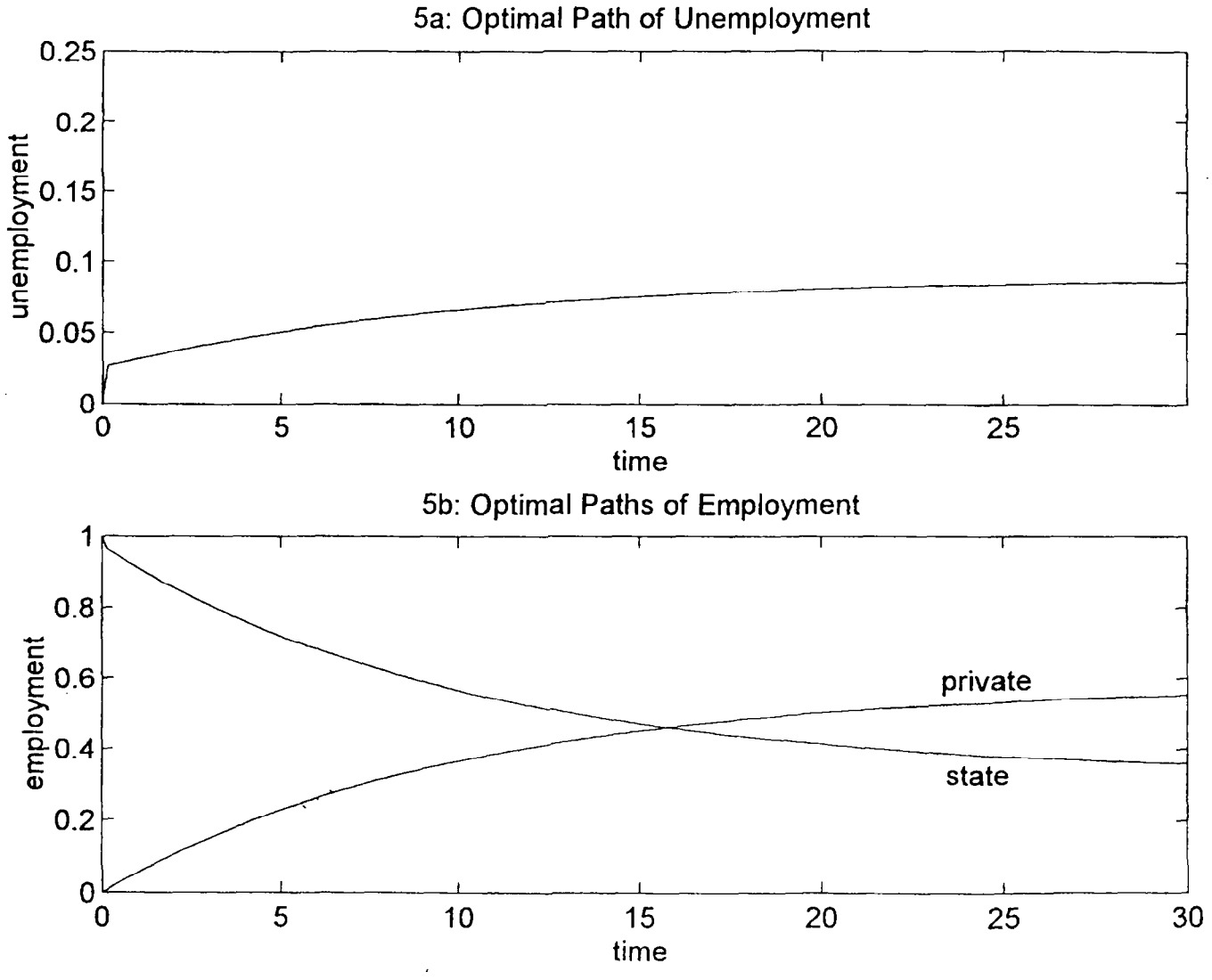


Figure 5: Optimal transition paths of unemployment level, and private and state employment levels when $\mu = 0.1$.



Finally, the solution for the optimal rate of the state sector closure shows that when workers employed in the state sector are involved in on-the-job search, it is optimal to close down the state sector at a slower rate than is the case with no on-the-job search.

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Appendix

The solution to the social planner's problem (17), (18) can be described by :

$$q_s=\alpha\phi\left(\frac{1-N-(1-\mu)S}{V}\right)^{\alpha-1}(1-\mu) \tag{19}$$

$$\dot{N}=\left(\frac{1-N-(1-\mu)S}{V}\right)^{\alpha}V-\delta N \tag{20}$$

where $\phi=\frac{q_p-q_s/(1-\mu)}{r+\delta}$. It is clear from (19) and (21) that the number of vacancies, V, and the ratio of job vacancies to searching workers, $\left(\frac{V}{1-N-(1-\mu)S}\right)$, is constant along the optimal path.[11] After substituting, the transition path of N becomes

$$\dot{N}=((1-\alpha)\gamma)\left(\frac{\alpha(1-\mu)}{q_s}\right)^{\frac{2\alpha}{1-\alpha}}\phi^{\frac{1+\alpha}{1-\alpha}}-\delta N \tag{22}$$

$$V=\gamma\phi(1-\alpha)\left(\frac{1-N-(1-\mu)S}{V}\right)^{\alpha} \tag{21}$$

with the initial condition $N(0) = 0$. Equation (22) implies that the creation of private jobs is also constant during the transition. The destruction of private jobs gradually increases until the steady state is reached. It can be seen from (19), (21), and (22) that the steady state private sector employment is lower and the state sector employment is higher when state sector workers search while working than when they do not.

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[11]If there is no on-the-job search, i.e. $\mu=0$, the optimal path becomes equivalent to that derived in Burda (1993), i.e. state sector is initially closed down so that unemployment immediately increases to its steady state level. With the on the on-the-job search, the optimal rate of state sector closure is lower and an increase in unemployment level is slower at the initial stages of the transition.