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Economic Restructuring, Unemployment, and Growth In a Transition Economy

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Abstract

This paper develops a model of the process of reallocation of labor from the state sector to the private sector. When growth is exogenously determined, we show that in the initial stages of transition unemployment will rise over time. After a critical stage in the transition process, restructuring is accompanied by a decline in unemployment. When growth is endogenously determined, and human capital is acquired by learning-by-doing, we show that whether restructuring eventually occurs is determined by the level of human capital in the private sector and the rate of unemployment. The effects of various shocks and government policies in affecting the costs, speed, and eventual outcome of restructuring are analyzed.

JEL Classification Numbers:

E24, P20

1/ The International Monetary Fund, the World Bank, and the Massachusetts Institute of Technology, respectively. We would like to thank Peter Clark, Richard Jackman, Mohsin Khan, Paul Masson, and seminar participants at the World Bank for useful comments. Any errors and all views expressed here are our own.

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Summary

This paper develops a simple model of the process of reallocation of labor from the state to the private sector and examines several questions relating to the dynamics of the transition process. The transition economy is characterized by the asymmetric behavior and market power of labor in the two sectors. In the state sector, labor dominates the decision process of enterprises, while in the private sector employment and wage decisions are determined by profit-maximizing firms. It is assumed that firms in the private sector are concerned with worker effort and productivity, while these considerations play a minor role in the state sector. Worker effort in the private sector is endogenously determined by an efficiency-wage mechanism. In order to boost work force productivity, firms find it optimal to pay a premium over the market-clearing wage, resulting in unemployment.

The paper examines two alternative processes driving growth and restructuring: a neoclassical exogenous productivity growth model, where transition is inevitable; and an endogenous growth model, where human capital is acquired through learning by doing, and restructuring is endogenously determined. When growth and restructuring are exogenously determined, the paper shows that, in the initial stages of transition, as a natural consequence of the reallocation of labor that accompanies the restructuring of production, the economy will not only suffer a cost in terms of unemployment but this cost will rise over time. Only after a critical stage in the transition process is restructuring accompanied by a decline in unemployment. The paper demonstrates that, when growth is endogenously determined, the level of human capital in the private sector and the rate of unemployment determine whether or not restructuring of production toward the private sector eventually occurs. With low levels of human capital or skills specialized in the production of the private sector good, a relatively high rate of unemployment is necessary to place the economy on a self-sustaining path of restructuring of production toward the private sector.

The paper analyzes the way in which various shocks--such as changes in relative prices--and government policies affect the dynamic path of unemployment. The role of government policies differs significantly depending on whether growth is viewed as an exogenous or an endogenous process. When growth is exogenously determined, the speed of transition has no long-run impact, and restructuring is inevitable. Therefore, policies that reduce unemployment in the early stages of transition--for instance, through subsidies to the state sector--may reduce short-term costs without affecting the long-run equilibrium. By contrast, when growth is endogenous, policies that reduce unemployment may slow down the transition process and jeopardize restructuring and eventual convergence to long-run specialization in the private sector good.

I. Introduction

The process of transition following the introduction of reforms and liberalization in the previously centrally planned economies (PCPEs) of Central and Eastern Europe has proved costly in terms of unemployment (see Chart 1) and output. 1/ In all of these economies open unemployment was absent prior to the reforms. Chart 1 indicates that unemployment rate has steadily increased, and so far--except for Czechoslovakia--there are no signs of a reversal in this trend, or even a levelling off of the unemployment rate. In most PCPEs, increases in the unemployment rate have occurred despite a rapid growth of the private sector. 2/ Thus, increasing unemployment reflects a gap between the speed at which the state sector is shedding labor, and the speed at which the private sector is absorbing labor.

This paper develops a simple model of the process of reallocation of labor from the state sector to the private sector and examines several questions relating to the dynamics of the transition process. The model emphasizes important institutional features of economies in transition that affect incentives and behavior in both the state and the private sector. Specifically, the transition economy is characterized by asymmetric behavior and market power of labor in the two sectors. In the state sector labor dominates the decision process of enterprises, while in the private sector employment and wage decisions are determined by profit-maximizing firms. It is assumed that firms in the private sector are concerned with worker effort and productivity, while these considerations play a minor role in the state sector. Worker effort in the private sector is endogenously determined by the differential of wages over the alternative income of workers. In order to boost productivity of the workforce, firms find it optimal to pay a premium over the market-clearing wage, resulting in unemployment. Unemployment acts as a disciplining device so that, at any wage rate, worker effort increases with unemployment. Unemployment thus exerts downward pressure on the equilibrium wage paid in the private sector. 3/

The level and behavior over time of the unemployment rate is determined by the relative speed of growth of the private sector and decline of the state sector. The scope for productivity growth is assumed to be greater in

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1/ We follow Calvo and Frenkel (1991) in referring to these economies as PCPEs. They discuss how a centrally planned economy is likely to spend a significant period in transition as a PCPE before becoming a full-fledged market economy. For a review of the experience with reform and stabilization during 1990-91 in Eastern Europe see Bruno (1992).

2/ See Bruno (1992).

3/ This is of course, exactly as posited by aggregative rules of disequilibrium price or wage adjustment such as the well-known Phillips curve relation.

the private sector and two alternative processes driving growth and restructuring are considered: a neoclassical exogenous productivity growth model, where transition is inevitable; and an endogenous growth model where human capital is acquired by learning-by-doing of the workforce, and restructuring is endogenously determined. The exogenous growth version of the model is related to recent work by Blanchard (1991) and Atkeson and Kehoe (1992) on the costs and speed of transition following major reform in a two-sector economy. 1/ A key difference of our approach is that the relative speeds at which the private sector expands and the state sector contracts are both determined endogenously and vary over time.

When growth and restructuring are exogenously determined, we show that the dynamic behavior of unemployment is determined by the initial distribution of the labor force. If the initial level of employment in the state sector is "high" and the level of unemployment is "low"--a stylized feature of the initial conditions of most PCPEs--then, in the early stages of the transition process, the unemployment rate will rise. Once private sector activity has expanded beyond a critical level, the private sector begins to absorb labor at a faster pace than it is shed by the state sector, and the unemployment rate falls over time. The framework presents a manifestation of popular notions of the cost of transition from an economy dominated by the state sector to one dominated by the private sector. In the initial stages of transition, as a natural consequence of the process of reallocation of labor accompanying the restructuring of production, the economy will not only suffer a cost in terms of unemployment but this cost will rise over time. Only after a critical stage in the transition process, is restructuring accompanied by a decline in unemployment.

When growth is endogenously determined, and human capital is acquired by learning-by-doing of the workforce, we show that there are two potential long-run equilibria. Whether or not restructuring of production toward the private sector eventually occurs is determined by the level of human capital in the private sector and the prevailing rate of unemployment. With low levels of human capital or skills specialized in the production of the private sector good, a relatively high rate of unemployment is necessary to place the economy on a self-sustaining path of restructuring of production toward the private sector. In this framework, the speed of transition, as measured by the share of the labor force employed in the private sector at any point in time, takes on a critical importance. Policies that succeed in

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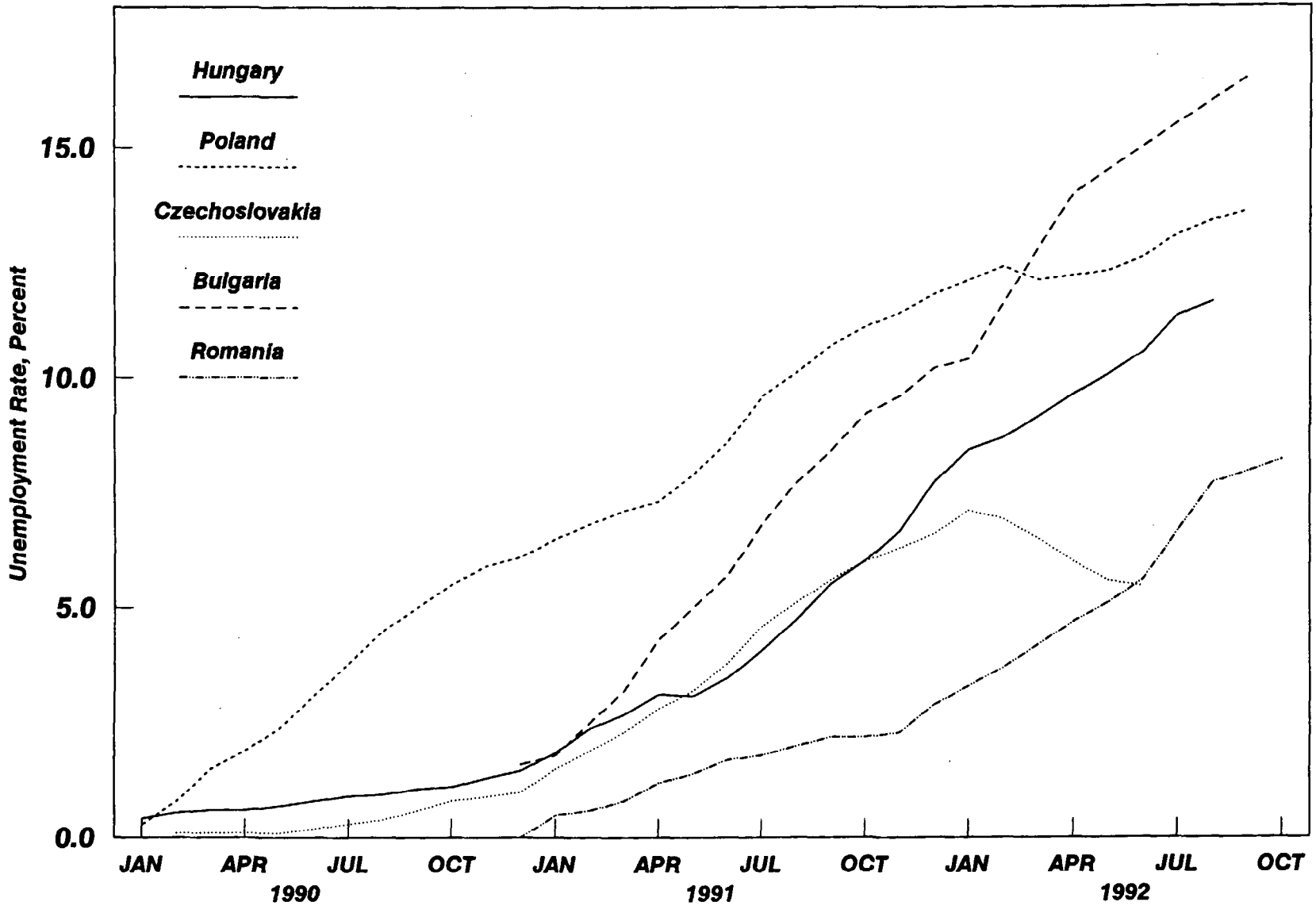
1/ Atkeson and Kehoe (1992) examine the effects of social insurance for risk in search on the speed of the transition process. They show that the presence of social insurance can slow the transition process. Blanchard (1991) develops a model where an initial shock due to reform of the state sector creates a pool of unemployed workers. Unemployment then declines over time as the unemployed are absorbed into an expanding private sector, while state sector employment is constant. Once unemployment declines sufficiently, it becomes constant with the private sector expanding and the state sector shrinking at the same constant rate.

Chart 1. Unemployment in the PCPEs, 1990-92.



allocating labor toward the private sector either by increasing unemployment, thus depressing private sector wages and expanding employment in the sector, or directly subsidizing employment in the sector, will result over time in the acquisition of comparative advantage in production of the private sector good and could place the economy on a path of restructuring toward the private sector good.

The effects of various shocks--such as changes in relative prices--and government policies in affecting the dynamic path of unemployment are analyzed. The role of government policies differs significantly depending on whether growth is viewed as an exogenous or an endogenous process.

When growth is exogenously determined the speed of transition has no long-run impact, and restructuring is inevitable. Therefore, policies which reduce unemployment in the early stages of transition--for instance through subsidies to the state sector--may reduce short-term costs without affecting the long-run equilibrium. In this framework, the budgetary costs of policies that attempt to lower unemployment need to be compared only against the welfare and budgetary costs of unemployment. In contrast, when growth is endogenous, policies which reduce unemployment may slow down the transition process and can jeopardize restructuring and eventual convergence to long-run specialization in the private sector good.

The paper is structured as follows. Section II presents a model of a transition economy when growth is driven by exogenous technological progress. In Section III, the basic model of the transition economy is embedded in an endogenous growth model. Section IV contains some concluding remarks.

II. A Model of Growth and Restructuring

We consider an open economy comprised of a "state" sector and a "private" sector. Each sector produces a (basket of) traded good(s), the prices of which are determined in the rest of the world. Each sector's good is produced with the use of labor as an input. For simplicity, and so as to focus on forces emanating directly from the employment decisions in each sector and the movement of labor across sectors, we abstract from the presence of physical capital and other factors in the production process. The population, or labor supply, is assumed to be constant and normalized to equal unity.

1. State sector

The model used to characterize the state sector here closely follows the model developed in Commander, Coricelli, and Stahr (1992), and is similar in spirit to that presented by Dinopoulos and Lane (1991). 1/ The

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1/ See also Lane (1991).

presentation here is, therefore, brief. The stylized feature of the state sector these models emphasize is that of a labor dominated firm: a firm controlled by a worker council, for example, whose interference in management is nontrivial. The implications of active participation of workers in management has been extensively explored in the literature (Ward (1958), Vanek (1970), Brewer and Browning (1982)). For our purposes, worker control is treated as equivalent to a powerful trade union presence where wages and employment are subject to joint maximization. 1/ In contrast to the classical labor-managed firm, the union modelled here also cares about employment and accordingly maximizes the expected utility of a representative worker in the firm or union. We assume further that there is a random selection of workers among those that remain employed and those that are laid off from the state sector. A worker who is laid off either remains unemployed and receives an exogenously set level of unemployment benefits from the government or gains employment in the private sector and earns the wage prevailing in that sector. These assumptions allow us to view the labor-dominated firm as a limiting case of an efficient bargaining model of the type commonly implemented for capitalist firms. The wage bill of the worker controlled firm will be constrained by the level of output, adjusted for any subsidies to (or taxes on) the sector. Since all profits are appropriated by workers, the wage and employment combination picked by the union will not generally correspond to the point on the contract curve picked by bargaining between union and employer in a conventional capitalist firm.

The union maximizes the expected utility of a representative worker over prospects of employment at the contract wage as against the expected utility of being laid off from the state sector. The expected utility of a worker who is laid off is a weighted average of unemployment benefits and the private sector wage, where the weights are defined by the probability that a laid off worker remains unemployed and the probability that he obtains employment in the private sector, respectively. All current workers or members of the union (M_t) receive equal treatment. The union's utility function is given by

$$V_t = \left(\frac{L_t^1}{M_t}\right) V(W_t^1) + \left(\frac{M_t - L_t^1}{M_t}\right) V(\delta_t B + (1-\delta_t)W_t^2) \qquad \text{for } M_t \geq L_t \tag{1}$$

where L_t^1 denotes the (share of the) labor force employed in the state sector--sector one; W_t^1 represents the real wage in the state sector expressed in units of the private sector's good, which is assumed to be the numeraire; δ_t represents the probability that a worker laid off from the

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1/ This contrasts with monopoly union models where the wage is either bargained or picked by the union and employment is subsequently set unilaterally by the employer; the outcome will, therefore, lie on the labor demand curve. See Oswald (1985) for a summary of this literature.

state sector remains unemployed, and $(1-\delta_t)$ represents the probability that he obtains employment in the private sector; B denotes the exogenous level of unemployment benefits paid by the government. The production function in the state sector is assumed to be of the Cobb-Douglas type, with diminishing returns to labor, so that

$$Q_t^1 = F(L_t^1) = H_t^1(L_t^1)^{\beta} \qquad \text{where } 0 < \beta < 1 \tag{2}$$

where H_t^1 represents the skill level or human capital specialized in the production of the state sector's good. The union maximizes its utility function with respect to wages and employment subject to a zero profit condition. 1/ Expressed in units of the numeraire, the private sector's good, this condition is

$$\tau P Q_t^1 - W_t^1 L_t^1 = 0 \tag{3}$$

where τ is a parameter determined by the subsidy (or tax) the enterprise receives (pays) from the government. P denotes the ratio of the internationally given relative price of the state sector's good to the private sector's good. We assume that the union does not care about its size over time, per se, and that membership evolves according to

$$\dot{M}_t = -\theta(M_t - L_t^1) \qquad \text{where } M_o > L_o^1, \quad 0 < \theta < 1 \tag{4}$$

so that a proportion of the members of the union that get laid off, leave the union.

Again, to keep the analysis simple, and to highlight the effects of certain forces in the labor market on the transition process, we assume that the union is risk neutral and $V(W_t^1)$ simply equals W_t^1. 2/ Then, maximizing the union's expected utility subject to the zero profit constraint, first order conditions can be combined to yield the union's employment rule as

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1/ In other words, the hard budget constraint is assumed to be binding. While subsidies to the state sector are allowed for, they are assumed to be prespecified and set exogenously by the government.

2/ The objective function we posit is analogous to that employed by Calvo (1978). He develops a two-sector model where a trade union in the urban sector maximizes the difference between its members' income and their alternative income in the rural sector. Note that when V( ) in equation (1) is linear, it can be rewritten as an increasing function of the differential of state sector wages over the expected alternative income of a worker laid off from the state sector.

$$F'(L_t^1) = H_t^1 \beta (L_t^1)^{\beta-1} = \frac{1}{\tau P} [\delta_t B + (1-\delta_t) W_t^2] \quad (5)$$

while the real wage in the sector equals the (subsidy adjusted) average product of labor. Note that the left hand side in equation (5), the marginal product of labor, is a decreasing function of employment in the state sector. Equation (5) therefore implies that for any given value of δ_t, the probability that a worker laid off from the state sector remains unemployed, an increase in the level of unemployment benefits or the wage level in the private sector will, by increasing the expected income of a worker laid off from the state sector, lower employment in the state sector. As employment in the state sector falls, the marginal and average product of labor will rise and the wage paid to those remaining employed will rise. 1/ Similarly, at a given level of unemployment benefits and private sector wages, a rise in δ_t reduces the expected income of a worker laid off by the union and will tend to maintain employment in the state sector. 2/

2. Private sector

The private sector is characterized as populated by firms whose employment and wage decisions are determined purely by profit maximization considerations. In particular, firms in the private sector, unlike the union in the state sector, derive no returns from maintaining employment per se and are free to fire workers. 3/ Worker effort in the private sector is endogenously determined by an efficiency-wage mechanism that is elaborated below. 4/ Output, Q_t^2, is produced by a technology of the Cobb-Douglas type, with diminishing returns to labor measured in efficiency units

$$Q_t^2 = H_t^2 [E(W_t^2 - B, U_t) L_t^2]^{\alpha} \quad \text{where } 0 < \alpha < 1, E(0, U_t) < 0 \text{ for all } U_t \quad (6)$$

where H_t^2 represents the skill level or human capital specialized in the production of the private sector's good. Labor measured in efficiency units, or the effective labor input, $[E(W_t^2-B,U_t)\cdot L_t^2]$ is defined as the product of the effort of an individual worker, $E(W_t^2-B,U_t)$, and the number of workers employed in the private sector, L_t^2. In the spirit of standard

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1/ Under the assumption of a Cobb-Douglas type technology, the average product of labor is, of course, simply a linear function of the marginal product of labor.

2/ Assuming--as will be evident below is always the case--that wages in the private sector are higher than the level of unemployment benefits.

3/ There are no incentives to "hoard" labor.

4/ Dinopoulos and Lane (1991) also employ an efficiency-wage mechanism in the private, or what they term the "nonsocialized" sector. However, our specifications differ. While they posit effort to be a function of the wage rate in the sector, we posit effort to be a function of both the wage rate and the aggregate unemployment rate. The implications differ considerably.

efficiency-wage theory 1/ we posit that an individual worker's effort in the private sector is an (i) increasing concave function of the differential of the real wage in the sector, W_t^2, over the level of unemployment benefits, B, which the worker would earn if he were fired from the private sector; it is assumed that a worker fired from the private sector cannot be immediately hired into the state sector since he is not a member of the state sector union, and so the workers reservation wage is given by the level of unemployment benefits; 2/ (ii) an increasing function of the aggregate level of unemployment, U_t. 3/ As shown below, this specification implies that aggregate unemployment acts as a disciplinary device, constraining wages in the private sector. For simplicity we assume that the effort function is separable in the two arguments.

The representative firm in the private sector maximizes profits with respect to wages and employment, given the skill level in the sector, the level of unemployment benefits, and the aggregate level of unemployment. The firm's first order conditions for profit maximization can be solved for wages and employment in the sector as functions of the level of unemployment in the economy and the level of human capital in the private sector. 4/ Wages are determined by the well known condition in efficiency-wage models that the elasticity of effort with respect to the real wage is unity

$$\frac{\partial E(W_t^2 - B, U_t)}{\partial W_t^2} \cdot \frac{W_t^2}{E(W_t^2 - B, U_t)} = 1 \qquad (7)$$

Equation (7) can then be used to solve for a unique real wage in the private sector as a function of the unemployment rate for any given level of unemployment benefits, that is

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1/ For a recent survey and overview of efficiency-wage models see Weiss (1990). Among the references cited there, for motivations of our specification see, in particular, Shapiro and Stiglitz (1984) and Calvo (1979).

2/ Since effort is an increasing function of the differential of the wage paid over unemployment benefits, it follows that the wage offered will always be greater than the level of unemployment benefits.

3/ This specification is intended to capture the mechanism put forward, for instance, by Shapiro and Stiglitz (1984) who show that unemployment induces effort because the higher is unemployment, the greater the punishment for a worker who is fired for shirking. The specification we adopt is chosen for analytical tractability. The main results on the dynamic path of unemployment are not affected by the presence of unemployment in the effort function.

4/ Both of which the firm treats as exogenous to its actions at any point in time. The specific assumptions on human capital are discussed below in the subsection on growth and restructuring.

$$W_t^2 = W^2 (U_t , B) \qquad (8)$$
$$\quad - \quad +$$

where signs underneath the arguments in the W^2 function indicate signs of the partial derivatives, and can be derived by differentiating (7). Equation (8) implies that for any given level of unemployment benefits, an increase in the aggregate unemployment rate leads the firm to offer a lower wage to workers. This effect corresponds to standard models of the Phillips curve. In our model, however, the effect results from the assumption that an increase in the aggregate unemployment rate raises each workers effort at the existing wage. This allows the firm to lower the wage offered and still obtain the same effort level from workers.

The optimal level of employment in the private sector can be expressed as a function of the wage as

$$L_t^2 = \frac{\left[\alpha H_t^2\right]^{\frac{1}{1-\alpha}} \left[E(W_t^2 - B, U_t) \right]^{\frac{\alpha}{1-\alpha}}}{\left[W_t^2\right]^{\frac{1}{1-\alpha}}} \qquad (9)$$

It is straightforward to show that the optimal level of employment in the private sector is a decreasing function of the wage offered by the firm. Employment in the private sector can, therefore, be described by the function

$$L_t^2 = L^2 [W_2 (U_t ; B) , U_t , H_t^2 ; B] \qquad (10)$$
$$\quad - \quad - \quad + \quad + \quad + \quad -$$

where signs underneath the last three arguments can be obtained directly by examination of (9). For later purposes it is useful to distinguish two separate channels through which an increase in unemployment affects employment in the private sector: one associated with the lowering of wages; the other directly through an increase in worker effort at the existing wage, as (9) brings out. Equation (10) implies that employment in the private sector can be written simply as

$$L_t^2 = L^2 (U_t , H_t^2 ; B) \qquad (11)$$
$$\quad + \quad + \quad -$$

that is, as an increasing function of the unemployment rate and the level of human capital in the private sector, and a decreasing function of the level of unemployment benefits.

3. Growth and restructuring

H_t^i in each sector's production function represents the skill level or human capital specialized in the production of each sector's good, or the

level of total factor productivity. The effect of the skill level or human capital is assumed to be entirely external to any single firm and it cannot be captured by it. In this section, in the spirit of neoclassical growth models we assume that the growth of this human capital or total factor productivity occurs exogenously. Skills are acquired according to

$$\frac{\dot{H}_t^1}{H_t^1} = \gamma_1 , \quad \frac{\dot{H}_t^2}{H_t^2} = \gamma_2 \tag{12}$$

We posit further that $\gamma_2 > \gamma_1$, so that the skill level or productivity grows at a faster rate in the private sector than in the state sector. Equation (12) then implies that the Production Possibility Frontier of the economy will shift out over time in favor of production of the private sector's good. Comparative advantage in producing the private sector good will thus grow over time and, at unchanged relative prices, employment and production will be restructured in favor of the private sector's good.

The assumption of a higher speed of productivity growth in the private sector is the driving force behind restructuring in the model. There are several reasons to expect this to be the case. First, to the extent that private sector activity represents a "new" activity while state sector activity represents an "old" activity, the scope for learning and hence productivity increases should be greater in the new activity. Second, if the private sector good is interpreted as representing goods produced in Western markets, while the state sector good is interpreted as representing goods produced, for an insulated market in the former CMEA, for example, then the higher speed of productivity growth can be interpreted as resulting from the greater potential for productivity increases, as the economy "catches up" to western total factor productivity levels. Third, rather than as a catch-up effect due to level differences, it could be argued that the underlying speed of innovations was greater in Western markets, so that one would expect a greater potential for technology transfer from the rest of the world. Finally, it could be argued that the inherent distortions in the state sector, the low quality of inherited physical capital--plants and machinery--and the obsolete technologies embodied in them, present an environment where productivity increases are likely to be slow.

The skill accumulation equations can be combined to yield a relative skill accumulation equation

$$\frac{\dot{H}_t}{H_t} = \gamma_2 - \gamma_1 = \theta_1 \tag{13}$$

where H_t represents the ratio of the skills level or human capital in the private sector to that in the state sector. To keep the analysis tractable, while still allowing for a higher speed of productivity growth in the private sector, we model the limiting case where skills accumulate in the private sector, but the skill level in the state sector is constant and normalized to equal unity. H_t is then used to denote the level of human capital in the private sector, and the sectoral subscript on it is dropped.

4. Equilibrium

Equilibrium in the economy at any point in time, that is for any level of the one state variable in the system given by history, the level of human capital in the private sector, can be defined by the identity

$$L_t^1 + L_t^2 + U_t = 1 \tag{14}$$

that is, the labor force is either employed in one of the two sectors or is unemployed. Further, we impose that in general equilibrium the probabilities perceived by members of the union that a worker laid off from the state sector becomes unemployed or gains employment in the private sector are equal to their actual values. Assuming that the private sector randomly selects the desired number of workers from the pool of workers who are not employed in the state sector, this probability is defined by

$$\delta_t = \frac{U_t}{U_t + L_t^2} \tag{15}$$

Substituting this definition into the state sector union's employment rule, equilibrium employment in the state sector can be expressed as a function of the unemployment rate, the level of employment in the private sector, the wage rate in the private sector, and the exogenous variables of the system

$$L_t^1 = L_t^1 \underset{+}{[U_t} , \underset{-}{W_t^2} , \underset{-}{L_t^2} ; \underset{+}{\tau P} , \underset{-}{B}] \tag{16}$$

where the signs of the partial derivatives are straightforward to note from equation (5). Substituting in equations (8) and (11) which define employment and the wage rate in the private sector, equilibrium employment in the state sector can be written as

$$L_t^1 = L_t^1 \underset{+}{[U_t} , \underset{-}{W^2} \underset{-}{(U_t)} , \underset{-}{L^2} \underset{+}{(U_t} , \underset{+}{H_t} ; \underset{-}{B}) ; \underset{+}{\tau P} , \underset{-}{B}] \tag{17}$$

that is, as a function of the unemployment rate, the level of human capital in the private sector, and the exogenous variables in the system. Substituting this expression for L_t^1 and the solution for L_t^2 in equation (11), into equation (14), then yields an equation that can be solved for equilibrium unemployment as a function of the level of private sector human capital. Since H_t is, for now, posited to grow exogenously over time, this

curve represents the phase diagram of the economy, that is the dynamic path of unemployment as the private sector grows.

To establish the nature of the time path of unemployment it is necessary first to determine the response of state sector employment to changes in unemployment and the level of human capital in the private sector. Note from equation (17) that employment in the state sector is a decreasing function of the level of human capital in the private sector. An increase in the level of human capital in the private sector expands employment in the private sector, lowering the probability that a worker laid off from the state sector becomes unemployed. This raises the expected wage of a worker laid off from the state sector causing the union to lay off workers.

The response of employment in the state sector to an increase in unemployment is more complicated. Three separate effects can be identified. First, an increase in unemployment raises the probability that a worker laid off from the state sector will remain unemployed, thus discouraging the union from laying off workers. Second, an increase in unemployment reduces wages in the private sector, also discouraging the union from laying off workers. Third, an increase in unemployment raises employment in the private sector, lowering the probability that a worker laid off from the state sector will become unemployed, thus encouraging the union to lay off workers. As we have noted earlier, an increase in unemployment increases employment in the private sector through two channels: through a decline in the real wage and through a direct effect on worker effort. Differentiating the union's employment rule, the response of employment in the state sector to an increase in unemployment can be written as the sum of the four mentioned effects with the first two positive and the second two negative

$$\frac{\partial L_t^1}{\partial U_t} = \frac{(L_t^1)^{2-\beta}}{\beta(1-\beta)\tau P}\,\frac{(1-\delta_t)(W_t^2-B)}{(1-L_t^1)} + \frac{(L_t^1)^{2-\beta}}{\beta(1-\beta)\tau P}(1-\delta_t)\left(-\frac{\partial W_t^2}{\partial U_t}\right) \tag{18}$$

$$-\frac{(L_t^1)^{2-\beta}}{\beta(1-\beta)\tau P}\,\frac{\delta_t(W_t^2-B)}{(1-L_t^1)}\,\frac{L_t^2}{W_t^2}\left(-\frac{\partial W_t^2}{\partial U_t}\right) - \frac{(L_t^1)^{2-\beta}}{\beta(1-\beta)\tau P}\,\frac{\delta_t(W_t-B)}{(1-L_t^1)}\,\frac{\alpha}{(1-\alpha)}\,L_t^2\,\frac{\partial E}{\partial U_t}\cdot\frac{1}{E}$$

Combining terms

$$\frac{\partial L_t^1}{\partial U_t} = \frac{(L_t^1)^{2-\beta}}{\beta(1-\beta)\tau P}\left[-\frac{\partial W_t^2}{\partial U_t}\right]\frac{(1-\delta_t)}{W_t^2}\left[\delta_t B + (1-\delta_t)W_t^2\right]$$

$$+\frac{(L_t^1)^{2-\beta}}{\beta(1-\beta)\tau P}\,\frac{\alpha}{(1-\alpha)}\,\frac{(1-\delta_t)}{(1-L_t^1)}\,(W_t^2 - B)\left[\frac{1-\alpha}{\alpha} - \frac{\partial E}{\partial U_t}\cdot\frac{U_t}{E_t}\right] \tag{19}$$

where the first term is positive, as the direct effect of a decline in wages in the private sector on state sector employment dominates the indirect effect by which the decline in private sector wages raises private sector employment and thus tends to reduce state sector employment. The second two terms represent the difference between the direct effect of unemployment on state sector employment and the indirect effect of unemployment through its effect on worker effort in the private sector and the consequent expansion in private sector employment. As equation (19) shows, as long as the elasticity of effort with respect to unemployment is less than a positive constant, this term will be positive, that is

$$\frac{\partial E_t}{\partial U_t}\cdot\frac{U_t}{E_t} < \frac{1-\alpha}{\alpha} \tag{20}$$

We assume that this is the case. It is worth noting that this condition is not necessary for any of our results. It is, however, sufficient. 1/ Under this condition, then, employment in the state sector is an increasing function of the unemployment rate.

While the effects of changes in relative prices and the rate of subsidy to the state sector on employment in the sector are straightforward to establish, the effect of a change in unemployment benefits is ambiguous as suggested by equation (17). We postpone a detailed discussion of the effects of unemployment benefits on employment in the state sector to the

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1/ The necessary condition for the analysis to be entirely unchanged is that the sum of the (i) partial derivative of employment in the state sector with respect to unemployment; (ii) the partial derivative of employment in the private sector with respect to unemployment--which is unambiguously positive; and (iii) unity be positive. Alternatively stated, the partial derivative of aggregate employment in the economy with respect to unemployment must be greater than negative unity. From a stability point of view one would expect the partial derivative of aggregate employment with respect to unemployment to be positive. While we could assume a much weaker condition, our assumption has the advantage of keeping the presentation of the analysis transparent. We note also that in simulations of the model we were unable to find a case where the partial derivative of employment in the private sector with respect to unemployment was negative.

discussion of policies below, and for now simply leave the partial derivative unsigned. To summarize, we have that

$$L_t^1 = L^1(\underset{+}{U_t}, \underset{-}{H_t}; \underset{+}{\tau P}, B) \tag{21}$$

General equilibrium in the economy at each point in time is defined by

$$L_t^1(\underset{+}{U_t}, \underset{-}{H_t}; \underset{+}{\tau P}, B) + L_t^2(\underset{+}{U_t}, \underset{+}{H_t}; \underset{-}{B}) + U_t = 1 \tag{22}$$

We now proceed to establish the shape of this curve, which we shall refer to as the UH curve in the unemployment-private sector human capital plane. Note from equation (9) that when the level of human capital in the private sector is zero, employment in the private sector will be zero. The probability that a worker laid off from the state sector remain unemployed is then unity. Therefore, the initial share of employment in the state sector is determined by solving

$$\beta(L_t^1)^{\beta-1} = \frac{B}{\tau P} \tag{23}$$

for L_t^1. The initial unemployment rate is then

$$\underline{U} = 1 - \left[\frac{\tau P \beta}{B}\right]^{\frac{1}{1-\beta}} \tag{24}$$

so that the higher are unemployment benefits, the lower is the initial level of employment in the state sector and the higher the initial unemployment rate.

For positive levels of human capital in the private sector, the evolution of the unemployment rate with the accumulation of private sector human capital is determined by differentiating (22)

$$\frac{dU_t}{dH_t} = \frac{-\left[\frac{\partial L_t^1}{\partial H_t} + \frac{\partial L_t^2}{\partial H_t}\right]}{\left[\frac{\partial L_t^1}{\partial U_t} + \frac{\partial L_t^2}{\partial U_t} + 1\right]} \tag{25}$$

The denominator is always positive. In the numerator, however, whereas employment in the state sector is a decreasing function of the level of

human capital, employment in the private sector is an increasing function of the level of human capital. Differentiating equation (5), and combining terms, the numerator in (25) can be expressed as

$$\left[\delta_t(W_t^2 - B) - \tau P(1 - L_t^1)(-F''(L_t^1))\right] \frac{1}{\tau P} \quad (1 - L_t^1) \frac{1}{(-F''(L_t^1))} \left(\frac{\partial L_t^2}{\partial H_t}\right)_{+} \tag{26}$$

Since the terms outside the square brackets are all positive, the sign of this expression will be determined by the sign of the expression in square brackets, that is

$$\text{Sign of } \left(\frac{dU_t}{dH_t}\right) = \text{Sign of } \left[\delta_t (W_t^2 - B) - \tau P(1 - L_t^1) (-F''(L_t^1))\right] \tag{27}$$

the difference of two positive terms.

We will now show that the slope of the UH curve eventually becomes negative as the level of human capital increases. However, at small values of human capital the slope can be negative or positive. The latter case implies that the slope of UH switches sign at some level of human capital: unemployment will first rise even as human capital in the private sector grows and employment opportunities in the sector expand. We show that whether or not this curve first slopes upward is determined by the initial distribution of the labor force between employment in the state sector and unemployment. The larger the initial size of the state sector, and hence the smaller the initial unemployment rate, the more likely it is that this curve will slope upwards at small levels of H.

It is useful to note several features of the expression in (27), which can be rewritten as

$$\left[W^2(U_t) - \frac{\tau P \beta}{(L_t^1)^{1-\beta}}\right] - \frac{\tau P(1 - L_t^1)\, \beta(1 - \beta)}{(L_t^1)^{2-\beta}} \tag{28}$$

First, note that as L_t^1 becomes small, the absolute value of the second term increases and the expression must, at some value of L_t^1, become negative. In fact as L_t^1 approaches zero the expression will approach negative infinity. Since L_t^1 is a decreasing function of H_t, it follows that as H increases, the slope of the UH curve eventually becomes negative. Second, note that when L_t^1 is large the second term is small. In fact as L_t^1 approaches unity the second term approaches zero. The magnitude of the first term depends also on the level of unemployment. Since the wage in the private sector is a decreasing function of the level of unemployment, the first term, i.e. the term in square brackets, will be largest when employment in the state sector

is high, so that the marginal product of labor in the state sector is low, and when unemployment is low, so that the level of unemployment does not exert much downward pressure on the private sector wage. In such circumstances the private sector wage will be determined predominantly by considerations of worker efficiency and hence tend to be relatively high. The expression is likely to be positive, therefore, when the initial level of employment in the state sector is high and the level of unemployment low. Since this is a feature of the initial condition of most PCPEs--with, in many cases, almost the entire labor force employed in the state sector and unemployment non existent--this is the case we focus on in the remainder of the paper. Figure 1 plots such a hump-shaped UH curve with the unemployment rate rising as H increases and then eventually declining as H continues to increase.

Whether or not the UH curve first slopes upward is determined by the initial distribution of the labor force between the state sector and unemployment. The initial distribution of the labor force is determined, as equations (23) and (24) show, by the level of unemployment benefits, the magnitude of the subsidy to the state sector, and the relative prices of the two goods. While we postpone for later a detailed discussion of the effects of policies on the path of unemployment, the above discussion implies that, for example, unemployment benefits can be increased sufficiently to ensure that the UH curve is downward sloping. Note, however, that this would be accomplished only by increasing the initial level of unemployment so that the potential increase in unemployment that occurs at a later stage in the transition process is simply brought forward in time.

5. Dynamic path of the economy

With unchanged policies, the UH curve in Figure 1 describes the dynamic path of the economy as the (relative) level of productivity, skills, or human capital in the private sector grows over time. It is possible to show that along this path, employment in the state sector shrinks continuously, while employment in the private sector expands continuously. Eventually, the unemployment rate goes to zero 1/, and subsequently the economy specializes in the production of the private sector good. 2/ On the left hand side of the peak unemployment rate, as the economy traverses up the UH curve, both unemployment and the level of human capital are increasing.

1/ Or some positive number representing the natural rate of unemployment. Here the natural rate has been "normalized" to zero.

2/ In microeconomic models of efficiency wages, as for example in Shapiro and Stiglitz (1984), the unemployment rate can never fall to the natural rate in that there is always involuntary unemployment. With our specification of a continuous effort function, however, as H_t continues to rise, unemployment will tend toward the natural rate. Once unemployment declines to the natural rate (zero), strictly speaking there is a discontinuity in behavior in our model, as efficiency considerations will cease to play any role and wages will be at their competitive level.

Since employment in the private sector is an increasing function of both, it must be expanding. Now, since private sector employment and unemployment are both expanding, the remainder of the labor force, which is employed in the state sector must be shrinking. On the right hand side of the peak unemployment rate, unemployment is falling, while the level of human capital is rising. Employment in the state sector is an increasing function of the level of unemployment and a decreasing function of the level of human capital in the private sector. It follows that employment in the state sector will continue to decline as the economy traverses down the UH curve from the peak unemployment rate. Since both state sector employment and unemployment are falling, the remainder of the labor force, which is employed in the private sector, must be rising. The entire restructuring process is characterized by a monotonic decline of employment in the state sector and a monotonic rise of employment in the private sector. However, in the early stages of the transition process, when the level of employment in the state sector is high and the level of employment in the private sector is low, the analysis shows that the speed at which the state sector sheds labor is greater than the speed at which the private sector absorbs labor, leading to a rise in unemployment. In the later stages of transition, the opposite is true. Once the private sector has expanded to a critical stage, it absorbs labor at a faster pace than the state sector sheds it, leading to a decline in unemployment. 1/

Consider the path of wages in each sector during the restructuring process. As employment in the state sector declines, the marginal and average products of labor in the state sector will rise and so the wage paid in the sector will rise. In the private sector, however, in the early stages of the transition process, as the unemployment rate rises, the wage rate will fall until the unemployment rate peaks. Subsequently, the wage in the private sector will begin to rise.

The analysis presents a manifestation of popular notions of the costs of transition from an economy dominated by a state sector to one comprised largely of a private sector. The forces in the system just discussed imply that in the initial stages of transition, as a natural consequence of the process of reallocation of labor accompanying the restructuring, the economy

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1/ It is possible to show that δ_t declines monotonically from unity, when H_t equals zero, as the economy moves rightward along the UH curve. On the left hand side of the peak unemployment rate, note that

$$(dL_t^1)_{-} = \left(\frac{\partial L_t^1}{\partial \delta}_{+}\right) d\delta + \left(\frac{\partial L_t^1}{\partial W_t^2}_{-}\right) (dW_2)_{-}$$

Therefore, $d\delta$ must be negative. On the right hand side of the peak unemployment rate, U_t is falling, while $(1-L_t^1)$ is rising, therefore δ_t which equals $U_t/(1-L_t^1)$ must continue to fall.

Figure 1. Dynamic Path of Economy with Exogenous Accumulation of Human Capital.

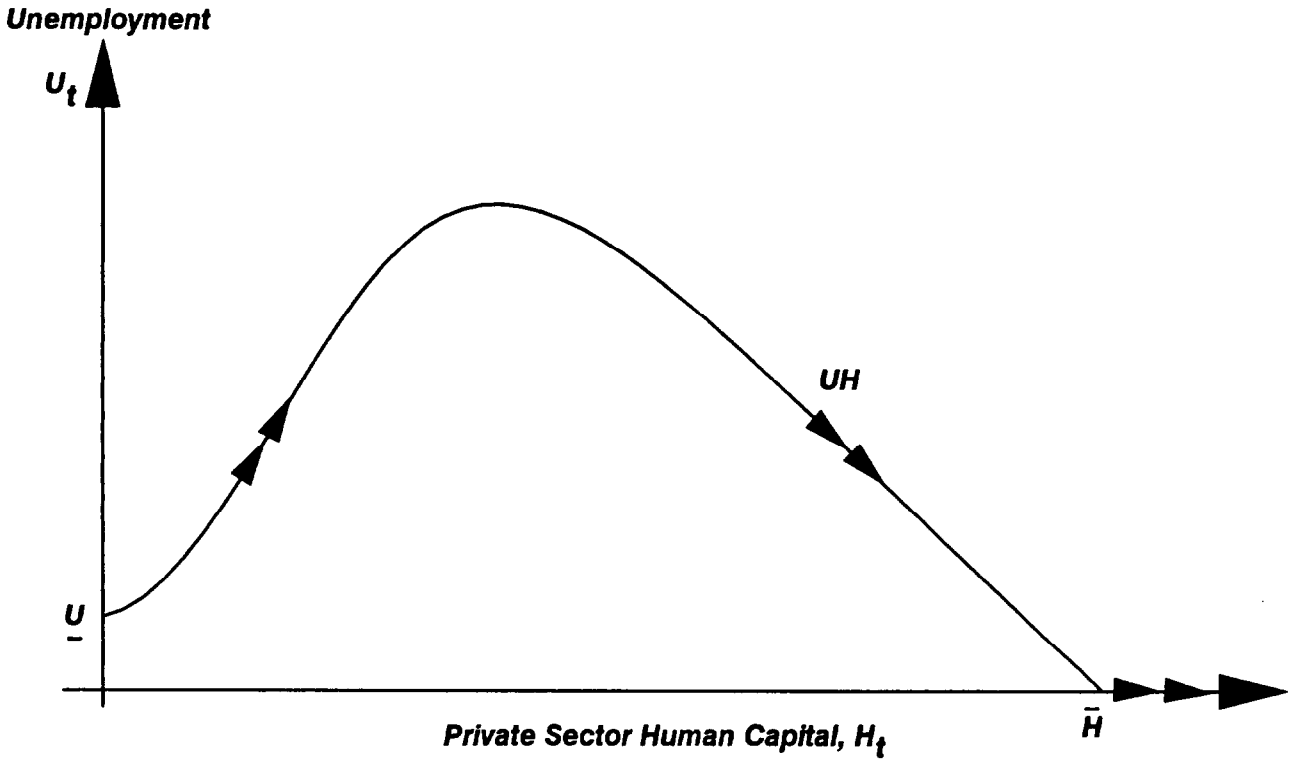
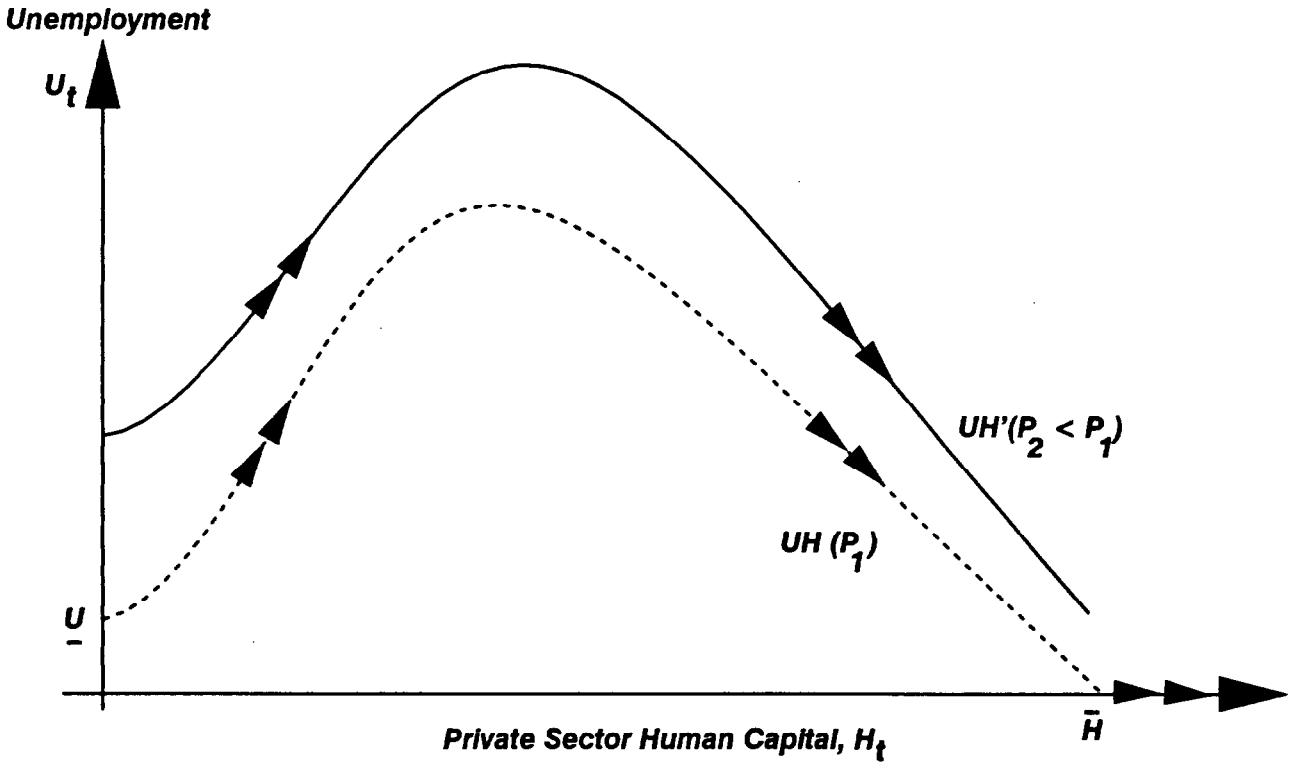


Figure 2. Effect of an Increase in the Price of the Private Sector's Good.



will not only suffer unemployment, but that this cost will rise over time even as the private sector expands. It is worth emphasizing that this is dictated by the intrinsic dynamics of the economy and happens in the absence of any new shocks to the system. It is only after a critical level of development of the private sector will continued restructuring be accompanied by a decline in the unemployment rate. There are thus two distinct stages in the transition process: an early difficult stage, and a relatively easier later stage. There is clearly a potential role for government policies in affecting the dynamic path of the economy during the restructuring process and thus reducing the costs of the transition. However, policies that attempt to reduce the costs of the transition by lowering the unemployment rate are also going to impact on the speed of the transition. 1/ We show in the next section that the speed of transition can play an important role in determining the outcome of the restructuring process when the accumulation of skills in the private sector are endogenously determined. We turn now to an examination of the effects of policies and exogenous variables on the time path of unemployment during the transition process and their effect on the speed of transition. We focus first on the effects of once-and-for-all changes in these variables and then examine the effects of a policy that attempts to continuously reduce unemployment.

6. Changes in the terms of trade or a liberalization of prices to international levels

Consider the effect of an exogenous increase in the internationally given relative price of the private sector's good. If the private sector's good is interpreted as the (basket of) good(s) predominantly produced in western markets, and the state sector's good is thought of as produced for an insulated market--for trade within the former CMEA, for example--then the process of price liberalization and the opening of markets to competition from the West that has taken place in the PCPEs of Central and Eastern Europe, can be likened to an exogenous decline in the relative price of the state sector's good. Note that P denotes the ratio of the state sector's good to the private sector's good. An increase in the relative price of the private sector's good thus corresponds to a decline in P. Then, differentiating equation (22) and noting the sign of the partial derivative of employment in the state sector with respect to an increase in P, we have that, at each level of H_t

$$\frac{dU_t}{dP} = \frac{-\frac{\partial L_t^1}{\partial P}}{\frac{\partial L_t^1}{\partial U_t} + \frac{\partial L_t^2}{\partial U_t} + 1} < 0 \qquad (29)$$

1/ A detailed examination of budgetary pressures on the transition process are examined in Chadha and Coricelli (1993).

Since we have established that the denominator is positive, the curve UH unambiguously shifts up in response to a decline in P as shown in Figure 2. Since the private sector's good is treated as the numeraire, a change in relative prices has no direct effect on the employment decision of the private sector. For the state sector, however, an increase in the relative price of the private sector's good raises the value of the expected income of a laid off worker, measured in units of the state sector's good, leading the union to lay off workers. While there is no direct effect of a change in the relative price on the private sector's employment decision, there is an indirect effect. Since unemployment is now higher at each level of H_t, the wage paid by the private sector will be lower, and employment in the private sector will expand. Since at each level of H_t, and therefore each point in time during the transition process, unemployment and private sector employment are higher, employment in the state sector is lower. The speed of transition of the economy is thus higher as a result of an increase in the relative price of the private sector's good.

7. Effect of changes in state sector subsidies

The effects of once-and-for-all changes in the parameter τ, which is used to represent (one plus) the rate of subsidy (or tax) on output of the state sector in equation (3), are completely analogous to the effects of a change in relative prices just discussed. This can be seen by noting that τ and P appear jointly in equation (5), the state sector's employment rule, and do not directly impact on the private sector's employment decision. The effect of a decline in the rate of subsidy to the state sector, which corresponds to a decline in the value of the parameter τ would, therefore, shift the UH curve up exactly as in Figure 2, increasing unemployment at each point in time, reducing the share of the labor force in the state sector, and increasing the share of the labor force employed in the private sector.

We note that at the level of aggregation employed in the model developed here, the effects of changes in the parameter τ can also be interpreted as the effects of changes in various other policy variables on the state sector: a tariff on the state sector; an employment or wage tax or subsidy in the state sector, and hence the effects of wage-bill ceilings. While these interpretations are not pursued here, it is useful to bear them in mind as alternative instruments for achieving the policy objectives discussed.

8. Effect of an employment or wage subsidy in the private sector

Since unemployment rises in the early stages of the transition process because the state sector sheds labor at a faster rate than the private sector absorbs labor, a natural question is the effect of an employment or wage subsidy in the private sector. If firms in the private sector are

granted an exogenous subsidy at the rate μ for each unit of labor they hire, the firm's first order conditions imply

$$\frac{\partial E(W_t^2 - B, U_t)}{\partial W_t^2} \cdot \frac{(W_t^2 - \mu)}{E(W_t^2 - B, U_t)} = 1 , \qquad \mu < W_t^2 \tag{30}$$

so that the elasticity of effort with respect to the real wage, adjusted for the rate of subsidy, equals unity. The real wage can then be expressed as a function of the rate of subsidy. It is straightforward to establish that

$$W_t^2 = W^2(U_t ; B , \mu) \tag{31}$$
$$\quad - \quad + \quad -$$

so that the wage paid in the private sector declines with an increase in the rate of employment subsidy. By lowering the cost of raw labor, the employment subsidy lowers the cost to the firm per unit of effective labor. The firm will therefore offer a lower wage rate to achieve the same cost per unit of effective labor and expand employment. Employment in the private sector is now given by

$$L_t^2 = \frac{(\alpha H_t)^{\frac{1}{1-\alpha}} [E(W_t^2 - B, U_t)]^{\frac{\alpha}{1-\alpha}}}{(W_t^2 - \mu)^{\frac{1}{1-\alpha}}} \tag{32}$$

and therefore

$$L_t^2 = L^2(U_t , H_t ; B, \mu) \tag{33}$$
$$\quad + \quad + \quad - \quad +$$

Noting that an employment subsidy to the private sector will directly impact also the state sector's employment decision by changing the expected wage of a worker laid off by the union, the impact on unemployment at any given level of H_t, or the vertical shift of the UH curve is given by

$$\frac{dU_t}{d\mu} = \frac{-\left[\frac{\partial L_t^1}{\partial \mu} + \frac{\partial L_t^2}{\partial \mu}\right]}{\left[\frac{\partial L_t^1}{\partial U_t} + \frac{\partial L_t^2}{\partial U_t} + 1\right]} \tag{34}$$

The denominator of (34) is positive. It can be shown that the sign of the numerator is determined by the sign of

$$\left[(W_t^2 - \tau P\, F'(L_t^1)) - (1 - L_t^1)\, \tau P(-F''(L_t^1))\right] \left(\frac{\partial L_t^2}{\partial \mu}\right)_{+} + L_t^2 \left(\frac{\partial W_t^2}{\partial \mu}\right)_{-} \tag{35}$$

Whereas the second term in the expression is negative, the sign of the first term is determined by the sign of the term in square brackets. This expression in square brackets is exactly the expression that determines the slope of the UH curve (see equation (27)). It follows that when the slope of the UH curve is zero or negative, as it is for large values of H_t, the expression in (35) must be negative, so that the curve UH shifts down. For small values of H_t, however, when the UH curve is positively sloped, the first term in (35) is positive. Note further that in the limiting case when H_t equals zero L_t^2 equals zero, so that the expression will be positive. By continuity it follows that there exists a range of values of H_t starting with zero such that the UH curve shifts up. Such a shift of the UH curve is plotted in Figure 3 where for small values of H_t the UH curve shifts up, while for larger values of H_t it shifts down. The downward shift of the UH curve or the reduction in unemployment at large values of H_t is intuitive. The reason for the upward shift at low levels of H_t should also be clear. Essentially, subsidizing employment in the private sector causes employment to expand. However, the size of the sector also affects the extent to which it will expand. At the same time, the expansion of employment opportunities in the private sector causes an outflow of workers from the state sector. What we have established is that at low levels of H_t, the outflow from the state sector will exceed the flow into the private sector.

We now establish that private sector employment is higher at each point in the transition process as a result of the increase in the employment subsidy to the sector. In Figure 3, for values of H_t up to H_1, the increase in employment subsidy in the private sector creates higher private sector employment since at each level of H_t, in addition to the effects of the subsidy, unemployment is higher. To establish that private sector employment is higher for all levels of H_t, first note that at H_1, where the values of unemployment and human capital in the private sector are the same on both curves, private sector employment is higher on the shifted UH curve since the rate of subsidy to the sector is higher. Then, note that the response of private sector employment to changes in H can be written as

$$\frac{\partial L_t^2}{\partial H_t} = \frac{1}{1 - \alpha}\, \frac{1}{(\alpha H)}\, L_t^2 \underset{+}{(\mu)} \tag{36}$$

Figure 3. Effect of increase in rate of employment subsidy to private sector.

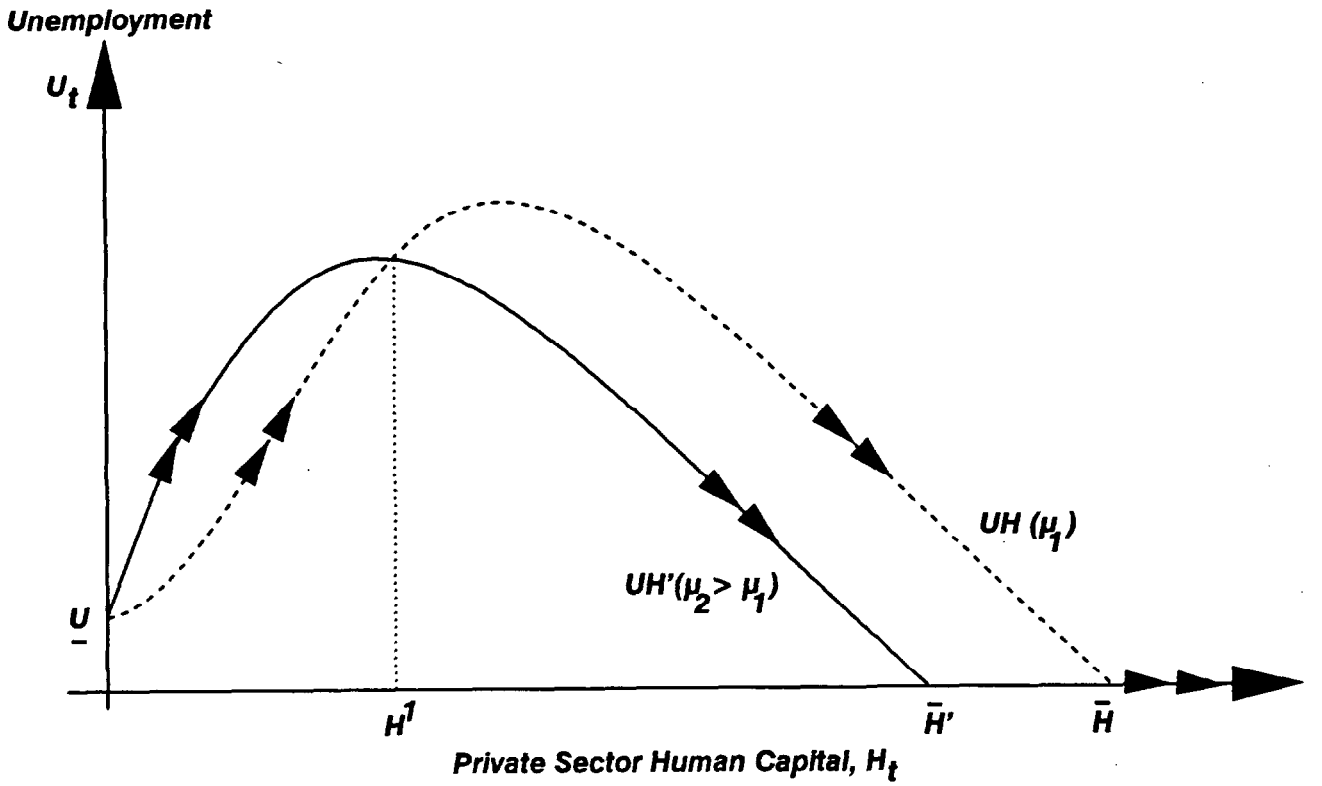
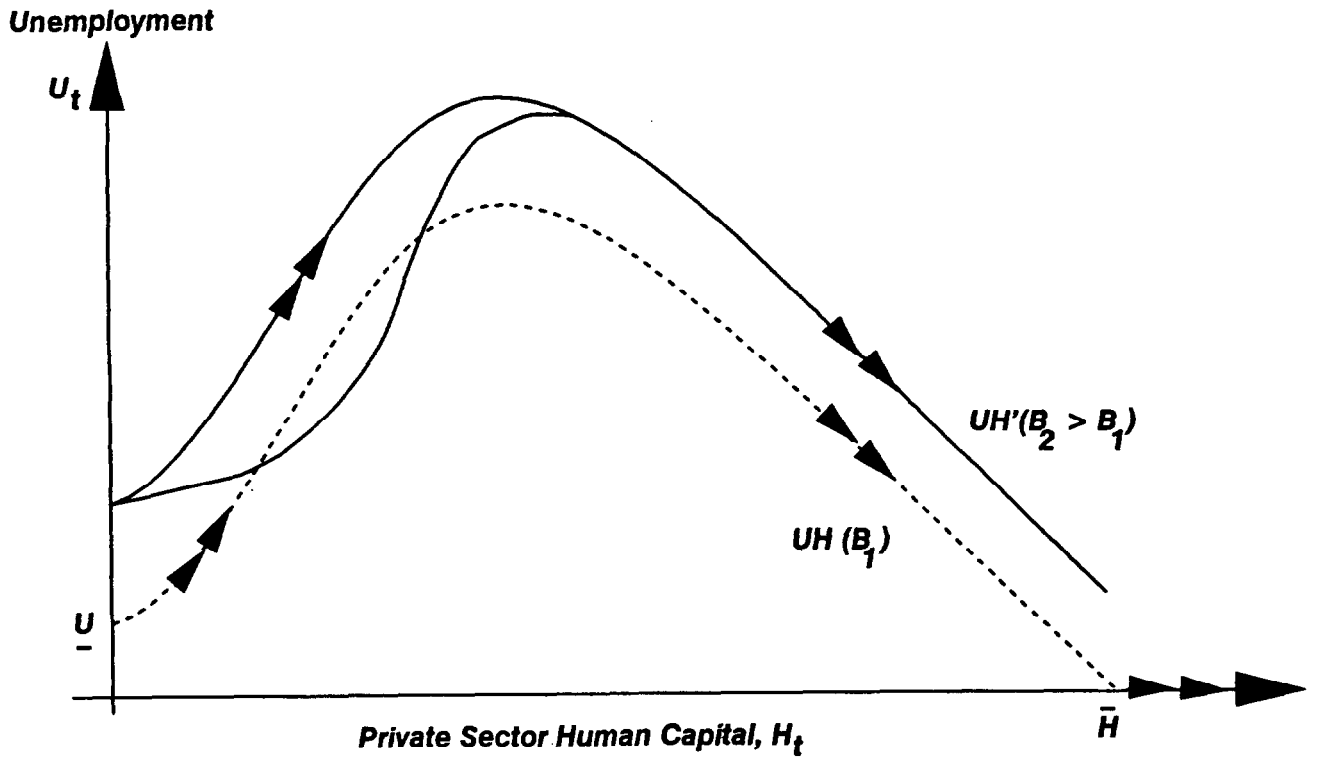


Figure 4. Alternative Effects of an Increase in Unemployment Benefits.



so that the response increases with an increase in the rate of subsidy. It follows that since the level of private sector employment at H_1 is higher after the increase in subsidy and its slope with respect to H_t increases, private sector employment is higher at all subsequent levels of H_t.

9. Unemployment benefits

An increase in unemployment benefits, by raising the alternative income of a worker employed in the private sector, that is, his reservation wage, causes firms in the private sector to raise offered wages and cut back employment. For workers in the state sector, the expected wage of a laid off worker increases because of both the increase in unemployment benefits and the increase in private sector wages, creating an incentive for the union to lay off workers. However, the outflow of workers from each sector increases the probability that a worker leaving the state sector remain unemployed, thus creating an incentive for the union to retain workers. The total impact on unemployment at any level of H_t is given by

$$\frac{dU_t}{dB} = \frac{-\frac{\partial L_t^1}{\partial B} - \frac{\partial L_t^2}{\partial B}}{\frac{\partial L_t^1}{\partial U_t} + \frac{\partial L_t^2}{\partial U_t} + 1} \tag{37}$$

where the denominator is always positive, while the sign of the numerator can be shown to be determined by the sign of

$$U_t + L_t^2 \left(\frac{\partial W_t^2}{\partial B} \right) + \left[(W_t^2 - \tau P F'(L_1)) - (1 - L_1)\, \tau P(-F''(L_t^1)) \right] \left(\frac{\partial L_t^2}{\partial B} \right) \tag{38}$$

(+) (−)

It follows that when the slope of the UH curve is negative or zero (as determined by the term in square brackets), the expression is positive so that the UH curve shifts up. For values of H_t between zero and that corresponding to the peak unemployment rate, however, the effect is ambiguous. Note from equation (24) that the intercept of the UH curve unambiguously shifts up. Figure 4 plots two alternative possible shifts of the UH curve in response to an increase in unemployment benefits.

10. Policies to continuously reduce the unemployment rate

There is of course no reason why policy variables should be adjusted only in a once-and-for-all manner in the present framework. Since the analysis suggests that with unchanged policies the unemployment rate will rise over time in the early stages of the transition, it is natural to consider policies that prevent the unemployment rate from rising over time or even, as the analysis predicts the unemployment rate will eventually fall to zero, to consider policies that attempt to reduce unemployment monotonically to such a level, and thereby reduce the costs of the transition. In the absence of specifying a particular objective function for the government there are, of course, an infinite number of paths for the unemployment rate that one could pick. To focus ideas, we examine one that seems intuitive. In Figure 5, with unchanged policies, unemployment rises from $\underline{U}$, then subsequently falls, eventually reaching zero at $\bar{H}$. We consider a policy that seeks to take the economy in a linear fashion from $\underline{U}$ to $\bar{H}$, so that the dynamic path is given by the straight line joining $\underline{U}$ and $\bar{H}$. Starting at the initial unemployment rate, therefore, such a policy would succeed not only in lowering the unemployment rate at each point in time compared to what it would be in the absence of such a policy, but also in lowering the rate of unemployment monotonically over time.

Consider how policies can achieve such a path. An employment subsidy to the private sector was shown to raise unemployment for small values of H without affecting the initial unemployment rate. This suggests that a policy to reduce the unemployment rate at small levels of H would actually need to tax employment in the private sector, and would succeed in lowering unemployment by preventing an outflow of workers from the state sector. A more direct way of doing this would of course be to subsidize employment or output in the state sector. 1/ Moreover, since changes in the subsidy (or tax) to the private sector are powerless to affect the vertical intercept of the UH curve, and the curve is positively sloped at this point for any rate of tax or subsidy to the private sector, it follows that there will exist some range of H_t over which a such a policy cannot succeed in lowering the unemployment rate monotonically over time.

Consider instead an output subsidy to the state sector. 2/ This was shown to shift the UH curve down for all levels of H. Figure 5 plots several UH curves as the rate of subsidy to the state sector increases. Figure 5 makes clear that for the economy to traverse on a straight line from $\underline{U}$ to $\bar{H}$ the rate of subsidy to the state sector will have to increase over time as H_t increases up to H'. That the rate of subsidy needs to increase over time is intuitive since the subsidy will be preventing

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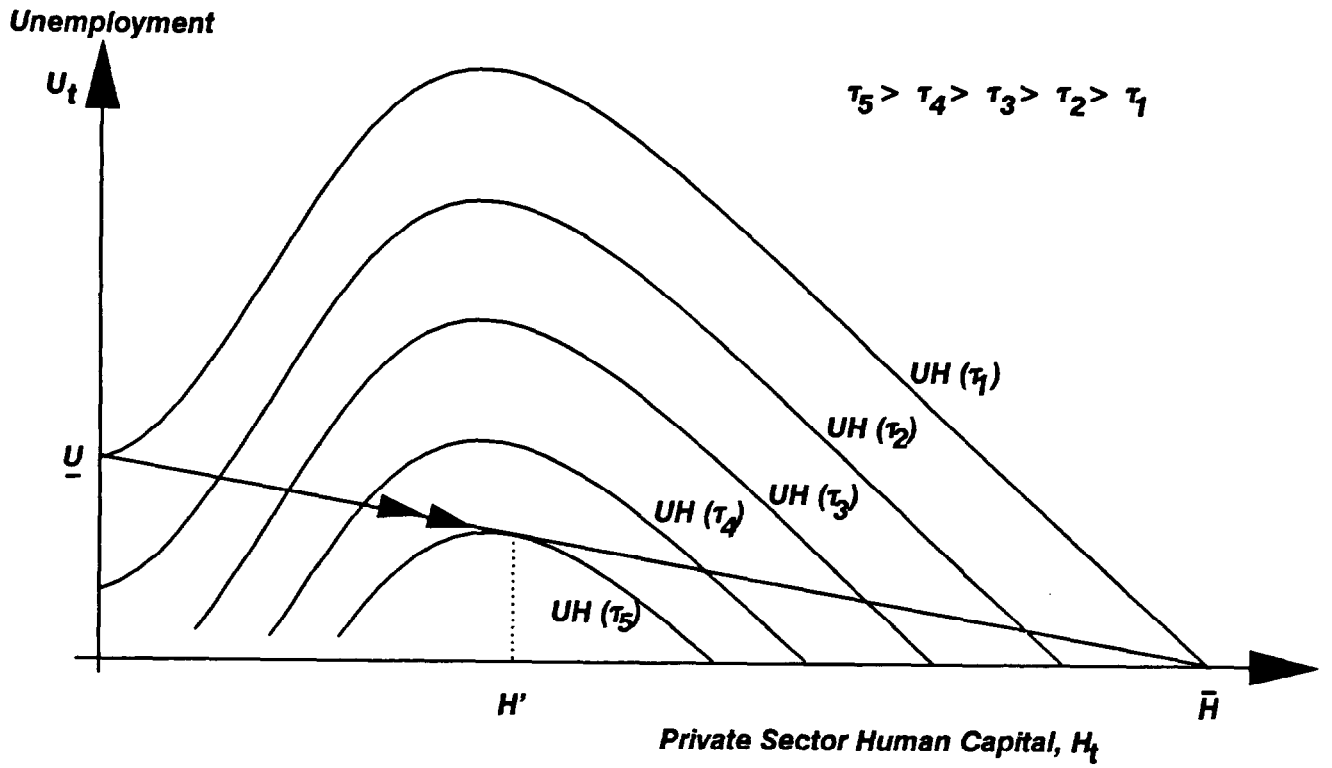
1/ There is no reason to use the same policy instrument for the entire transition process.

2/ Recall the earlier discussion that the use of several alternative policy instruments in the state sector would be equivalent in this model to the use of an output subsidy.

Figure 5. Time Varying State Sector Subsidy to Lower Unemployment Continuously.



potentially increasing amounts of unemployment. As H exceeds H' in Figure 5, however, if the rate of subsidy is maintained then the economy will simply traverse down the right hand side of the UH curve tangent to the straight line $\underline{U}\bar{H}$ at H=H'. Therefore, a more gradual reduction in the unemployment rate, as implied by a movement along the $\underline{U}\bar{H}$ line would imply that the rate of subsidy can be relaxed or reduced over time.

Now compare the implications of a transition path along the straight line $\underline{U}\bar{H}$ to a transition path along the original UH curve for the speed of transition or transformation of the economy. Since unemployment is lower for each level of H_t and the state sector subsidy does not directly impact on the private sector's employment decision, it follows that employment in the private sector will be lower at each point in time. Since private sector employment and unemployment are both lower at each point in time it follows that state sector employment is higher at each point in time.

By maintaining employment in the state sector at a higher level, the policy succeeds in reducing the costs of the transition but it slows the speed of the transition process. In this framework, where the transition is inevitable because of an exogenously assumed faster rate of skills accumulation in the private sector, the budgetary costs of the subsidies to the state sector need to be compared only against the budgetary and welfare costs of unemployment. The speed of transition or transformation has no long-run impact. If the process of skill accumulation driving the transition process were endogenously determined, however, as in the next section, the extent of transformation at any point in time as measured by the relative size of employment in the private sector takes on, as we show, a critical importance in determining whether or not restructuring actually takes place.

III. A Model of Endogenous Growth and Restructuring

Following Lucas (1988) and Chadha (1991), suppose now that skills or human capital specialized in the production of each sector are acquired according to

$$\dot{H}_t^1 = H_t^1 \theta_1 L_t^1 \ , \ \dot{H}_t^2 = H_t^2 \theta_2 L_t^2 \qquad (39)$$

where, as before, skills are assumed to be entirely external to any single firm. The growth of the skill level should now be interpreted as occurring due to learning by doing of the workforce. The rate of growth of skills in equation (39) is a positive function of both a pure speed of learning parameter θ_i, and the effort or resources devoted to producing good i, which is assumed to be related to the proportion of the labor force employed in the production of good i. It is posited further that the speed of learning or potential for productivity increases is greater in the private sector so

that $\theta_2 > \theta_1$. In terms of the previous discussion of the role for different rates of technology transfer from the rest of the world to the two sectors, imagine that "available" technological progress globally is greater in the production of the private sector good than in the production of the state sector good. The present formulation then implies that the speed of adoption of technologies, i.e. the actual technology transfer, will also be a function of the resources devoted to producing the private sector good.

The learning or skill accumulation equations can be combined to obtain a relative learning equation, and on substituting in the labor market identity

$$\frac{\dot{H}_t}{H_t} = \theta_2 L_t^2 - \theta_1 L_t^1 = (\theta_1 + \theta_2) L_t^2 - \theta_1 + \theta_1 U_t \qquad (40)$$

where H_t denotes the ratio of human capital in the private sector to that in the state sector. Equation (40) brings out that there will exist distributions of the labor force between the two sectors such that the ratio of skills levels remains exactly constant over time: where, for example, the effect on the growth of the relative skill level of a smaller share of labor in the private sector is offset exactly by the higher speed of learning in that activity.

To keep the analysis tractable, we assume, as in the previous section, that whereas skills are accumulated in the private sector by learning-by-doing, the skill level in the state sector is constant and normalized to equal unity. Again we use H_t to denote the level of human capital in the private sector and suppress sectoral subscripts. To retain the essence of the effects of differential speeds of learning-by-doing in the two sectors on relative skill accumulation, as in equation (40) above, we assume that

$$\frac{\dot{H}_t}{H_t} = (\theta_1 + \theta_2) L_t^2 - \theta_1 \qquad (41)$$

where the θ_i now represent some arbitrary constants and the term in the unemployment rate has been dropped for simplicity. 1/ Then, substituting in the employment rule in the private sector from equation (33) yields

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1/ Since L_t^2 is a positive function of U_t, and U_t enters equation (40) positively, its presence would have no qualitative impact on the slope of the $\dot{H} = 0$ locus.

Figure 6. Dynamic Path of Economy with Endogenous Accumulation of Skills.

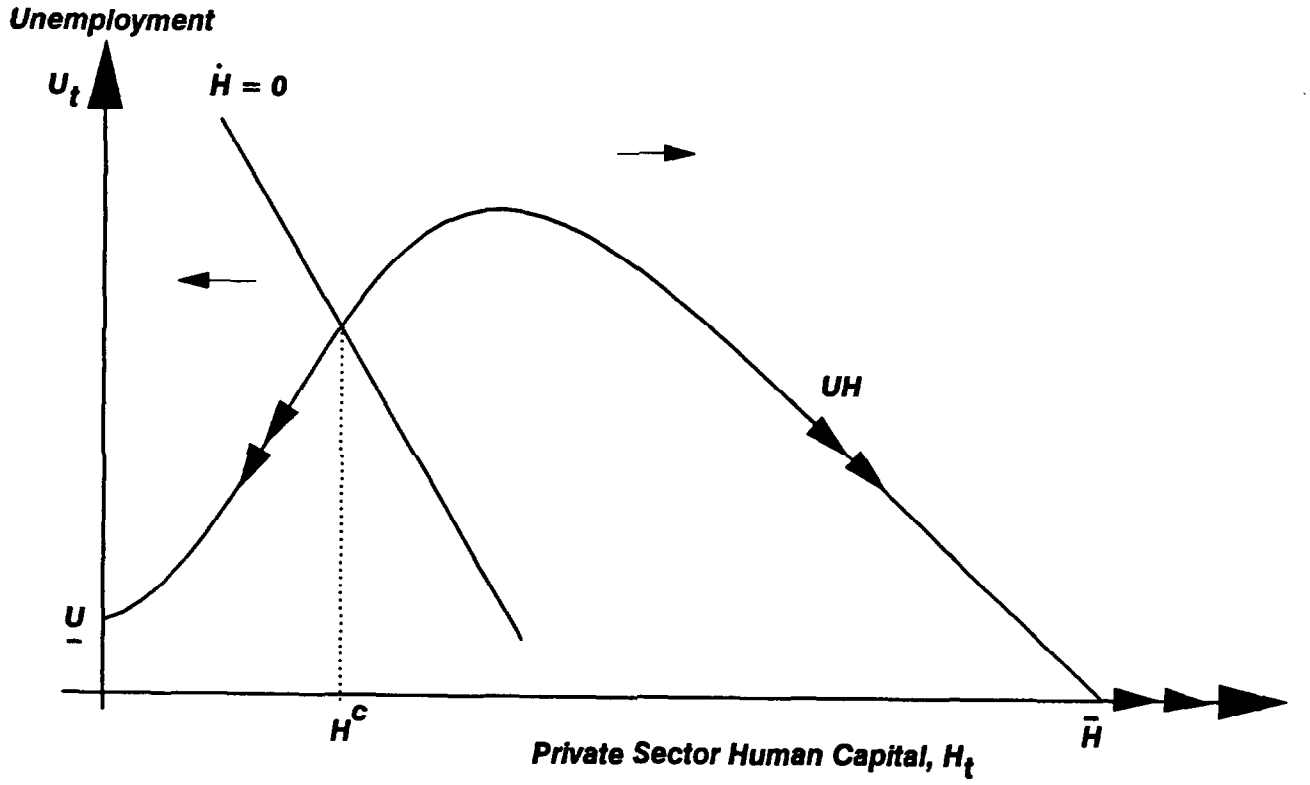
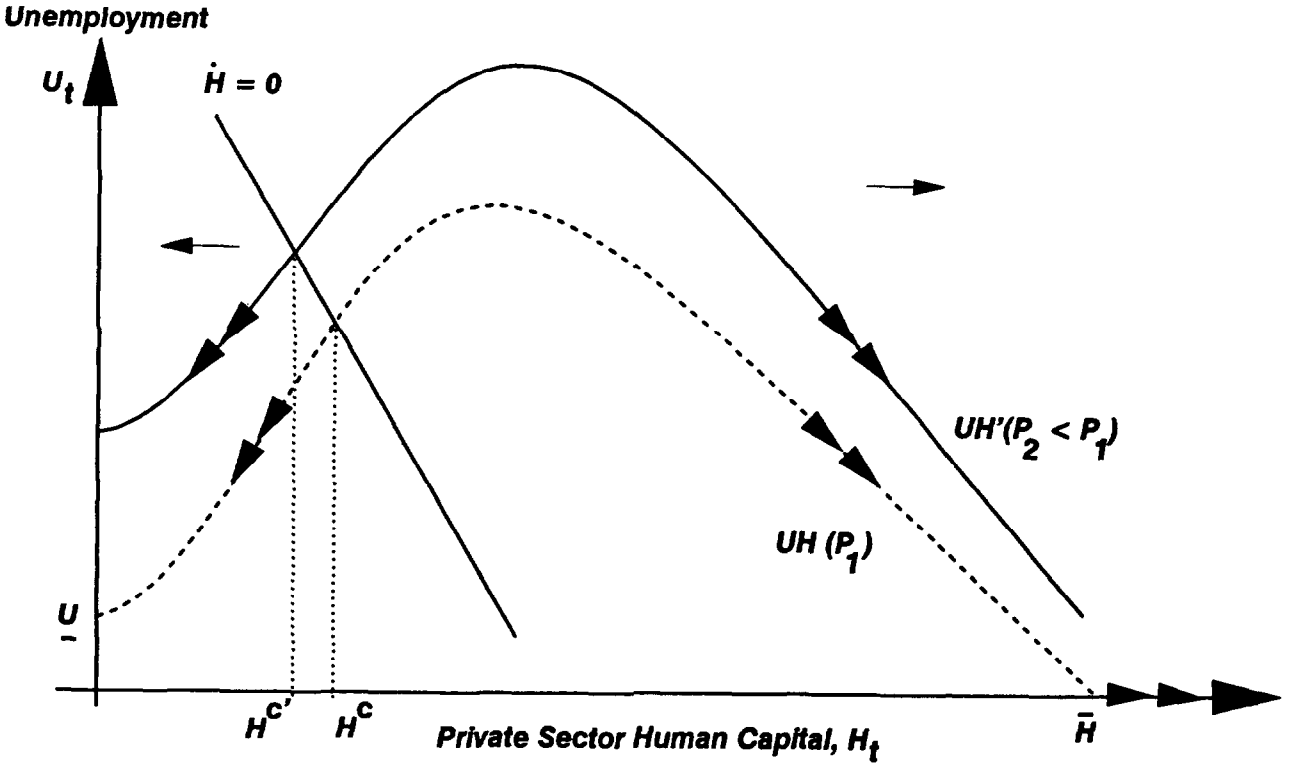


Figure 7. Decrease in State Sector Subsidy with Endogenous Skill Accumulation.



$$\frac{\dot{H}_t}{H_t} = (\theta_1 + \theta_2)L^2 (U_t, H_t; B, \mu) - \theta_2 \qquad (42)$$

The locus of points where the (relative) skill level in the private sector remains constant can then be plotted as a function of unemployment and human capital as the downward sloping $\dot{H} = 0$ curve in Figure 6. The arrows indicate the direction of movement of the (relative) skill level in the private sector when the economy is off the $\dot{H} = 0$ locus. To the right of the locus, human capital increases while to the left it falls.

The UH curve represents the equilibrium of the economy at each point in time. The direction of movement along the UH curve, however, will be determined by the intersection of the UH curve with the $\dot{H} = 0$ locus. Appendix I establishes that the slope of the UH curve is always greater than the slope of the $\dot{H} = 0$ locus so that there is a unique intersection of the two curves. The intersection can in general occur below, at, or above the peak unemployment rate on the UH curve and will be determined by all the parameters and exogenous variables of the system. Since the economy is always on the UH curve, the double arrows in Figure 6 are used to denote the actual path of the economy starting from any initial level of human capital given by history. The intersection of the $\dot{H} = 0$ locus with the UH curve defines a critical level of human capital, H_t^c. Unless the economy has an initial human capital ratio of exactly H_t^c, the economy will, over time, traverse either rightward along the UH curve and eventually specialize in the production of the private sector good or it will traverse leftward becoming specialized in the production of the state sector good.

The Production Possibility Frontier of the economy shifts out, over time, with experience gained by the labor force proportionately in favor of one of the two goods, depending on the speed of learning-by-doing in each sector, and the effort or resources devoted to learning in each activity. The implications of the analysis differ markedly from that with exogenous growth in the previous section. There are now no forces in the system that would necessarily place the economy on a path converging to eventual specialization in the private sector good. There is thus a clear role for government intervention. In particular, policies that allocate labor toward the private sector, would result over time in the acquisition of comparative advantage in the production of the private sector good and could place the economy on a path to self-sustained restructuring in production, leading eventually to specialization in the private sector good. Under our assumptions specialization in the private sector good implies a higher long-run growth rate of output.

1. Role of policies with endogenous restructuring

The $\dot{H} = 0$ locus of unemployment and human capital combinations separates initial conditions that imply eventual convergence to specialization in either the state sector or the private sector good. If the equilibrium level of unemployment for any given level of human capital is higher than that implied by the $\dot{H} = 0$ locus the economy will converge to specialization in the private sector good. Note that the curve is negatively sloped in the unemployment-human-capital plane. This implies that at low levels of human capital a high rate of unemployment is necessary to place the economy on a path leading to specialization in the private sector good. This characteristic of the present framework creates the fundamental dilemma for policies in that while unemployment represents a cost to the economy it may be necessary for creating downward pressure on wages, such that private sector employment can expand sufficiently. The negative slope also implies, on the other hand, that at high levels of human capital, a (relatively) low level of unemployment may be sufficient for eventual specialization in the private sector good.

Consider now the effects of various alternative policies and exogenous variables in affecting restructuring toward the private sector good. Essentially, policies that succeed in reducing the critical level of human capital necessary for attaining a self-sustained path to restructuring toward the private sector good will increase the set of initial conditions converging to such a path, and can thus potentially alter the long-run equilibrium of the economy. Alternative policies will, however, have alternative implications for the unemployment rate.

An increase in the relative price of the private sector's good, or a reduction in the rate of subsidy to the state sector will shift the UH curve up as in Figure 7. Skill levels between H_t^c and $H_t^{c\prime}$ which were previously levels of human capital implying convergence to the state sector good, now imply with the higher rates of unemployment on the new UH curve, UH', convergence to production of the private sector's good. Figure 8 shows the effects of an increase in the rate of employment subsidy to the private sector. This will shift the UH curve leftward, 1/ implying at low levels of H higher unemployment, and at higher levels of H lower unemployment. In addition, the $\dot{H} = 0$ locus shifts to the left, implying a lower level of unemployment necessary at any given level of human capital to place the economy on a path to self-sustained restructuring toward the private sector good. Figure 8 depicts two potential alternative situations: when the $\dot{H} = 0$ locus intersects the UH curve on the upward sloping portion of the UH curve and when it intersects it on the downward sloping portion of the curve. In the former case the $\dot{H} = 0$ locus is downward sloping while the UH curve is upward sloping. Since both curves shift leftward it follows that the critical level of human capital unambiguously falls. In the latter case when both curves are downward sloping it is possible to show--as is done in

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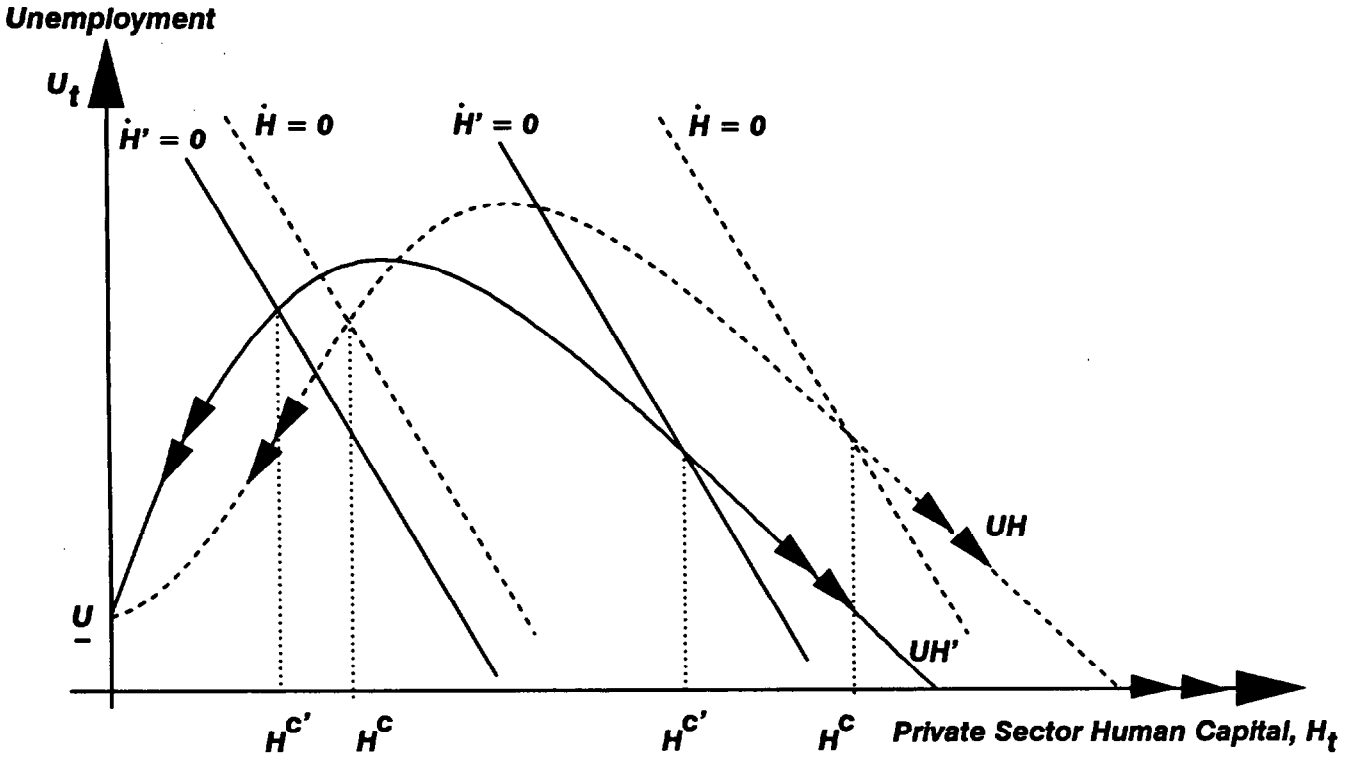
1/ Maintaining the vertical intercept, however.

Figure 8. Increase in employment subsidy to private sector.



appendix I--that the $\dot{H} = 0$ locus shifts down by more than the UH curve so that the critical level of human capital again falls.

In summary then, policies that affect the state sector alone affect restructuring by shifting the UH curve, with an increase in unemployment increasing the set of initial conditions converging to specialization in the private sector's good. Policies that affect the private sector, on the other hand, while affecting the UH curve, have the advantage that by also shifting the $\dot{H} = 0$ locus they reduce the unemployment necessary at any level of human capital to bring about restructuring toward the private sector good.

IV. Concluding Remarks

This paper has developed a simple model of the process of reallocation of labor from the state to the private sector in PCPEs. When growth and restructuring are viewed as exogenously driven, we showed that unemployment may increase in the transition process due to the intrinsic dynamics of the reallocation process, and in the absence of any new shocks to the economy. In explaining the actual experience of unemployment in the PCPEs several factors are likely to have contributed to the rise in unemployment. First, the rise in unemployment can be viewed as resulting from a sequence of unanticipated exogenous shocks that generated and have sustained increases in unemployment. 1/ While the initial reforms probably represented the largest shock, they were followed by a series of subsequent reforms so that there were several shocks. Similarly, the collapse of the CMEA, and the subsequent loss of markets could be viewed as having generated a sequence of shocks. Second, the rise in unemployment could be interpreted as a one-time movement toward an equilibrium rate of unemployment, in an economy characterized initially by "excessive" employment. Our analysis is not intended to diminish the role of these or other such factors in explaining the rise in unemployment in the PCPEs. Rather, it complements their role by highlighting a set of intrinsic dynamics that will tend to exacerbate increases in unemployment triggered by exogenous shocks.

The effects of alternative policies in reducing the unemployment costs of the transition process, and their impact on the speed of transition were examined when growth was viewed as exogenous and restructuring inevitable. In that context, several policies could be adopted to reduce or prevent a rise of unemployment during the initial stages of the transition process without jeopardizing the final outcome of the restructuring process. Nevertheless, we showed that these unemployment reducing policies would slowdown the restructuring process.

1/ If there are adjustment costs, each shock that changed relative prices, for example, would generate transitory unemployment. See Mussa (1978) and Neary (1982) for two sector models in the trade context that incorporate costs of adjustment.

In a framework where growth was endogenous and the eventual outcome of restructuring determined by initial conditions, we showed that unemployment may be necessary to ensure that restructuring occurs. Policies which reduce unemployment, thus alleviating the costs of the transition, may jeopardize the final outcome of the restructuring.

Figure A1. Proof by Contradiction of Unique Intersection of UH and $\dot{H} = 0$ Curve.

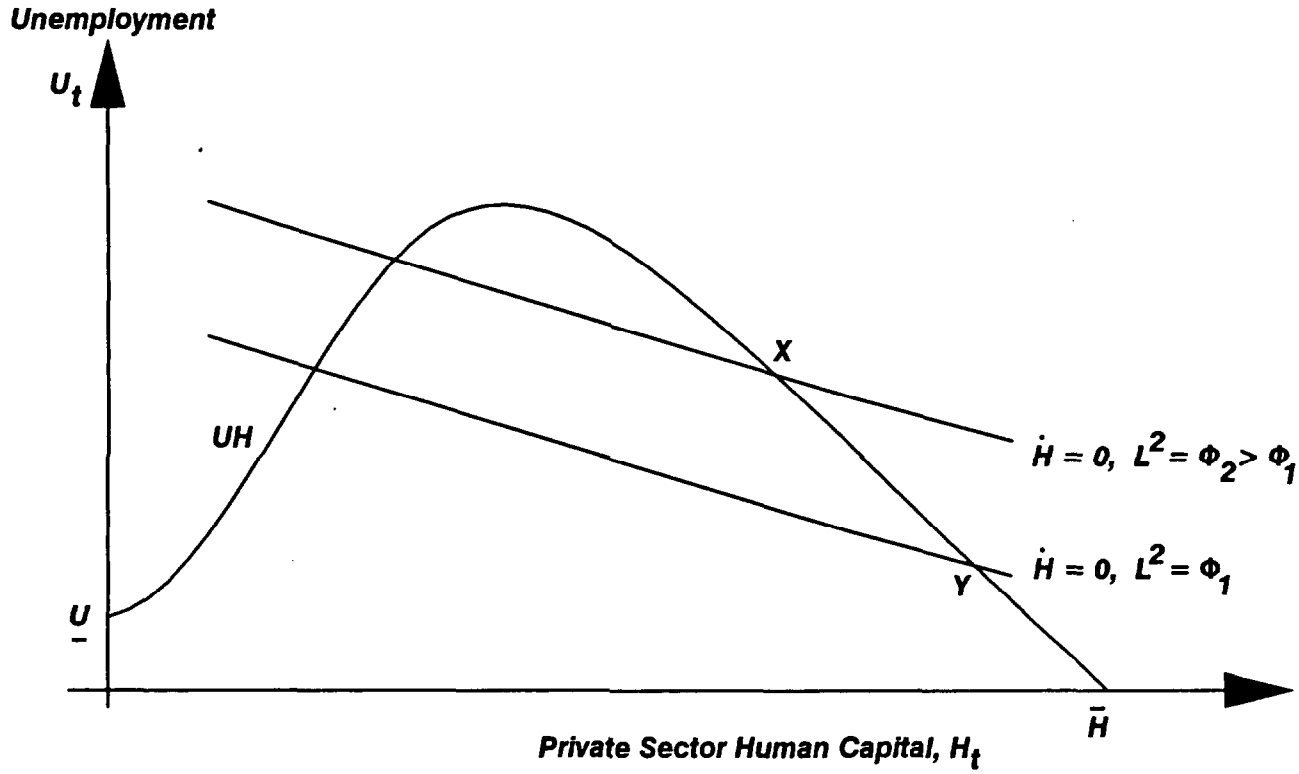
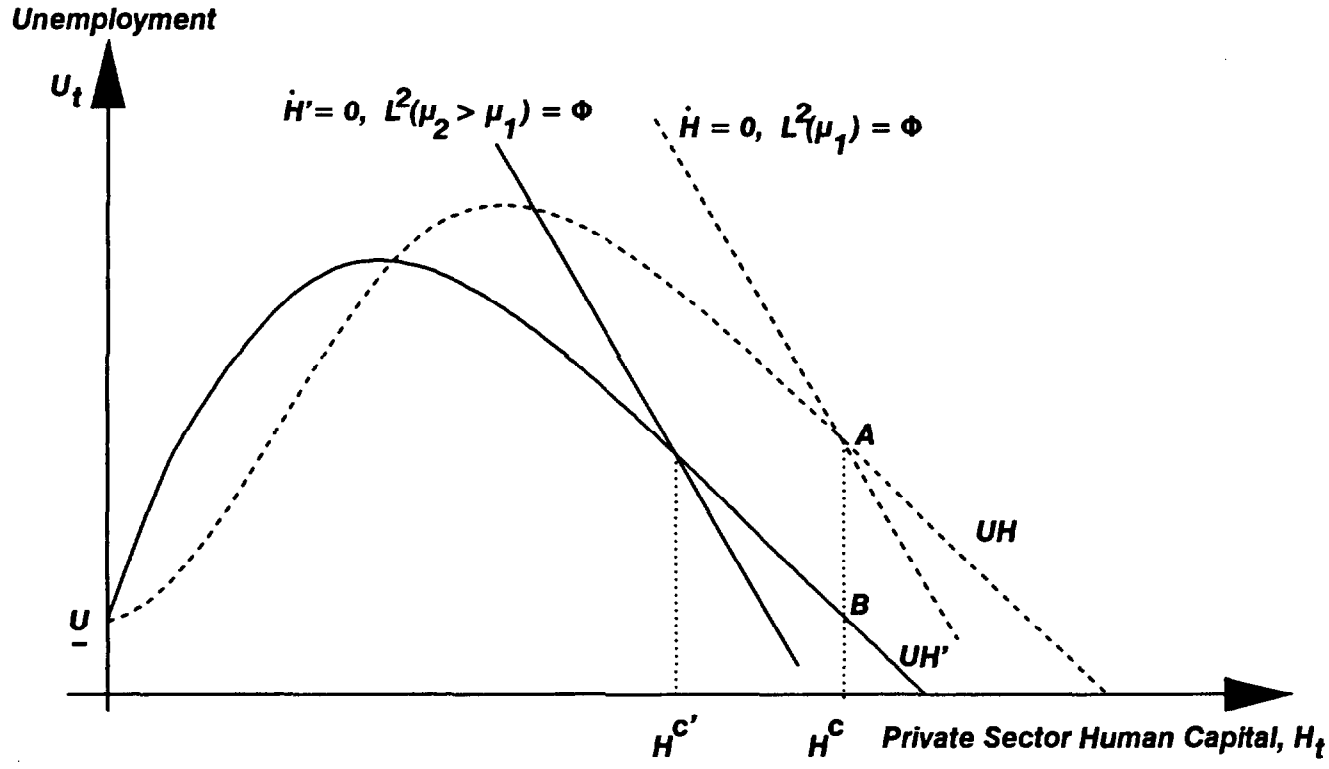


Figure A2. Increase in employment subsidy to private sector.



Appendix I

This appendix establishes that (i) the slope of the UH curve is always greater than the slope of the $\dot{H} = 0$ locus so that there is a unique intersection of the two curves; and (ii) in response to an increase in the private sector employment subsidy, when both the UH curve and the $\dot{H} = 0$ locus are downward sloping, the $\dot{H} = 0$ locus shifts down by more than the UH curve, and the critical level of human capital falls.

To establish that the two curves have a unique intersection, two observations are necessary.
First, note that the $\dot{H} = 0$ locus can be written as $L_t^2 = \theta_2/(\theta_1+\theta_2)$, so that along an $\dot{H} = 0$ locus the proportion of the labor force employed in the private sector is constant. Since L_t^2 is a positive function of unemployment and private sector human capital, note that the $\dot{H} = 0$ locus shifts to the right for an increase in ϕ. Along the new $\dot{H} = 0$ locus, L_t^2 is constant at a higher level. Second, recall that L_t^2 increases monotonically as the economy moves rightward along the UH curve. Now, suppose that the UH curve and the $\dot{H} = 0$ locus intersected twice, as in Figure A1. Then in moving from point X to Y in figure A1 along the UH curve, L_t^2 increases. However, this contradicts the fact that L_t^2 is higher along the $\dot{H}(\phi_2 > \phi_1) = 0$ curve than along the $\dot{H}(\phi_1) = 0$ curve. Therefore, this can never be.

We have established that an increase in the private sector employment subsidy shifts the UH curve to the left and L_t^2 is higher at each level of H on the new UH curve. Comparing points A and B on the two UH curves drawn in Figure A2, L_t^2 is greater at B than at A. The original $\dot{H} = 0$ locus intersecting the original UH curve at point A implies that L_t^2 equals ϕ at point A. So L_t^2 must be greater than ϕ at B. Recalling that L_t^2 increases monotonically along the UH curve, it follows that L_t^2 is greater than ϕ all along the right hand side of B on the new UH curve UH'. Now, note that the new or shifted $\dot{H} = 0$ locus still represents $L_t^2 = \phi$. Therefore, it must intersect UH' to the left of B.

References

Atkeson, Andrew and Patrick J. Kehoe, "Social Insurance and Transition", mimeo., June 1992.

Blanchard, Olivier J., "Notes on the Speed of Transition, Unemployment and Growth in Poland", mimeo., May, 1991,

Brewer, A.A. and M.J. Browning, "On the 'Employment' Decision of a Labor Managed Firm", Economica, Vol. 49, pp. 141-46, 1982.

Bruno, Michael, "Stabilization and Reform in Eastern Europe: A Preliminary Evaluation", International Monetary Fund, Working Paper, WP/92/30, 1992.

Calvo, Guillermo A., "Urban Unemployment and Wage Determination in LDCs: Trade Unions in the Harris-Todaro Model", International Economic Review, Vol. 19, no. 1, pp. 65-81, 1978.

Calvo, Guillermo A., "Quasi-Walrasian Theories of Unemployment", American Economic Review: Papers and Proceedings, Vol. 69, no. 2, pp. 102-107, 1979.

Calvo, Guillermo A. and Jacob A. Frenkel, "From Centrally Planned to Market Economy: The Road from CPE to PCPE", International Monetary Fund Staff Papers, Vol. 38, no. 2, pp. 268-299, 1991.

Chadha, Bankim, "Wages, Profitability, and Growth in a Small Open Economy", International Monetary Fund Staff Papers, Vol. 38, no. 1, pp. 59-82, 1991.

Chadha, Bankim and Fabrizio Coricelli, "Fiscal Pressures and the Transition Process", mimeo., International Monetary Fund and World Bank, 1993.

Commander, Simon, Fabrizio Coricelli and Karsten Stahr, "Wages and Employment in the Transition to a Market Economy", in Georg Winckler, Central and Eastern Europe Roads to Growth, International Monetary Fund and Austrian National Bank, Washington, 1992.

Dinopoulos, Elias and Timothy D. Lane, "Market Liberalization Policies in a Reforming Socialist Economy", International Monetary Fund, Working Paper, WP/91/119, 1991.

Lane, Timothy D., "Wage Controls and Employment in a Socialist Economy", International Monetary Fund, Working Paper, WP/91/111, 1991.

Lucas, Robert E., Jr., "On the Mechanics of Economic Development", Journal of Monetary Economics, Vol. 22, pp. 3-42, 1988.

Mussa, Michael, "Dynamic Adjustment in the Heckscher-Ohlin-Samuelson Model", Journal of Political Economy, Vol. 86 no. 5, pp. 775-791, 1978.

Neary, J. Peter, "Intersectoral Capital Mobility, Wage Stickiness, and the Case for Adjustment Assistance", in Jagdish N. Bhagwati, ed., Import Competition and Response, The University of Chicago Press, 1982.

Oswald, Andrew J., "The Economic Theory of Trade Unions: An Introductory Survey", Scandinavian Journal of Economics, Vol. 87, No. 2, pp. 160-93, 1985.

Shapiro, C. and J.E. Stiglitz, "Equilibrium Unemployment as a Worker Discipline Device", American Economic Review, Vol. 74, No. 3, pp. 433-444, 1984.

Vanek, J., The General Theory of Labor Managed Market Economies, Cornell University Press, Ithaca, New York, 1970.

Ward, Benjamin, "The Firm in Illyria: Market Syndicalism", American Economic Review, Vol. 48, pp. 566-89, 1958.

Weiss, Andrew, Efficiency Wages: Models of Unemployment, Layoffs, and Wage Dispersion, Princeton University Press, Princeton, New Jersey, 1990.