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Restructuring and Taxation in Transition Economies

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What are the implications of different tax burdens on state and private sectors, and what effect do they have on the speed at which state firms are restructured in transition economies? Low compliance by the private sector, while fiscally dangerous, can stimulate that sector's growth and result in a speedier transition, whereas capturing the private sector in the tax net early in the transition can lead to the sector's collapse and hence to the failure of restructuring.

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Summary findings

At what speed should state firms be restructured? One challenge in transition economies has been to avoid being caught between the Scylla of overrapid restructuring (which hurts the private sector) and the Charybdis of gradual change (signals from which can undermine the emergence of a robust private sector).

Empirical evidence suggests that in most of Eastern Europe and the former Soviet Union, insiders, by exerting control over decisionmaking, have materially affected the rate of restructuring. Still, in Central and Eastern Europe, shocks to firms have generally led to sharp rises in unemployment. Unemployment benefits were initially generous and, combined with lost payroll taxes, substantially increased fiscal costs.

In the former Soviet Union, both restructuring and unemployment have remained limited and subsidies to firms remained high. The private sector expanded, but chiefly in the gray (untaxed) part of the economy.

Commander and Tolstopiatenko examine the implications of various speeds of restructuring, explicitly introducing probabilities of closure and of restructuring.

They find that when the probability of closure is small (as at the outset of transition), unemployment will peak at a lower level than when the probability of closure is high — but the speed of transition will be much slower.

They find that widespread tax avoidance in the private sector can stimulate that sector's growth and result in a speedier transition. What this means is that while a low tax burden on the private sector can drive unemployment up rapidly by increasing the probability of closure in the state sector, it can also help speed up the transition by provoking a more rapid private sector response.

Commander and Tolstopiatenko show that while the speed of restructuring in the state sector is sensitive to the tax burden, which in turn depends on unemployment and the ability to tax the private sector, it is also true that the private sector's growth depends on the tax burden it faces. In particular, they show that capturing the private sector in the tax net early in the transition can lead to its collapse and hence to the failure of restructuring.

Restructuring and taxation in transition economies

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1. Introduction

At what speed to restructure state firms has been a key issue in the transition economies. One of the challenges has been to avoid being caught between the Scylla of too rapid restructuring with its associated negative impact on the private sector, and the Charybdis of gradual change and its associated policy signals that could also undermine the emergence of a robust private sector. Country experiences point to significant diversity in restructuring rates and private sector expansion but also indicate that restructuring has tended to move in phases and has been powerfully affected by the fiscal and political economy effects that it has itself set in motion.

One regularity that emerges from the empirical evidence is insider privatisation has largely dominated through most of Eastern Europe and the FSU. An important implcation of this is that insiders have exerted important control over decision-making and this has materially affected the rate of restructuing. Even with such insider control dominant, the scale of shocks to firms has generally led in East and Central Europe to sharp rises in unemployment. For those made unemployment, benefits were initially reasonably generous and this, combined with foregone payroll taxes, resulted in substantial fiscal costs. In the FSU, the adjustment has been rather different. Restructuring has been limited and unemployment has generally also remained small. Instead of outlays on unemployment benefits, labour hoarding and firm-based social protection has continued to require subsidies to firms. While there has been significant expansion of the de novo private sector, it has been largely in the grey or untaxed part of the economy.

This paper builds on the insights provided by a series of two sector models of transition, particularly Aghion and Blanchard (1994) and Chadha and Coricelli (1994), and attempts to look more closely at the factors likely determining restructuring decisions in a two sector world of state and private firms. Our main focus is on the impact on the restructuring choice and hence, in effect, on the restructuring decision from within the firm. In particular, we introduce exogenous probabilities of closure and restructuring for the state sector and look at the sensitivity of restructuring to those probabilities. Given the prevalence of insider privatisation this seems a reasonable limitation. We also attempt to look more closely at the fiscal implications of restructuring, primarily by looking at the implications of differential tax burdens on the two core sectors of these economy. For example, while the speed of restructuring in the state sector will be

sensitive to the tax burden, which in turn will depend on unemployment and the ability to tax the private sector, we can also think of the private sector's growth as depending critically on the tax burden that it faces. In particular, we show that capturing the private sector early in the transition in the tax net can also lead to its collapse and hence to the failure of the restructuring process.

2. Points of departure

The economy consists of two sectors -- state and private -- and three labour market states, state employment, private employment and unemployment. The labour force is given by; $N^s + N^p + U \equiv N_1 + N_2 + U = 1$. At the start of transition, all employment is in the state sector; $N_2 = U = 0$; there is no private employment and no unemployment. But faced with large, negative shocks, state firms have had to make an initial cut in employment. Therefore, we can assume that at the start of transition;

$$N_1 = N_1^0 < 1, \quad N_2 = N_2^0 > 0, \quad U = U^0 = 1 - N_1^0 - N_2^0 > 0.$$

2.1 State firms

Initially the economy is dominated by state firms whose constraint is that of zero profits. This is because insiders have power and can extract all surplus in the firm. With no capital accumulation, we can write the state firm's problem as;

$$\max_{w_1, N_1} \left\{ \frac{\overline{N}_1 - N_1}{\overline{N}_1} V_u + \frac{N_1}{\overline{N}_1} V_1 \right\}$$

subject to; $w_1 N_1 = p_1 Y_1$

Wages in the state sector are set equal to average product; $w_1 = AP_1$ or, incorporating taxes per worker; $w_1 = AP_1 - t_1$.

State firms can continue to operate with this wage setting rule but in each period a certain proportion of these firms will fail. This is given exogenously and is an attempt to capture the fact that state firms cannot survive indefinitely without investment and this must necessarily force insiders to think about restructuring or privatization. If the insiders do restructure or privatize, this will lead immediately to a decline in employment, an increase in marginal product for remaining workers and a change in wage setting, with wages now set as in the private sector.

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The initial value of being in state employment can then be written as;

$$rV_1 = w_1 + p_{1U}(V_u - V_1) + p_{12}(V_2 - V_1) + \dot{V}_1 \quad \text{(1) Value of being in the state sector}$$

where; $p_{1U} = p + p_R(1 - \gamma)^2$ - the complete probability of moving from the state sector to unemployment and $p_{12} = p_R\gamma$ - the probability of moving from the state to the private sector.

In effect, we consider two channels through which workers can become unemployed. The first channel is through the closure of the state firm with probability p, where p is the probability of the state firm closing or failing. Clearly, the higher is p, the smaller the value of being in the state sector relative to unemployment is likely to be. The second channel is through the restructuring process itself, after which a proportion of workers *(1-γ)* becomes unemployed. This proportion has to be multiplied by the probability of restructuring to get the unconditional joint probability of becoming unemployed through this channel.

Note that the second channel moves workers not only to unemployment but also to the private sector, as a proportion, *(γ)*, of workers remains in the restructured firm. We further assume that the value of a restructured firm , V_R, is the same as the value of a private firm, V_2. The balance equation for state sector employment which incorporates all outflows from the state sector is given by;

$$\dot{N}_1 = -(p_{1u} + p_{12})N_1$$

2.2 Private sector

We assume that the private sector pays efficiency wages and firms are constrained by their labour demand curves.

The value of being in the private sector is;

$$(2) \quad rV_2 = w_2 + \beta(V_u - V_2) + \dot{V}_2$$

where β is the probability of losing work.

For job creation, the key issue is the rate at which a new job is created;

$$H(U)/U = \alpha\ (MP_2 - w_2 - t_2)/U$$

where MP_2=marginal product; w_2= wage; t_2= taxes per worker in the private sector.

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[2] The probability of closure of the state firm can be written as $p=p^0(1-p_R)$ and includes both the probability of not restructuring $(1-p_R)$ and the probability of closure of the unrestructured firm, p^0.

Private wages depend on the outside labour market so that;

$$w_2 = b + c(r + \beta + H / U)$$

where c is a constant (mark-up value), r = interest rate and H/U is the exit rate from unemployment.

2.3 Unemployment

The value of being unemployed is given by;

$$rV_u = b + (H / U)(V_2 - V_u) + \dot{V}_u \quad (3) \text{ Value of being unemployed}$$

where b = unemployment benefits and H/U = the hiring rate from unemployment. As in Aghion and Blanchard (1994), when unemployed, workers receive unemployment benefits, b, with the probability H/U of leaving unemployment for work. When employed again the worker receives the private sector wage. In other words, we assume that workers can only lose their jobs in the state sector and can only find new work in the private sector or be unemployed.

Initially, in response to product market shocks and institutional disruption, state employment at impact drops to N_1^0 and $1 - N_1^0$ workers become unemployed. As restructuring/privatization continues, this creates an additional flow into unemployment proportional to $(1\text{-}\gamma)$. The flow into unemployment depends on the speed of restructuring which will in part depend on the parameter p -- the exogenous rate of failure of state firms -- and the flow out is equal to private job creation, H.

Accordingly, unemployment follows;

$$dU / dt = (p + p_R(1 - \gamma))N_1 - H(U) + \beta N_2$$

3. The restructuring choice

We now turn explicitly to the restructuring choice facing insiders in state firms. Here we can think of workers weighing up the respective values of staying employed in the state sector, subject to the probability, p, that the firm will close and they will become unemployed with its associated exit probability. Restructuring implies job losses and ultimately a shift in the wage setting rule to that holding in the private sector. With restructuring, as already indicated, a proportion $(1 - \gamma)$ of workers will become unemployed.

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Taking the risk neutral case and workers facing equal probabilities of staying employed, restructuring will only proceed when;

(4) $V_R > V_1$ or $\gamma V_R + (1-\gamma)V_U \geq V_1$ or

$\gamma V_2 + (1-\gamma)V_U \geq V_1$,

where we consider the restructured firm to have the same value for a worker after restructuring as a private firm. This implicitly assumes that those that stay in the firm are better off than being unemployed. Alternatively, if there is no severance mechanism, the condition would become;

(5) $V_u \geq V_R$

those that lose their jobs should be no worse off as a result of restructuring.

We proceed with assumption (4). We can now get the values of being in several states, assuming this costless adjustment. The value to the worker of being in a state firm that does not restructure ($p_R = 0$) is;

$$rV_1 = AP_1 - t_1 + p(V_u - V_1) + \dot{V}_1$$

The initial question to ask is what will determine the decision to restructure ? The restructuring condition is;

$$V_R = (1 - p_R)V_1 + p_R\gamma V_2 + p_R(1-\gamma)V_U \geq V_1 \qquad (6)$$

which is equivalent to;

$$\gamma V_2 + (1-\gamma)V_U \geq V_1$$

given an a posteriori probability of restructuring, $p_R = 1$. From the equation for V_1,

$$rV_1 = w_1 + p_{1U}(V_u - V_1) + p_{12}(V_2 - V_1) + \dot{V}_1 \qquad \text{(1) Value of being in the state sector}$$

where

$$p_{1U} = p + p_R(1-\gamma)$$
$$p_{12} = p_R\gamma$$

it follows that,

$$\gamma V_2 + (1-\gamma)V_U \geq V_1 = \frac{w_1 + p_{1U}V_u + p_{12}V_2}{r + p_{1U} + p_{12}}$$

Substituting expressions for probabilities into this equation we get

$$(r + p)(\gamma V_2 + (1-\gamma)V_U) \geq w_1 + pV_u \Rightarrow r(\gamma V_2 + (1-\gamma)V_U) + \gamma p(V_2 - V_U) \geq w_1$$

We can see from this equation that restructuring will take place if the probability of closure, p, exceeds some critical value. We term this critical value, p_c;

$$p_c = \frac{w_1 - r(\gamma V_2 + (1-\gamma)V_U)}{\gamma (V_2 - V_U)} = \frac{w_1 - rV_U}{\gamma c} - r$$

Substituting the value of unemployment into this equation and assuming the markup value, c, for the private wage as constant, we finally get;

$$p_c = \frac{w_1 - b - \left(\dfrac{H}{U} + \gamma r\right)c}{\gamma c}$$

Therefore the lower is the hiring rate, the larger must be the probability of closure to make workers choose to restructure. We can see from this condition that if the state wage is close to unemployment benefits, b, then $p_c < 0$. In this case workers will have an incentive to restructure ($p > p_c$) for any value of the hiring rate.

3.1 Severance

To this point we have assumed that it is possible to separate workers costlessly. Perhaps more realistically, we now introduce the possibility of a severance scheme and modify our expression for the value of restructuring. Let the workers who are likely to lose their job as a result of restructuring be offered a share of future profits, m. The payment scheme is summarized as follows;

$$V_1 \underset{1-\gamma}{\overset{\gamma}{\rightleftarrows}} \begin{array}{l} V_2 - (1-\gamma)/\gamma \cdot m/r \\ V_U + m/r \end{array}$$

The value of restructuring will be the same as before, since

$$V_R = \gamma (V_2 - \frac{1-\gamma}{\gamma}\frac{m}{r}) + (1-\gamma)(V_u + \frac{m}{r}) = \gamma V_2 + (1-\gamma)V_u$$

The severance value m/r can be determined from the condition;

$$V_u + \frac{m}{r} = V_1$$

which means that losers must not be worse off than before restructuring.

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We can also consider a more general case in which that share, *(γ)*, of workers dominates the others and can force the latter to follow their restructuring decision. In this case, compensation can be smaller;

$$\frac{m}{r} = \chi(V_1 - V_u)$$

where $0 \leq \chi \leq 1$.

Finally, in the case that the share of the labour force that stands to lose from restructuring, *(1- γ)*, constitutes the majority and has some bargaining power, they will be able to extract a larget part of future profit and the increase in value due to restructuring $(V_2 - V_1)$ will be shared between these two parts according to their bargaining power[3].

4. Dynamics with taxation

Having laid out the conditions under which restructuring can occur, we now move to the dynamics. Here we explicitly consider a significant part of unemployment benefits are financed (or analogously, the subsidies required to keep unemployment low) through payroll taxes. What we now try and capture is the effect of different values of payroll taxes in the state and private sectors and the influence this exerts on the dynamics of unemployment.

Reminding ourselves of the basic arbitrage equations,

$$rV_1 = w_1 + p_{1U}(V_u - V_1) + p_{12}(V_2 - V_1) + \dot{V_1} \qquad \text{(1) Value of being in the state sector}$$

$$rV_2 = w_2 + \beta(V_u - V_2) + \dot{V_2} \qquad \text{(2) Value of being in the private sector}$$

$$rV_u = b + (H/U)(V_2 - V_u) + \dot{V_u} \qquad \text{(3) Value of being unemployed}.$$

Collecting together all the dynamic equations, we get the following expressions for our dynamic model of restructuring;

$$\frac{dN_1}{dt} = -(p_{1U} + p_{12})N_1$$

$$\frac{dU}{dt} = p_{1U}N_1 - H(U) + \beta N_2$$

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3 See Commander and Naudé (1995)

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$$\frac{dN_2}{dt} = H(U) + p_{12}N_1 - \beta N_2$$

where;

p = probability of closure of state firm; p_R = probability of restructuring; β = probability of job loss in the private sector; H/U = probability of hiring.

Summing up the balance equations we get the consistency condition;

$$\frac{dN_1}{dt} + \frac{dN_2}{dt} + \frac{dU}{dt} = \left\{-(p_{1U} + p_{12})N_1\right\} + \left\{\frac{H}{U}U + p_{12}N_1 - \beta N_2\right\} + \left\{p_{1U}N_1 - \frac{H}{U}U + \beta N_2\right\} = 0$$

since $N_1 + N_2 + U = 1$.

We consider probabilities p and p_R as exogenous and given [4]. We assume different values of payroll taxes for the state (t_1) and private sector (t_2) and introduce the parameter, $\varepsilon = t_2/t_1$ where $t_1 = t$ and $t_2 = \varepsilon t$. We will assume that taxes in private sector are smaller than taxes in the state sector, i.e. $\varepsilon < 1$. Finally, we assume that only a part of unemployment, $U - U^0$, is financed through payroll taxes. With these assumptions we have;

$$w_2 = b + c(r + \beta + H/U)$$

$$t = \frac{b(U - U^0)}{N_1(1 - \varepsilon) + \varepsilon(1 - U)}$$

$$H = \alpha(MP_2 - w_2(H,U) - \varepsilon t(U))$$

where,

w_2 = wage in the private sector; b = unemployment benefits; $t_1 \equiv t$ taxes per worker in the state sector; $t_2 \equiv \varepsilon t$ - taxes per worker in the private sector and α = a matching term relating the sensitivity of the hiring rate to the private sector's performance.

From these equations we can find H as a function of U;

$$H(U) = \frac{\alpha U\left[MP_2 - b - c(r + \beta) - \varepsilon b(U - U^0)/(N_1(1 - \varepsilon) + \varepsilon(1 - U))\right]}{\alpha c + U}$$

Substituting this function into the balance equations we get the following system of dynamic equations;

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[4] This is substantially different from Aghion and Blanchard (1994) who assume that;

$-\dot{N}_1 \equiv s = (p_{1u} + p_{12})N_1 = const$, where s=speed of restructuring, with the probability of contraction of the state sector -- $p_{1U} + p_{12} = p + p_R = s/N_1$ -- increasing with the overall contraction of the state sector $(N_1 \to 0)$.

$$\frac{dU}{dt} = p_{1U}N_1 - H(U) + \beta(1 - U - N_1)$$

$$\frac{dN_1}{dt} = -(p_{1U} + p_{12})N_1$$

We first start by assuming that the private sector does not pay any taxes so that in the extremum, $\varepsilon=0$. For the present, we assume that the probability of restructuring is constant and that there is only outflow from the state sector into unemployment, viz, $\beta=0$ [5]. In this case the dynamic picture will be clear. It is determined by the equation;

$$\frac{dU}{dt} = p_{1U}N_1^0 e^{-(p+p_R)t} - \alpha(MP_2 - b - cr)\frac{U}{U + \alpha c}$$

If $p_{1U}N_1^0 > \alpha(MP_2 - b - cr)$ -- the hiring rate is rather small -- and the initial picture will be;
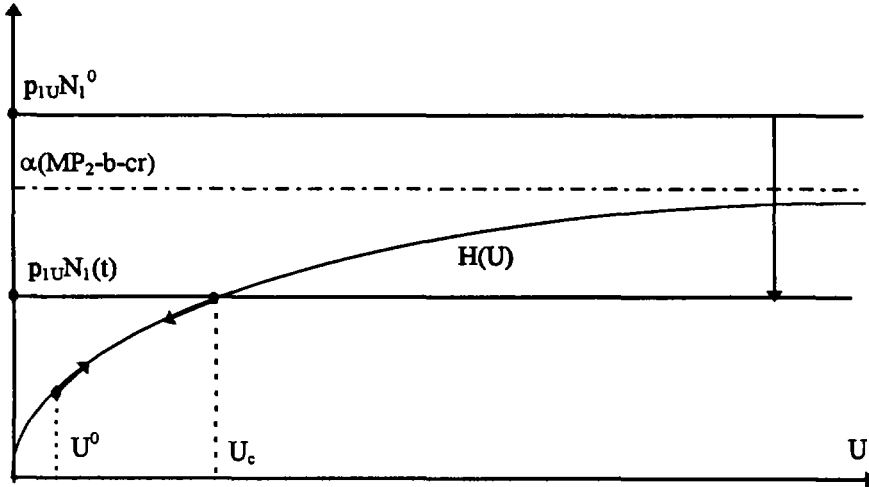

Figure 1

Unemployment will increase driven by the outflow from the state sector until it reaches the point (U_c) at which the $H(U)$ curve crosses the straight line $p_{1U}N_1(t)$ which is dropping from above due to the contraction of the state sector (Figure 1). Unemployment will then decline until it takes a zero value which means that all the labour force is in the private sector (Figure 2).

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[5] Note if we set $\varepsilon=1$, $\beta=0$, $p_{1U}+p_{12}=p+p_R=s/N_1$, $p_{1U}=s(1-\gamma)/N_1$, then we would get pretty much a similar set-up to Aghion and Blanchard (1994).
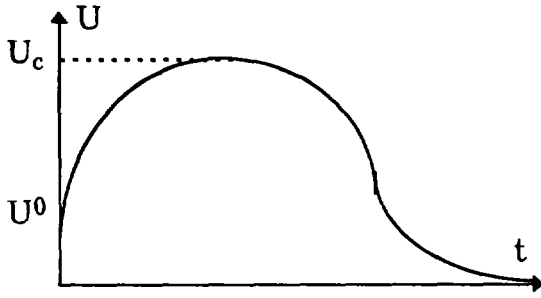
Taking β (the probability of job-loss in the private sector) into account will change the final zero value of unemployment for some finite value. If $p_{1U}N_1(t)$ is a slowly changing function of time, then U_c will be a quasi-equilibrium value, slowly decreasing in time.

4.1 Speed of restructuring and exogenous closure

Now rejecting the assumption that the probability of closure of a state firm is constant during the restructuring process, we consider two values for the probability of closure -- p_1 , the probability at the start of the restructuring process and p_2, the probability that emerges as discrete policy changes, such as the implementation of a bankruptcy law and the switch to a hard budget constraint. It seems reasonable to assume that in general, $p_1 < p_c < p_2$. We can also assume that the probability of restructuring, p_R, is not constant and depends on whether the condition of restructuring, $V_R > V_1$ or $p > p_c$. In particular, if $p < p_c$ then $p_R = 0$. Accordingly, at the start of transition $p = p_1$ and $p_R = 0$. The system of dynamic equations will now take the form,

$$\frac{dU}{dt} = p_1 N_1 - H(U) + \beta(1 - U - N_1)$$

$$\frac{dN_1}{dt} = -p_1 N_1$$

$$\frac{dN_2}{dt} = H(U) - \beta N_2$$

where

$$H(U) = \frac{\alpha U \left[MP_2 - b - c(r + \beta) - \varepsilon b(U - U^0)/(N_1(1 - \varepsilon) + \varepsilon(1 - U)) \right]}{\alpha c + U}$$

We now provide several numerical simulations. In the first scenario, $p_1 < p_c$. Since p_1 is small, N_1 is a slowly changing variable (almost constant), and this makes the speed of adjustment

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very slow. If H_{max} $(U) < p_1N_1$, then it will obviously take considerable time for unemployment to achieve its quasi-equilibrium maximum value (Figure 3).

If, through policy, the probability of closure switches so that, $p_1 < p_c$ for $p_2 > p_c$ we get,

$$\frac{dU}{dt} = (p_2 + p_R (1 - \gamma))N_1 - H(U) + \beta (1 - U - N_1)$$

$$\frac{dN_1}{dt} = -(p_2 + p_R)N_1$$

$$\frac{dN_2}{dt} = H(U) - \beta N_2$$

There will be an obvious increase in unemployment but the main result will be an accelerated speed of adjustment and the quicker attainment of equilibrium (see Figure 4).

We now consider the consequences of varying the tax ratio (ε). Given the unemployment financing constraint and the role of payroll taxation in that financing, we can immediately understand that the extent of tax compliance by the private sector will have clear repercussions for not only its own growth path but also on the rate of decline of the state sector. Low tax compliance by the private sector can stimulate its own rate of growth, while raising the effective tax burden on the state sector. We use two extreme values -- $\varepsilon = 0.1$ and $\varepsilon = 1$ -- and present two scenarios; the first has a small rate of closure and no restructuring under both tax regimes; the second has a far higher probability of closure and restructuring.

In the first case -- Figure 5 -- we can see that the state sector declines very gradually indeed. Unemployment peaks at around 30 percent but is quite persistent. The private sector's growth is quite protracted in both cases. What is clear is that at low probabilities of closure or restructuring the tax ratio does not matter very much. Indeed, with the private sector largely outside of the tax net, the main result is for the private sector to grow slightly more rapidly and consequently for a more rapid elimination of unemployment and completion of the transition. This weak tax effect can obviously be traced to the low level of unemployment generated under these probabilities with its associated impact on the financing side.

The second case -- Figure 6 -- has higher probabilities of closure and restructuring. These raise the unemployment peak very substantially. Further, that peak is quite rapidly attained. The main factor driving this process is the decline of the state sector. The decline is particularly rapid

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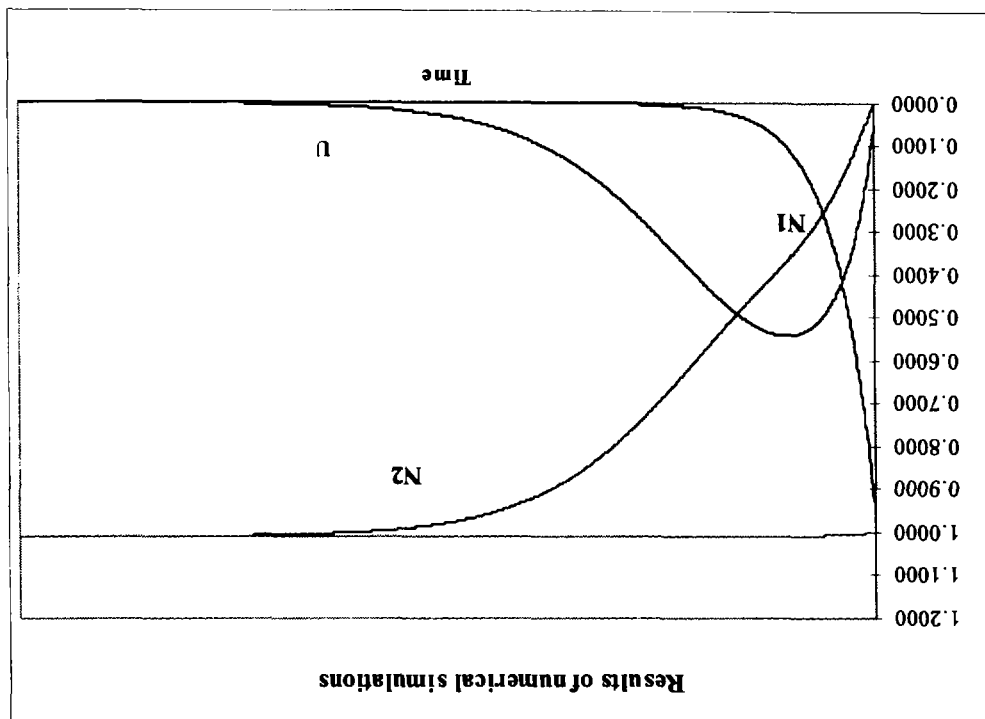Results of numerical simulations
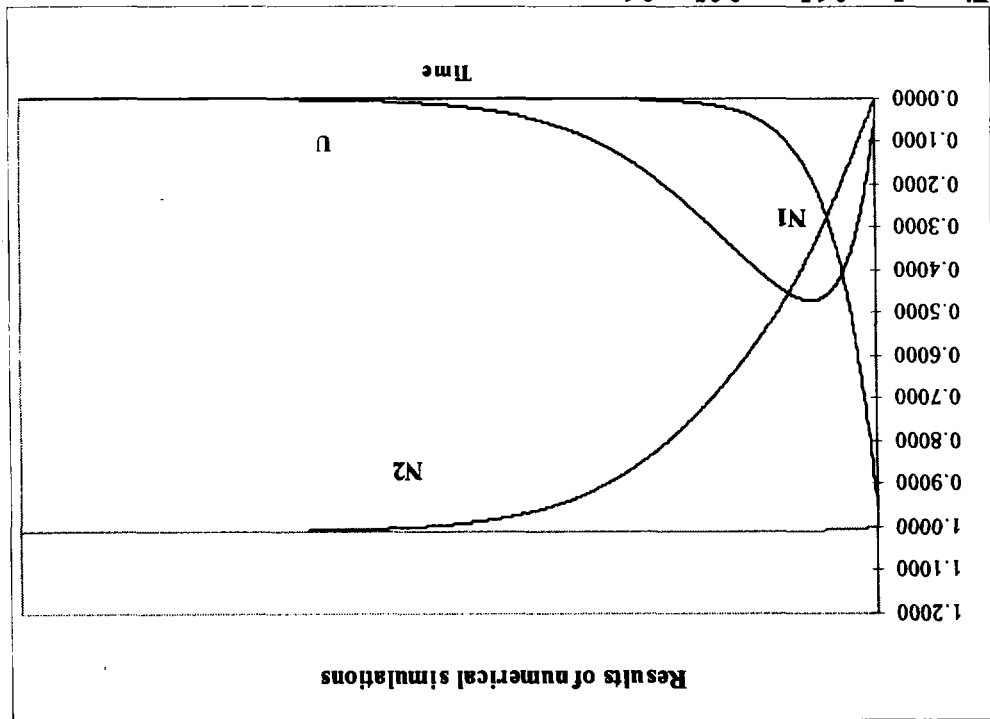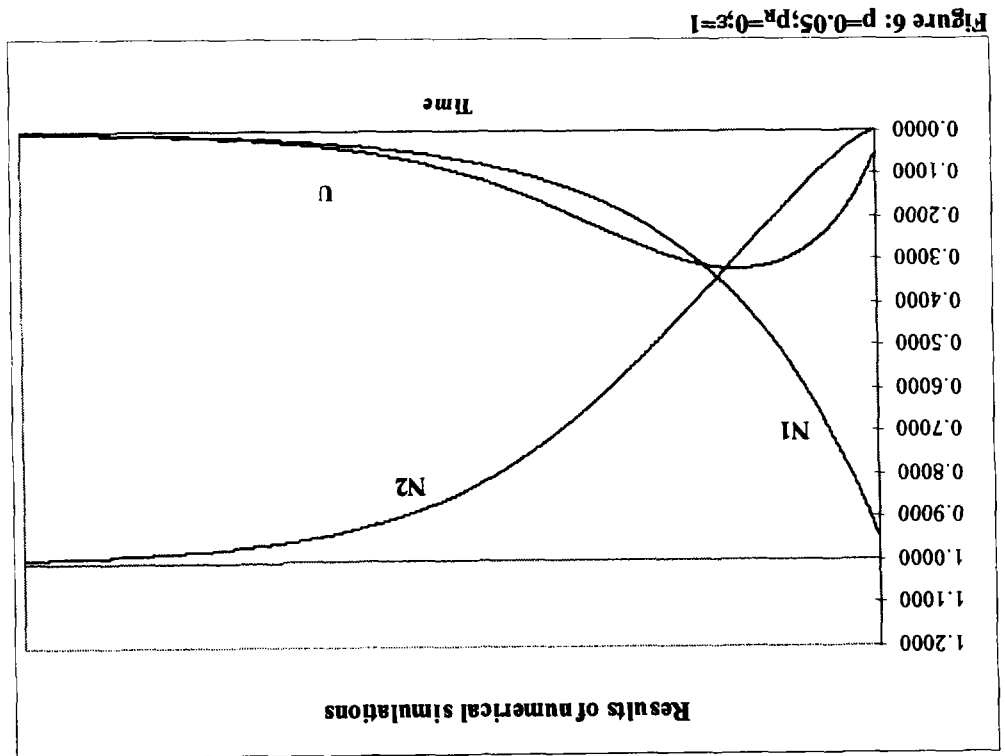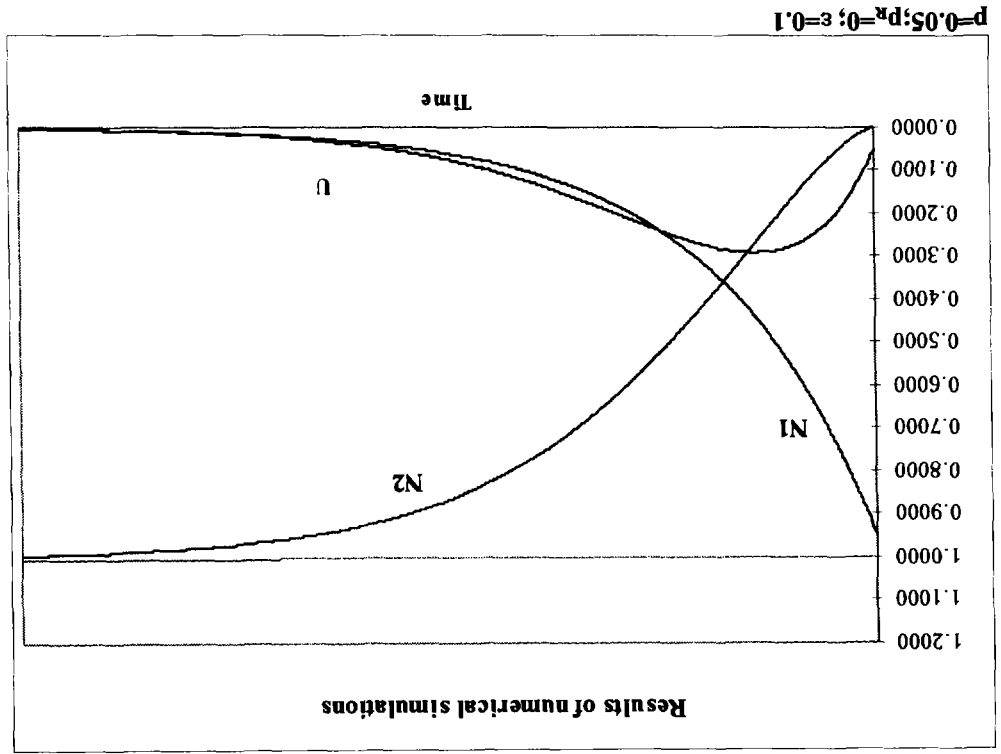
p=0.15; p_R=0.05; ε=1

Results of numerical simulations
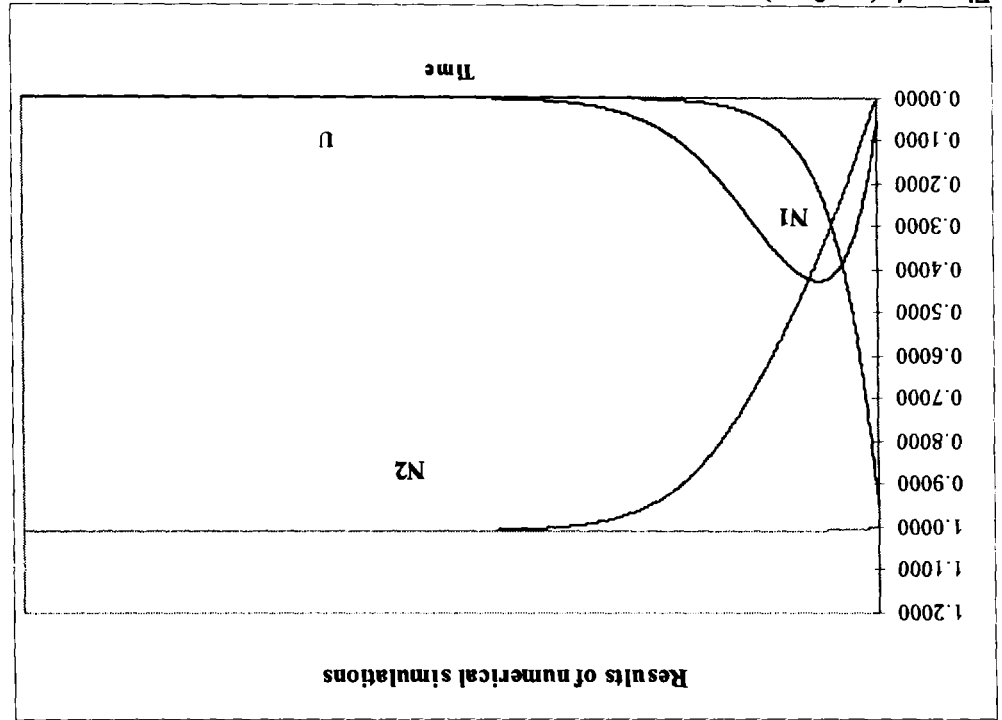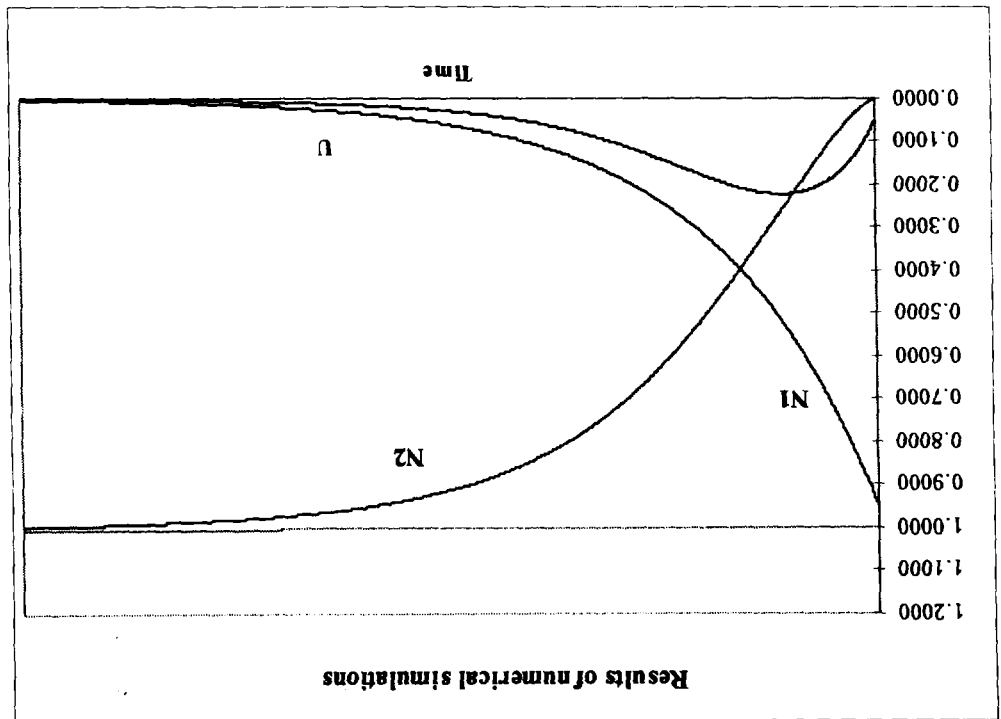
Figure 5: p=0.15; p_R=0.05; ε=0.1

when the private sector is effectively untaxed. When there is equality in taxation across sectors, we find not only that unemployment peaks nearly ten percentages points higher but that it is notably longer lasting. This can largely be traced to the effect that the equal tax incidence has on the rate of increase of the private sector. Relative to the case with $\varepsilon=0.1$, the private sector grows less quickly and the overall pace of the transition is slower. These respective paths will also be sensitive to the values of being in private employment relative to unemployment ,$V^2 > V^R$. If that mark-up is significant then we will observe a quite powerful effect on unemployment, whose level will be unambiguously higher .

4.2 Analysis of stability conditions and scenarios

In order to analyse which values for the parameters in our set-up give stable outcomes for restructuring and which result in unstable outcomes, we take a standard phase space approach. Consequently, we now transform the initial system of equations;

$$\frac{dN_1}{dt} = -(p_{1U} + p_{12})N_1$$

$$\frac{dU}{dt} = p_{1U}N_1 - \frac{\alpha U\left[MP_2 - b - cr - \varepsilon b(U - U^0)/(N_1(1-\varepsilon) + \varepsilon(1-U))\right]}{\alpha c + U}$$

to the form

$$\frac{dx}{d\tau} = -\lambda x$$

$$\frac{dz}{d\tau} = -\frac{(z-x)(\mu + (1+\varphi)x - z)}{(\alpha c - x + z)\left(1 + \left(1 + \frac{1-\varepsilon}{\varepsilon\eta}\right)x - z\right)}$$

and we introduce several new notations:

$\tau = \alpha\,(d+b)t$;   time scale

$d = MP_2 - b - cr$;   the departure from competitive wage setting in the private sector

(excluding taxes)

$x(\tau) = \eta\,N_1(\tau)$;   scaled state employment

$\lambda = \dfrac{p + p_R}{\alpha\,(d+b)}$;   inverse of rate of decay of state employment

and transform the variables in order to eliminate an additive term in the unemployment equation so as to get a multiplicative representation on the right hand side of unemployment equation for the stability analysis.

$z(\tau) = U(\tau) + \eta\,N_1(\tau)$ is a new variable which asymptotically converges to unemployment in a period of time greater than $1/\lambda$. We introduce parameters for simplifying the equations

$\mu = \dfrac{d + bU^0}{d + b}$;   asymptotic critical value for unemployment

$\eta = \dfrac{p_{1U}}{p_{1U} + p_{12}} = \dfrac{1}{1 + p_{12}\,/\,p_{1U}}$;   relative rate of flow to unemployment from the state sector

$\varphi = \dfrac{d}{d+b}\dfrac{1-\varepsilon}{\varepsilon\eta}$;   auxiliary parameter.

From the equations of motion for the transformed variables we directly get an equation for the trajectories

$$\frac{dz}{dx} = \frac{1}{\lambda} \cdot \frac{(z - x)(\mu + (1 + \varphi)x - z)}{x\left(\alpha\,c - x + z\right)\left(1 + \left(1 + \dfrac{1-\varepsilon}{\varepsilon\eta}\right)x - z\right)}$$

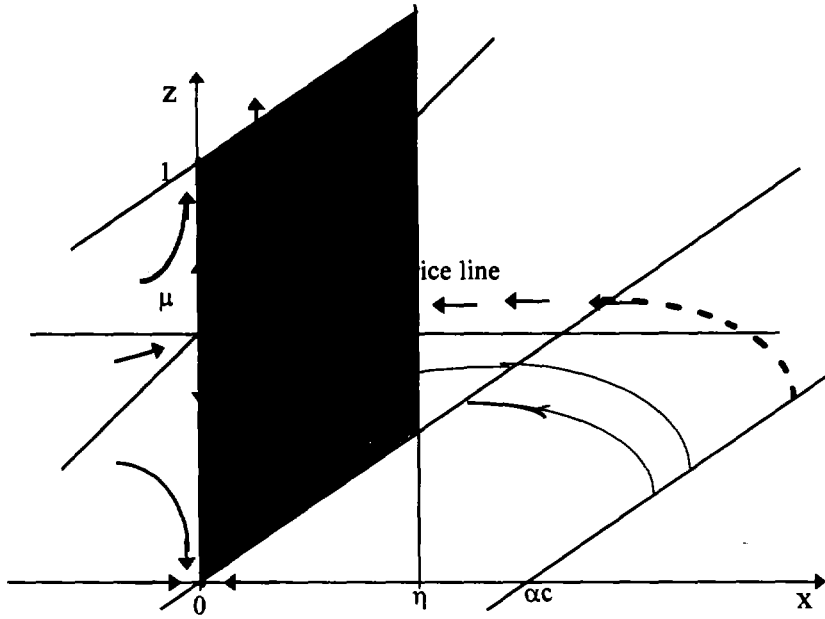Due to the simple form of this equation we can draw characteristic trajectories in the phase plane

Figure 7

The shaded area in the figure shows the range of values which z and x can take $(x \le z \le 1 + x, 0 \le x \le \eta)$. We get them from the conditions $(0 \le U \le 1,$ and $0 \le N_1 \le 1)$. We have two stable and one unstable point in this figure, of which: $(x=0, z=0)$ is the stable point which corresponds to a successful outcome of the restructuring process $(N_1(\infty)=0, U(\infty)=0)$; $(x=0, z=\mu)$ is an unstable point which leads to the collapse of the private sector $(N_2(\infty)=0, U(\infty)=1)$.

If we are interested in the values of parameters for which we have stable outcomes for restructuring, we need to find the separatrice line $z_c(x)$. For this purpose we need to solve the differential equation for $z(x)$ in the vicinity of the unstable point, $(x=0, z=\mu)$. Since the slope of function $z(x)$ at the steady point is;

$$\frac{dz}{dx} = \frac{0}{0}$$

We use l'Hopital's rule for this indeterminate form and application yields;

$$\left.\frac{dz}{dx}\right|_{x=\mu} = \frac{\mu}{\lambda} \frac{1}{(\alpha c + \mu)(1 - \mu)}\left(1 + \varphi - \left.\frac{dz}{dx}\right|_{x=\mu}\right)$$

Introducing a new parameter, characterizing the slope of the separatrice line,

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$$\rho = \frac{1}{\lambda(\alpha c + \mu)(1-\mu)}$$

we find a solution to the linear equation with respect to the slope of the separatrice line at the steady state;

$$\left.\frac{dz}{dx}\right|_{x=\mu} = \frac{\rho\mu(1+\varphi)}{1+\rho\mu}$$

We can use this value as the initial slope and compute the whole function determining the separatrice line analytically as a series on powers of deviations from the steady point $(x-\mu)$ or using standard numerical methods.

The analytical approach gives us -- in quadratic approximation -- the following function;

$$z_c(x) = \mu\left(1 + \frac{\rho(1+\varphi)x}{1+\rho\mu} + \frac{\rho^2(1+\varphi)^2 x^2}{(1+\rho\mu)^2(2+\rho\mu)} + O(x^3)\right)$$

Having obtained this we can write the condition for a stable outcome for the restructuring process;

$$U^0 + \eta N_1^0 < z_c\left(\eta N_1^0\right.$$

In the linear approximation it gives us a constraint on the value of ε (the ratio of private and state pay-roll taxes);

$$\varepsilon < \frac{1}{1 + \dfrac{\eta(d+b)(U^0-\mu)(1+\rho\mu) + \eta N_1^0}{d\rho\mu\eta N_1^0}}$$

or a constraint on the values of the probabilities of closure and restructuring when the tax ratio ε is fixed.

From this constraint, which is approximate, we can see that for a wide range of other parameters there exists a critical value of ε , exceeding which leads to the collapse of the restructuring process. To analyse this question more quantitatively we consider the results of some numerical simulations. These results are shown in two figures with a separatrice line and an initial point (the position of which relative to the separatrice line (up or under) determines the stability of the trajectories) and the plot of three variables; unemployment (U), state employment (N_1) and private employment (N_2), for different values of the parameters.

Figures 8 and 9 now give the results for small values of the probabilities of restructuring and closure with a small ratio of private and state taxes $\varepsilon = t_2/t_1$.

Figure 8: Values: p=0.02, p_R=0, ε=0.1
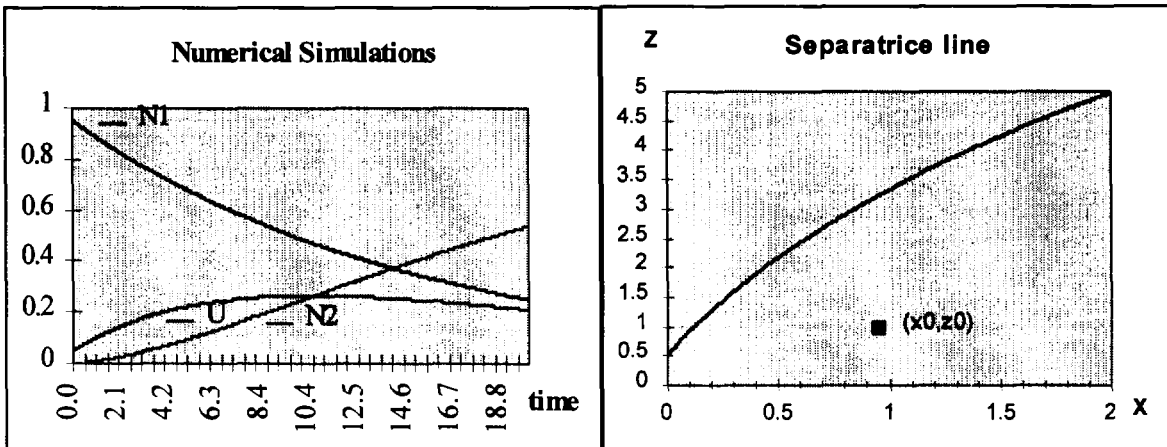
We can immediately see that a larger distance from the initial point to the separatrice line in Figure 9 indicates that there will be a greater sensitivity of the solution to the change in initial conditions and hence the outcome with tax equivalence $(\varepsilon=1)$ appears significantly less stable.

Figure 9: Values: p=0.02, p_R=0, ε=1
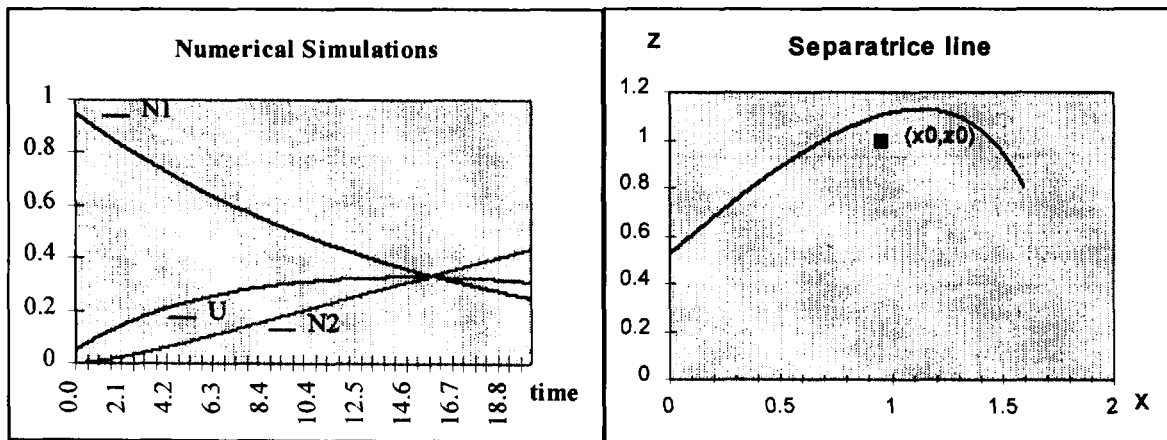
We now raise the probabilities of closure and restructuring, under the two tax ratios and get;
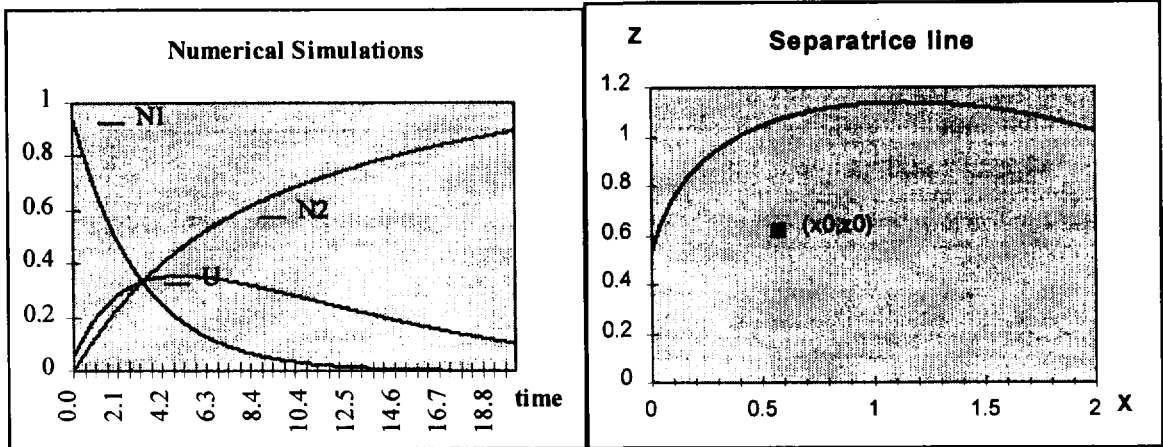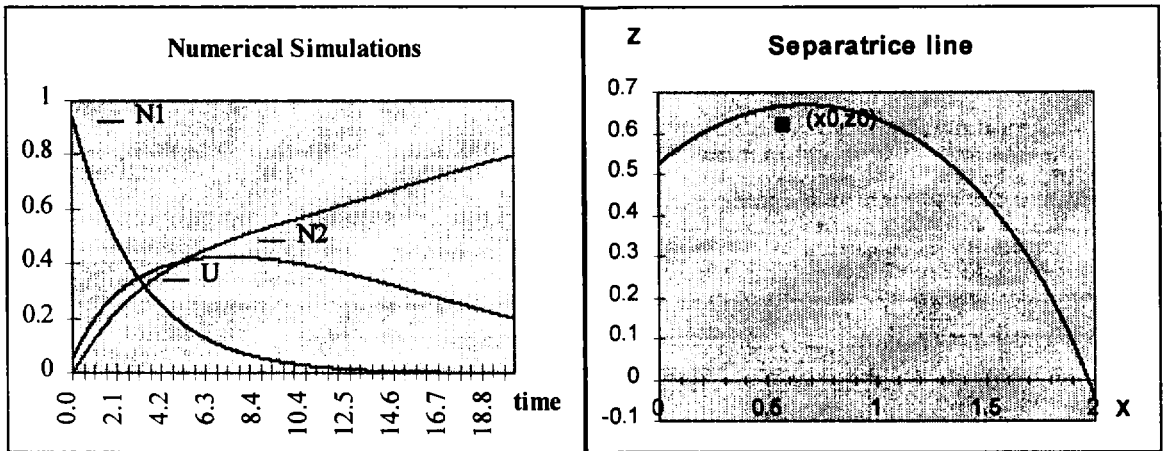
Figure 10: Values: p=0.05, p_R=0.05, ε=0.1

Figure 11: Values: p=0.05, p_R=0.05, ε=1

We can see from the figures that though the maximum value for unemployment is higher than it was with smaller probabilities of closure and restructuring, the overall adjustment time is lower.

Finally, it is also interesting to trace the influence of the matching process in the labour market which we have described by parameter α, measuring the sensitivity of hiring rate to the private sector's performance, as measured by the mark-up of marginal product over the wage. If we decrease significantly the value of this parameter we get quite a different picture. There will exist some critical value of ε such that the initial point in the phase space lies on the separatrice and we have large and long lasting unemployment.

Figure 12:
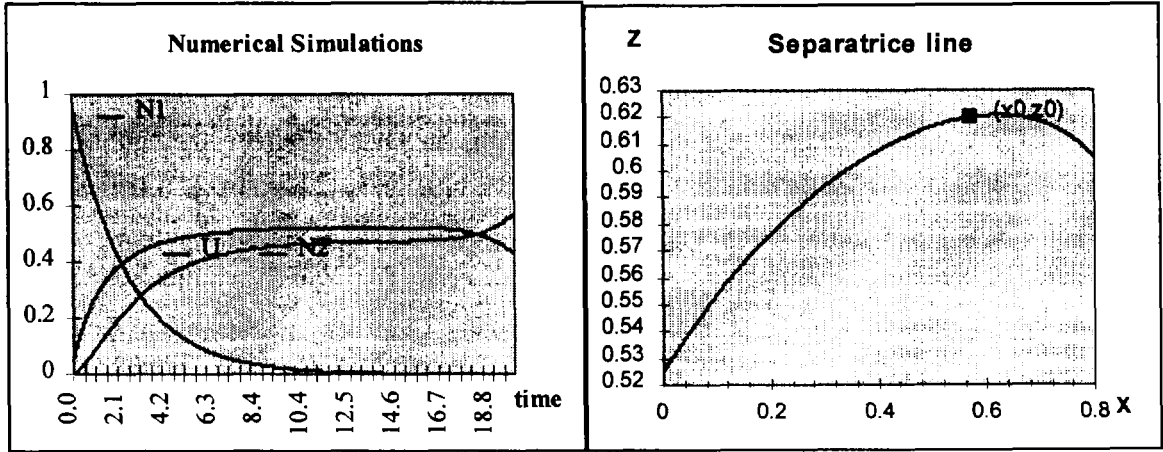
If we increase the value of ε even very slightly we get a collapse of the private sector. We get the same situation (and behaviour with respect to ε) as for small values of α, if we increase the value of unemployment benefits b, as shown below for $\varepsilon > \varepsilon_c$.

Figure 13:
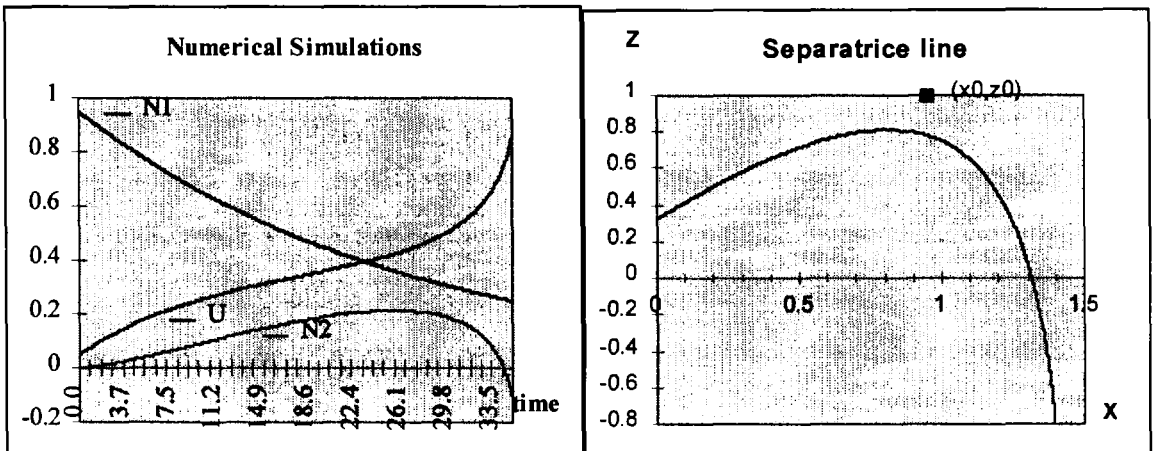
From the above, we can see that the outcome of restructuring process becomes very sensitive to the tax ratio between the state and private sector and leads to instability when the value of ε exceeds some critical value.

We can see from the analysis above that the tax ratio $\varepsilon = t_2/t_1$ plays a critical role in explaining the path of restructuring. A low effective tax rate confronting the private sector has the clear effect of increasing the private sector's hiring rate, hence helping to absorb unemployment and accelerate the restructuring process. Analogously, a low tax rate facing the private sector imposes an additional tax burden on the state sector, in part because of the

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necessity of financing unemployment benefits. Raising the tax burden on the state sector stimulates the outflow from the state sector and raises the probabilities of closure and restructuring in the state sector.

We can analyse this feedback channel by explicitly endogenizing the probabilities of closure and restructuring and assume that they depend on the change in the value of remaining in a state firm. This will be done in the subsequent paper.

Conclusion

Our paper has been primarily concerned with the dynamics of transition where our focus has been on restructuring choices. Having set up the conditions under which restructuring can occur, we then proceed to the dynamics. We look initially at the implications of various speeds of restructuring, introducing two probabilities of closure and a restructuring probability. We identify a critical value for restructuring. When the closure probability is small, as at the outset of transition, and below the critical value, we find that unemployment will peak lower than with a higher closure probability but that the overall speed of transition will be much slower. Focusing on the effect of different tax incidence across state and private sectors, our numerical simulations similarly show that widespread tax avoidance by the private sector can stimulate that sector's growth and result in a faster overall speed of transition. In this regard, one of the findings of the paper is that while a low tax burden on the private sector can drive unemployment up rapidly, through raising the probability of closure for the state sector, it can also assist in achieving a faster transition by provoking a more rapid private sector response. Finally, we look at the stability properties.

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