Note on Adjustment and the Specific Factor Model

Econ 372

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1 Adjustment and the Specific Factor Model

A critical element of transition is the shift of resources from the state sector to new parts of the economy. If we believe that productivity is higher in the newer sectors (why else have transition?) then the fact that output fall must have something to do with the difficulty in getting this process to work. So we want to ask why this process is not smooth.

The specific factors model is a useful way to think about some elements of adjustment and restructuring. In particular, it allows us to separate the effects of wage rigidity from the slow adjustment of the capital stock. We start out with most employment in the state sector and at the wage w_0. Notice that there is full employment in the initial state. We are at point A in the upper diagram, and point A' in the lower one.

Now consider a decrease in the demand for the state-owned good. This causes labor demand to shift inward (from L_1^S to L_2^S). If the wage is flexible, then we move from point A to point C. The demand for labor in the private sector does not increase immediately. We assume that this takes time, because capital is immobile in the initial stages of transition. This means that initially, only employment can adjust between the two sectors.

With only labor adjustment, wages fall to w_1, and labor shifts from the state sector to the private sector. This is point C in the upper diagram and point C' in the lower diagram. In the lower diagram the movement is horizontal from A to C, because the capital stocks are fixed in the short run. Notice that employment does not fall because factors are still fully

L_1^S L_2^P wage

L_1^P

L_2^S

$W*$ E B A

W_0

C

W_1

State Private

Employment

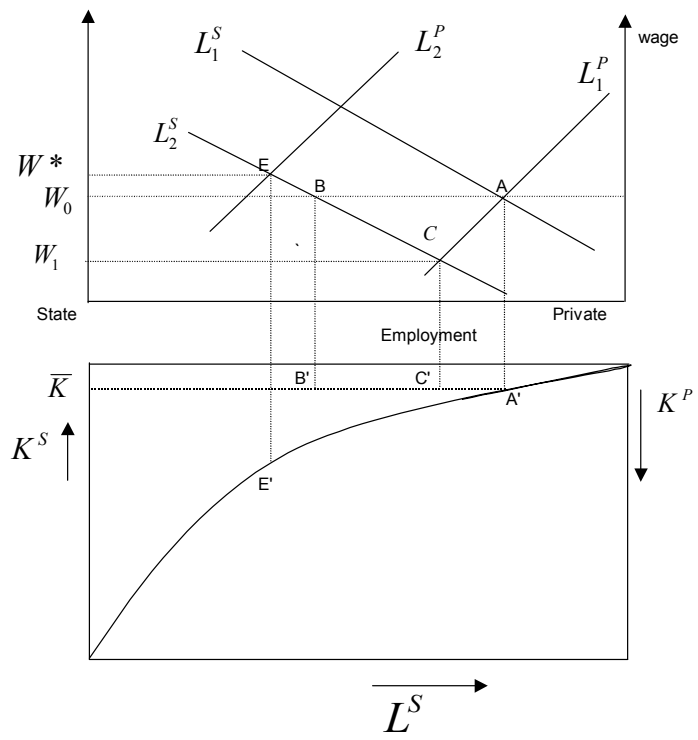$\overline{K}$ B' C'

A' K^P

K^S

E'

L^S

Figure 1: Adjustment in the Specific Factors Model

employed. But output is inside the production frontier because the capital-labor ratios in the two sectors are not at the levels where marginal products are equated. What happens to the level of output depends on what happens to the respective marginal products of labor as the $\frac{K^s}{L^s}$ rises and as $\frac{K^P}{L^P}$ falls, thus:

$$\Delta Q = \Delta L^P \frac{\partial Q^P}{\partial L^p} - \Delta L^P \frac{\partial Q^S}{\partial L^S} = \Delta L^P \left[\frac{\partial Q^P}{\partial L^p} - \frac{\partial Q^S}{\partial L^S} \right] \qquad (1)$$

Clearly the impact on ΔQ will depend on the respective elasticities of substitution in the two sectors. Notice, for example, that if productivity is constant, and if it is higher in the private sector, output must rise, since the term in the brackets is positive. Hence, unemployment of resources is needed for output to fall. Of course, it may be that productivities are not constant.

One might suspect, for example, that the marginal product of labor will not rise at all with the increase in $\frac{K^s}{L^s}$.[1] What happens to the marginal product of labor in the private sector? Clearly it must fall since $\frac{K^P}{L^P} \downarrow$.

What happens when wages are rigid downwards? This is likely in a transition economy where the initial social safety net is high.[2] Then the wage rate stays at w_0, and unemployment results, equal to AB in the upper figure. The capital-labor ratio in both sectors stays the same, but there is less full employment. Some labor is unemployed, which is evident in the lower picture where we are at A' and B'. Output thus falls even more.

Notice that whether wages are rigid or if wages fall to clear the labor market there is one important fact that this model does not explain: the fall in aggregate labor productivity.

- with rigid wages labor productivity is unchanged; output falls due to unemployment, but the capital-labor ratios in both sectors are unchanged

- with flexible wages labor productivity in the private sector falls, but in the state sector it could rise (since the capital-labor ratio goes up – it certainly does not fall).

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[1]Whether it does depends partly on the elasticity of substitution between capital and labor in the state sector. One suspects that this will not be very high, given all the problems of organization and incentives in the state sector.

[2]There may be other reasons – such as access to goods and housing – that attach workers to their enterprises.

- the problem of course, is that in all transition economies labor productivity fell faster than output, and this is especially so in the state sector.[3]

In the long-run both capital and labor can adjust. Full adjustment means that capital moves to the private sector; hence, the demand for labor in the private sector increases. The full adjustment equilibrium is at point E and E'.

1.0.1 Assessment

Notice that this type of model explains output losses due to unemployment of resources. But in transition economies labor productivity has fallen, as employment fell by much less than output. Hence, we also need to explain why labor productivity fell. This is one of the virtues of a disorganization-type of explanation.

An alternative explanation of this puzzle is that the state firm does not lay off workers, but continues to produce via subsidies. There may be no purchasers, and inventories build up. The price of the output has also fallen. Hence, labor productivity falls.

Notice that this type of model tells us that we need to focus on several items:

1. What determines the rate of contraction in the state sector? Presumably, this is related to the magnitude of the initial distortion, the speed with which subsidies are ended, and the means of enterprise survival.

2. What determines the rate of private sector expansion? Presumably this depends on the legal infrastructure for the private sector – how easy is it to start new firms – corruption, corporate governance.

3. What determines the pace at which capital can flow from the state to the private sector? Again this will depend on the financial system, legal system, corporate governance.

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[3]This is one more reason why we need some explanation of output dynamics that focuses on changes in efficiency. This could be disorganization, for example, or it could be revelation of past inefficiency.

2 Structural Adjustment

Structural change and structural adjustment is an important explanation of transition. The basic idea is that the move to hard budget constraints causes declines in production in those sectors experiencing a decline in relative prices, combined with a slower expansion of those sectors that experience an increase in relative prices.

The basic argument is that it takes time for structural adjustment to take place. Another way to say this is that resources will be unemployed during some period of the transition. From a simple arithmetic point of view, the initial preponderance of the state sector means that enormous growth of the private sector is needed to offset contraction.

$$\frac{\Delta y}{y} = \mu \frac{\Delta X^s}{X^s} + (1 - \mu) \frac{\Delta X^p}{X^p} \tag{2}$$

where μ is the share in the state sector, and ΔX^p is the change in output in the private sector. Then for the rate of output growth to be constant,

$$\frac{\mu}{1 - \mu} = -\frac{\frac{\Delta X^p}{X^p}}{\frac{\Delta X^s}{X^s}}. \tag{3}$$

If we start from a situation where the state sector was 90% of total production (an underestimate, to be sure!), then if the state sector is declining at 10% a year, the private sector must expand at 90% per year to keep output growth constant.

How does private and public sector production coincide if the former is more productive? It is easiest to begin with the case where the goods are the same, and the different ownership form affects quality or cost. Suppose that the latter is of poorer quality, and let θ measure this difference; hence, $P^p = P^s(1 + \theta)$. If consumers purchase both types of goods, then it must be that subsidies and taxes (the excess tax burden on the private sector) must offset the quality differential. Thus, we must have $P^p(1 - t) = P^s(1 + \sigma)$. It then follows that

$$1 + \theta = \frac{1 + \sigma}{1 - t}. \tag{4}$$

From 4 it follows that elimination of the subsidy or of the tax on private production would disturb the equilibrium between the two sectors.

We can use 4 to illustrate two aspects of transition. We can think of *restructuring* as the process of improving the former state-owned enterprises.

In short-hand this can be thought of as reducing θ. As $\theta \longrightarrow 0$, state-sector production becomes as efficient as private production.[4] *Reallocation*, on the other hand, can be thought of as elimination of the cost advantages of the state sector: either by reducing subsidies or equalizing taxes. Note, however, that reallocation requires that factors of production will respond to rates of return. This is not necessarily the case, and is, in fact, at the heart of the problems of transition.

We have to be careful about this argument. If resources in the private sector are used more productively than in the state sector, then output will not decline, unless there is some *unemployment* of resources. Let α and β be the productivity of resources in the state and private sectors, respectively, with $\alpha < \beta$. Suppose that the only resource is labor, L, and that initially this is all used in the state sector. If we rule out unemployment, then total employment is equal to $\overline{L} = L^s + L^p$. Hence, output is equal to

$$
\begin{aligned}
Y &= \alpha L^s + \beta L^p \\
&= \alpha L^s + \beta(\overline{L} - L^s)
\end{aligned}
$$

if we divide through by $\overline{L}$ we get per-capita output:

$$
\frac{Y}{\overline{L}} \equiv y = \alpha \frac{L^s}{\overline{L}} + \beta \frac{\overline{L} - L^s}{\overline{L}} \tag{5}
$$

$$
= \frac{(\alpha - \beta)L^s}{\overline{L}} + \beta \tag{6}
$$

initially all employment is in the state sector ($L^s = \overline{L}$) so per-capita output is equal to α. As labor moves to the private sector labor productivity and output rise continuously because of the assumption that $\alpha < \beta$. Eventually all output is in the private sector ($L^s = 0$) and $y = \beta$.

Notice that equation (6) describes the path of output. It makes a strong prediction: output and productivity rise continuously during transition. Unfortunately, this is not in accord with observation. We know that output fall in the early part of transition and labor productivity falls even faster. So the model must be augmented.

For output to fall it is thus necessary for the process of resource transfer to be rocky. If there are some costs that prevent resources from moving

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[4]Of course, the mechanism required to affect this change may be privatization. It certainly involves microeconomic changes.

freely between sectors then output can fall. It could be, for example, that the private sector cannot absorb all the resources freed from the state sector at constant productivity. It could be that $\beta = \beta(\frac{\dot{L^p}}{L^p})$, with $\beta' < 0$. The idea here is that the faster the private sector grows the more productivity declines. If β falls below some threshold $\widehat{\beta}$ then the private sector ceases to hire. The *absorption* rate may be less than infinite, and this determines the rate of growth of the private sector. In that case some resources may be unemployed, L^u.[5] Now we have a third state so that $\overline{L} = L^s + L^p$. Per-capita output is now given by

$$y = \alpha \frac{L^s}{\overline{L}} + \beta \frac{\overline{L} - L^s - L^u}{\overline{L}} \tag{7}$$

where it is now apparent that per-capita output will decline if the resources shed from the state sector move to the unemployed state rather than to the private sector.

Let the three states be $S, P,$ and U. Transitions can follow the direct path $S \rightarrow P$ or the indirect path $S \rightarrow U \rightarrow P$. This means that workers exit the unemployment state by going to the private sector. Hence, the exit rate from unemployment, $\frac{\dot{L^u}}{L^u}$ will depend on the rate of growth of the private sector. What is important to understand are the exit rates from these states. Notice that the growth of the private sector may depend on what is happening in the other sectors. This dependence can happen for several reasons. First, following Aghion and Blanchard, unemployment can cause fiscal deficits which must be financed at the expense of the private sector, limiting its growth. Second, the growth of the private sector may depend on the rate at which complementary resources are *released* from the state sector.

At the most basic level, unemployment can be due to rigidity in real wages. Notice that when the state sector contracts the employment that is released could be absorbed by the private sector. We can think of the contraction of the state sector as an inward shift in the labor demand curve in this sector. If all labor must be employed, then the market clearing wage must fall: $w^* < \widetilde{w}$, and $\Delta L^p = -\Delta L^s$. But this will happen only if one of two conditions are present:

- the private sector expands, or

[5]In the FSU excess labor is more likely to be underemployed than unemployed. Labor hoarding seems more important in these economies. This is an important issue.

- the real wage decreases

Notice that the private sector will expand only if there is investment. At the start of transition we may think that this will take time. So begin with the assumption that the private sector is fixed in size (in terms of capital stock). Then for employment to be absorbed we need a decrease in real wages. If, however, real wages are rigid downward, then unemployment will occur instead. This means that output will fall and unemployment will increase.

The unexplained part is what keeps the real wage from decreasing? One answer might be that subsidies to the state sector are not eliminated, combined with sufficiently high unemployment compensation. This may prevent workers from moving to the private sector for lower real wages. Assume that subsidies and unemployment compensation are set at the former real wage. Then the private sector will also have to pay this wage, and unemployment must result.

Notice that this would be unlikely if the state sector were profit maximizing, or at least cost minimizing. But this is, of course, hardly the case. Closer to the actual situation would be the assumption that the workers' collective determines wages in the state sector. We know that in the late stages of socialism the center lost authority to the enterprise. Directors who want to stay in control may have to give more authority to the workers to stay on top. The workers may then resist wage cuts. This suggests that privatization may be an important element in initiating adjustment. But notice that this will not work if budget constraints are immediately hardened.

The need for directors to stay in contorl is may also help explain the decline in labor productivity. Directors need to enhance their popularity with workers to keep their positions. This is valuable because they want control if assets are privatized. The best way to enhance popularity is to improve working conditions and increase wages. The latter may be difficult if budget constraints are hardened. The former is easier. This could lead to weaker incentives to work hard. Hence labor producitivity in the state sector declines due to *anticipated* privatization.

2.1   Mechanisms

We have yet to explain the decision to transfer resources between sectors. What is the *mechanism* that causes L to move from the state sector to the private sector or to unemployment? Since $\alpha < \beta$ if there is no problem

of absorbing resources then the state sector is privatized immediately, and output immediately increases. This is called a *bang-bang* solution. If there are absorption costs then the transfer of resources is more gradual. But what explains the pace?

Remark 1 *If the resources are capital then it would be logical to think of enterprises shutting down freeing resources for the private sector. Then the mechanism that leads to gradual adjustment would be the pace of shutdowns.*

Remark 2 *If we think of the resources as labor then we might consider the wage in the private sector. If too many workers leave state production the wage in the private sector may fall below state wages.[6] Of course this absorptive capacity will depend on the capital stock as well.*

What accounts for the pace of adjustment? There are two questions to ask. First, what factors explain the pace of decline of the state sector. Second, what factors explain the rate of absorption of the private sector. We might also wish to ask what determines the path that resources take from the state sector to their ultimate destination in the private sector.

With respect to the pace of decline, our question is how to characterize $\frac{\dot{L^s}}{L^s}$? One way to think of this is as an exogenous policy instrument that is chosen by reformers, e.g., $\frac{\dot{L^s}}{L^s} = -S$. For example, the tighter is the budget constraint (i.e., the greater the commitment to the hard-budget constraint), the greater will be this rate. Once we have specified the process of absorption and the costs of unemployment then we can ask questions about the optimal value of S.

Remark 3 *We could think of transition causing an immediate decline in productivity in the state sector, so that $\alpha \downarrow \alpha'$ instantaneously. This could be due to disorganization. This might cause a discontinuous jump in $\frac{\dot{L^s}}{L^s}$ as well. This could coincide with a jump in private sector employment.*

Alternatively, we could try to endogenize $\frac{\dot{L^s}}{L^s}$. We could argue that this depends on the gap between productivity in the two sectors, i.e., $\frac{\dot{L^s}}{L^s} = -\lambda[\beta(\frac{L^p}{L^p}) - \alpha]$; where $\lambda > 0$ and $\beta' < 0$. The idea is that contraction of

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[6]This is another way of saying that β is not constant.

the state sector depends on the productivity differential. Here we are assuming that productivity in the state sector is constant, but that productivity in the private sector depends on the rate of growth of the private sector. Notice that to close the model one needs to answer the third question; i.e., what is the relation between $\frac{\dot{L}^s}{L^s}$ and $\frac{\dot{L}^u}{L^u}$? If there were no third state, then one could argue that $\dot{L}^u = -\dot{L}^s$. This is unlikely to be the case, however. It assumes that there are no frictions in the adjustment process, an assumption inconsistent with the poor market infrastructure inherited by transition economies.

Remark 4 *A more plausible assumption would continue to assume that $\frac{\dot{L}^s}{L^s}$ is a function of the productivity differential, but assume that there is a threshold that $\beta - \alpha$ must exceed before the state sector will contract; i.e., $\frac{\dot{L}^s}{L^s} = -F[\beta(\frac{\dot{L}^u}{L^u}) - \alpha - \gamma]$, where γ is the threshold value, and where $F' > 0$, but without necessarily assuming that $\frac{\dot{L}^s}{L^s} < 0$ for all positive productivity differentials. It may be the case, for example, that $\beta > \alpha$ is required for the state sector to contract. This would follow if there are subsidies to the state sector, or if there is uncertainty about the duration of opportunities in the private sector. This is especially the case if leaving the state sector is irreversible.*

Remark 5 *We could also think of γ as an adjustment cost that must be borne as the private sector expands; $\gamma = \gamma(\frac{\dot{L}^p}{L^p})$. The net benefit of moving to the private sector is now $\beta(\frac{\dot{L}^u}{L^u}) - \alpha - \gamma$, rather than $\beta(\frac{\dot{L}^u}{L^u}) - \alpha$ as before. Notice that this adjustment cost is a sunk cost. This means that there is an option value to waiting if returns are uncertain. Agents may wait to switch until they have more information about the prospects for returns.*

Remark 6 *Absorption depends on entry. This may, in turn, depend on exit from the state sector to free resources for the private sector.*

Remark 7 *Notice that this framework neglects any changes in the state sector. But we would expect that privatization may also affect the productivity of resources that remain in that sector. We could add another state, L^x, the ex-state sector, with productivity α', where $\alpha < \alpha' < \beta$.*

Remark 8 *The key to recovery is for job creation to exceed job destruction, i.e.,*

$$\frac{\dot{L}^p}{L^p} > -\frac{\dot{L}^s}{L^s}$$

If this condition does not hold, then unemployment (or underemployment) will continue to grow.

Remark 9 *Absorption (or job creation) can be a function of tax rates. If unemployment gets too large, tax rates may rise, and this could cause slower job creation.*

Regarding the second question, there are a variety of reasons why structural adjustment is costly. Privatization takes a significant period to be implemented. The absence of property rights makes capital immobile in the early stages of transition. An interesting example of this is the difficulty of leasing. More generally, the absence of market infrastructure makes the immediate movement of resources from one sector to another too costly. We will talk about these various costs in a variety of ways as we proceed.