

## Abstract

This paper considers the impact on sectoral outputs and employments of rapid and large changes in relative prices, such as those which occurred in transition economies during the 1990s. A simple general equilibrium model is developed in which price changes are induced by a tax reform and resource mobility is restricted. The reform is designed to improve the quality of the price system, but is shown to cause a recession the size of which is proportional to the initial tax distortion. It is also demonstrated that a wage flexibility would moderate the magnitude of the recession, but this gain would be obtained at a cost in longer term efficiency, and would be, in any case, unsustainable.

# **A Simple Model of the Transformational Recession Under a Limited Mobility Constraint**

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# Introduction

The phenomenon of large output falls in the economies of Central Europe (CE) and the Former Soviet Union (FSU) during their systemic transformation in the 1990s is one of the most researched and yet still controversial. Kornai (1994) proposed the term “transformational recession” to indicate that these falls were directly related to the change of economic system rather than to transition policies. However, they took place against the background of rapid growth in China and Vietnam, which had been also introducing fundamental changes of their economic systems. This may indicate that the falls were related not merely to the systemic transformation as such, but also to its speed. Stiglitz (1999), among others, argues that the speed of transition was a choice variable, and choosing high speed was a major error. In a recent survey of evidence and interpretations of the recession, Gomulka (1998) suggests that in the countries of CE and the FSU the rapid speed was forced principally by the initial conditions of their much deeper (economic, institutional and political) crisis. In the survey, four classes of specific causes of output falls were identified:

1. sharp changes in relative prices in conditions of limited resource mobility;
2. the elimination of excessive real aggregate demand to establish buyers’ markets;
3. the collapse of captive markets within the former CMEA area; and
4. the collapse of the arms industry and of state-financed investments in housing, energy, agriculture, and infrastructure.

In this paper we discuss only the potentially contractionary impact of a rapid change in relative prices. We develop a simple demonstration model. In this model, relative prices change because of changes in taxes and subsidies. In practice relative prices also changed significantly as a result of rapid price and trade liberalization, sharp increases in interest rates and large up-front devaluations. However, what is important here is the fact that relative prices have changed rapidly and massively, not what caused these changes. To discuss the impact of such changes, Blanchard (1997), proposed a two-sector model in which, before transition, one sector (state-owned) is subsidized and the other (private) is taxed. In that model, however, resources are assumed to be fully mobile, so that any output contraction in the state sector in response to the removal of subsidy could, in principle, be matched by an increase in private sector output in response to a tax-reduction, so that the aggregate output need not decline. The Blanchard model is unconvincing for two other reasons. Firstly, in transition economies the private sector was typically very small at the outset of transition and, secondly, the large informal private sector which emerged during transition was taxed less than the state sector. The key empirical features which we wished to incorporate in our model were the rapid change of the highly differentiated tax treatment of (initially) state enterprises during transition and the very limited mobility of resources between these enterprises. We also show that the output fall which results in such circumstances can be moderated by wage flexibility. However, a short term gain in lower output and employment losses is obtained at a cost in lower long-term efficiency, and is, in any case, unsustainable.

## The Model

The economy we consider is assumed to produce consumer goods only, of which two kinds are purely private and one kind purely public. Labour is assumed to be the only input needed. The wage costs of producing public good are financed in full by taxes imposed on the sale of private goods. However, initially, under the centrally-managed system, the two tax rates were

highly differentiated; one rate might even be negative. An important aspect of the systemic transformation is equalization of tax rates, as a means of improving substantially the quality of the price system. We assume that this tax equalization is introduced suddenly. Such a reform causes, therefore, a rapid and large change in relative prices. Moreover, since it shifted supply functions, the reform represents a supply shock.

Our primary purpose is to investigate the short-term impact of such a sudden change in relative prices on the composition of demand and on sectorial and total employment, under the assumption of limited labour mobility. This latter assumption reflects the fact that the production of specific goods requires, typically, specific skills. Moreover, production is based in specific localities, but labour mobility between localities is often limited, especially in the short-term. Boeri and Flinn [1999] computed some standard measures of mobility and showed that “there is strikingly more interindustry and interoccupational mobility in countries with rigid labour markets, like Italy, than in Central and Eastern European transforming economies” (p. 30). We interpret this limited skill and space mobility to mean that, following the price shock, employment in each sector cannot exceed the level just before transition to equal tax rates. To simplify analysis, we assume that the wage rate is the same in all sectors and that the utility function for the representative household is of the Cobb-Douglas type. As there are no savings, the utility maximizing households would then spend constant fractions of their wage income on each of the two private goods.

The economy is therefore described by the following equations:

$$p_i x_i = a_i \prod_{j=1}^3 w L_j^D, \quad i = 1, 2, \quad a_1 = a \quad \text{and} \quad a_2 = 1 ? a \quad \#$$

$$p_i = V_i w + t_i p_i, \quad i = 1, 2 \quad \#$$

$$p_3 = V_3 w \quad \#$$

$$L_j^D = V_j x_j, \quad j = 1, 2, 3 \quad \#$$

$$x_3 = G, \text{ given} \quad \#$$

$$t_1 p_1 x_1 + t_2 p_2 x_2 = p_3 G \quad \#$$

$$V_1 x_1 + V_2 x_2 + V_3 G \stackrel{?}{=} L, \text{ with equality before the shock.} \quad \#$$

In those equations  $x$ 's are quantities of private goods,  $p$ 's are prices,  $w$  is the wage rate,  $V$ 's are fixed labour inputs per unit of output,  $t$ 's are tax rates,  $G$  is the given supply of public good and  $L$  is the total labour supply.

The two key features of the economy are, firstly, full employment before transition and, secondly, that

$$\begin{array}{ll} t_2 \ll t_1 < 1 & \text{before transition} \\ t_2 = t_1 = t > 0 & \text{after transition} \end{array}$$

The tax rate  $t_2$  may be negative before transition, indicating that goods of type 2 were subsidized at that time. In what follows, we solve the system (1) to (7) in order to establish the effect on sectorial outputs and employments of the sudden tax equalization. Apart from technical coefficients, the given parameters are  $w, G$  and - before transition - one of the tax rates.

# The Economy Before Transition

By assumption there is full employment of labour, at a common wage rate  $w$ , in all sectors. Therefore,  $p_2x_2 = \sum_{i=1}^3 a_i p_i w L$ . As  $p_2 = V_2 w + t_2 p_2$ , this implies that

$$x_2 = \sum_{i=1}^3 a_i p_i V_2^{-1} \bar{x}_2. \quad \#$$

So from (7)

$$x_1 = \sum_{i=1}^3 a_i p_i V_1^{-1} \sum_{i=1}^3 V_3 G / V_1 p_i G^{-1} \bar{x}_1. \quad \#$$

From (1) and (3) the budget equation (6) becomes,  $\sum_{i=1}^3 a_i t_1 + \sum_{i=1}^3 a_i t_2 \bar{x}_i > L_i / L = V_3 G / L$ . Hence

$$t_1 = \frac{V_3 G}{a L} + \frac{1}{a} t_2 \quad \#$$

This full employment constraint is illustrated by the thick line in Fig.1. It is the lower boundary of the long-run 'tax-possibility' set.

We regard  $t_2$  as given, and  $t_1$  is adjusted, depending on the fixed  $t_2$  and  $G$ , to satisfy the budget constraint. Prices and sectorial employments immediately follow. In particular,

$$L_1 = V_1 x_1 = \sum_{i=1}^3 a_i p_i V_1^{-1} \sum_{i=1}^3 V_3 G^{-1} \bar{L}_1 \quad \#$$

and

$$L_2 = V_2 x_2 = \sum_{i=1}^3 a_i p_i V_2^{-1} \bar{L}_2 \quad \#$$

Social welfare is maximized when  $t_1 = t_2 = t^D$ , say. footnote From (10) it follows that  $t^D = V_3 G / L$ , so the optimal quantities are:

$$X_1^{LT} = \sum_{i=1}^3 a_i p_i V_1^{-1} \text{ and } X_2^{LT} = \sum_{i=1}^3 a_i p_i V_2^{-1} \quad \#$$

However, these quantities can be produced only in the long term, i.e., after a suitable redeployment of labour between sectors and the necessary adjustments in terms of skills and places of work. This long term equilibrium is shown by the point  $E^{LT}$  in Fig.1 and Fig.2, the latter showing the long term production possibility frontier as determined by the full employment condition:  $V_1 x_1 + V_2 x_2 = L + V_3 G$ .

By assumption,  $t_1 \gg t_2$ , so the initial situation (point '0' in both Figures) is suboptimal. footnote We seek to examine the short term impact of improving the signalling function of prices by eliminating the tax distortion between the two (private goods) sectors.

# The Economy Just After Transition

The quantities  $x_1$  and  $x_2$  must still satisfy the supply-demand equation:

$$p_i x_i = a_i w \sum_{i=1}^3 V_i x_i + V_3 G p_i, \quad i = 1, 2 \quad \#$$

where the product prices are given by



$$p_i = wV_i / \sum_{i=1}^2 t_i p_i, \quad i = 1, 2. \quad \#$$

Solving (14) and (15) yields

$$V_i x_i = a_i \sum_{i=1}^2 t_i p_i V_3 G / \sum_{i=1}^2 a_i \sum_{i=1}^2 t_i p_i + a_2 \sum_{i=1}^2 t_i p_i \quad \#$$

By virtue of Walras' Law, these quantities and prices satisfy the budget constraint (6).

In the short-run, labour cannot change sectors, so

$$L_i^D = \bar{L}_i, \quad i = 1, 2 \quad \#$$

Equivalently,  $x_i = \bar{x}_i$ . This short run production possibility frontier is shown as the shaded area in Figure 2. From (16) it defines, in the  $\sum_{i=1}^2 t_i p_i$  space, the tax rate pairs for which the labour constraints bind. Both constraints must be simultaneously satisfied, so the short run 'tax-possibility' set is as shown by the shaded area in Figure 1.

The reform equalises tax rates so (16) implies

$$V_i x_i = a_i V_3 \frac{\sum_{i=1}^2 t_i p_i}{t} G, \quad i = 1, 2. \quad \#$$

A feasible choice of an equalised tax rate requires setting  $t = t^s$ , say, with  $t^s > t^D$ . From (18) this implies that  $x_2$  falls below its long run equilibrium value. Thus if full employment is possible at all in any sector it would be in sector 1; a scenario which is consistent with the reduction in the relative price of good 1. To this end the required tax rate  $t^s$  has to meet the condition,

$$a_1 \frac{V_3}{V_1} \frac{1}{t^s} G = \bar{x}_1 \quad \#$$

where  $\bar{x}_1$  is given by (9). This short term equilibrium is denoted by  $E^{ST}$  in Figures 1 and 2. Welfare will have decreased vis à vis the initial situation '0'.

From (10) one can draw many lines above and parallel to the full employment constraint through  $E^{LT}$  in Figure 1; successively higher lines correspond to a larger fixed level of aggregate unemployment. Therefore the specified short term policy is the "best" in the sense that amongst all feasible equalised tax rates it is the one that minimises aggregate unemployment.

From (16):

$$L_2^D = V_2 x_2 = a_2 \sum_{i=1}^2 t_i p_i V_3 G / t^s$$

and from (19)

$$t^s \sum_{i=1}^2 t_i p_i = a_1 V_3 G / \bar{L}_1$$

so:

$$L_2^D = \frac{a_2}{a_1} \bar{L}_1 \quad \#$$

as there is full employment in sector one. Prior to the shock there is full employment of labour (in both sectors) so (10) to (12) inclusive imply

$$\begin{aligned} \bar{L}_2 &= \frac{1}{1} \frac{t_2}{t_1} \frac{a_2}{a_1} \bar{L}_1 \\ &= \frac{1}{1} \frac{t_2}{t_1} L_2^D \text{ by (20).} \quad \# \end{aligned}$$

Hence, under the "best" policy, the short term rate of unemployment in sector 2 is:

$$\frac{\bar{L}_2 \cdot L_2^D}{\bar{L}_2} = \frac{t_1 \cdot t_2}{1 \cdot t_2} \quad \#$$

as in sector 2 employment is equal to labour demand.

The rate of unemployment is thus proportional to, and greater than, the difference in tax rates which the transition reform is removing. We can also find, from (12) and (22), the minimum economy-wide rate of unemployment:

$$\frac{\bar{L}_2 \cdot L_2^D}{L} = \gamma_1 \cdot a \cdot \gamma_1 \cdot t_1 \cdot t_2 \quad \#$$

In centrally managed economies, the intersectoral differences in tax rates were extremely large. A significant fraction of enterprises were heavily subsidized, while many of the remaining enterprises were heavily taxed. The tax reforms of the early transition period tended to eliminate enterprise subsidies and widen the tax base. The originally large difference  $t_1 \cdot t_2$  was thus reduced over a short period of time. The supply-side shocks which such tax changes brought about might, in reality, have had the considerable contractionary effects which this model implies.

These effects could well have been even greater than those given by formulas (22) and (23). For tax equalization reforms were taking place under considerable uncertainty with respect to outputs, but with a clear determination of the reformers to reduce or even remove budget deficits. In such circumstances, the common tax rate  $t$  might have been set at a level higher than  $t^s$ , and public spending  $G$  at a level lower than that prevailing before transition. Our model implies that, under such a fiscal policy, all sectoral outputs would initially be lower than before transition.

A rapid price liberalization and a large up-front devaluation of the domestic currency would probably have compounded the effect of tax equalization on changes in relative prices. Subsequent changes in the composition of demand, under the conditions of limited resource mobility, could have therefore been sizeable enough to account for a large part of the “transformational recession”.

## Wage Flexibility and Employment

In an influential paper, Layard and Richter (1995) noted that in Russia real wages fell sharply in response to initial falls of output, and argued that the observed low rate of unemployment can be attributed to this exceptionally high wage flexibility. In our model wage flexibility can be introduced by allowing the real wage rate in sector 2, one with unemployment post-transition, to fall below the common rate which obtains before transition, and which continues in sector 1 after transition.

To derive the implications for employment, we use equations (14) and (15), in which wages are now sector-specific. We retain the full employment condition for sector 1. Simple algebra gives the employment level in sector 2.

$$L_2 - V_2 x_2 = \frac{1 \cdot a \cdot w_1}{a \cdot w_2} L_1 \quad \#$$

Since, by (21),  $\frac{L_1}{L_2} = \frac{a}{1 \cdot a} \frac{1 \cdot t_1}{1 \cdot t_2}$  and by (12)  $\frac{L_2}{L} = \gamma_1 \cdot a \cdot \gamma_1 \cdot t_1 \cdot t_2$ , the unemployment rates are now as follows: in sector 2,

$$u_2 = \frac{L_2 - L_2^D}{L_2} = 1 - \frac{w_1}{w_2} \frac{1 \cdot t_1}{1 \cdot t_2} \quad \#$$

and economy-wide,

$$u - \frac{\partial L_2}{L} = \frac{\partial L_2}{L} \frac{\partial L_2}{L} = \gamma_1 \frac{\partial L_2}{L} \frac{\partial L_2}{L} \quad \#$$

Thus, unemployment would be lower if a gap opens up between sectoral wages. If the gap is sufficiently large, there would be no unemployment (and no recession) whatsoever. The reason is that a removal of subsidy is then (partially) compensated for by a reduction of the wage rate, so that the relative price of the no longer subsidised product increases less.

However, as the initial sectoral composition of the economy is distorted and suboptimal, this sub-optimality would be preserved through the substitution of a tax distortion by a wage distortion. Moreover, this wage distortion cannot be sustained in the long term. Thus, when a limited mobility constraint is binding, the transformational recession inflicts a welfare cost in the short-run, but this temporary cost can be viewed as an investment needed to obtain a permanent improvement.

## Extensions

The analysis in section 4 above assumes that the utility function for households is of the Cobb-Douglas type, i.e. that the substitution elasticity between the two private goods is unitary. Clearly, any impact of changes in relative prices would be lower (higher) than the one derived in that section if the magnitude of that elasticity were lower (higher). In the extreme case of these goods being perfect complements (zero substitution elasticity), the quantities demanded are independent of prices, and therefore, any price shocks would have no effect at all on sectoral outputs and employments. In the other extreme case, in which the goods are perfect substitutes, tax equalization would lead to the total collapse of one of the sectors, that producing the good which is relatively more expensive after the transition. In a real economy with many private goods, we would therefore expect greater output contraction to take place in industries where the increase in unit costs is relatively greater, and producing goods which are easier to substitute. The empirical evidence is consistent with that conclusion (Czyzewski et.al. 1995, Zukowski 1998).

This analysis can be extended to recognize also capital as an input, investment as a type of demand and profits as a form of income. In an earlier paper we discussed the potential impact of an external price shock in a two-sector model with capital accumulation (Gomulka and Lane, 1997). The presence of capital, investment and profits complicates the analysis, but its conclusions are similar to those obtained in this paper. The main substantive gain of such an extension is that it allows one to highlight the path-dependence of any post-transition adjustments in response to the initial recession. This path-dependence is particularly important when the intersectoral mobility of capital is restricted and the labour-capital substitution elasticity is small. In such circumstances, since initial recession typically reduces capital accumulation, the task of restoring full-employment equilibrium is a more prolonged affair.

Another extension of the analysis is from 2 private goods to  $n$  goods (plus the  $n + 1$  public good). The goods can be ranked by the tax rate, so that  $t_1 > t_2 > \dots > t_n$  before transition. Following the tax equalization reform, assuming the Cobb-Douglas utility function, the labour constraint would be, at best, binding only in sector 1. The importance of this extension lies in pointing out that, under limited mobility, the state of unemployment would prevail in (almost) the entire economy.

# Concluding Remarks

The usual textbook assumption of unrestricted resource mobility between production lines within enterprises and between enterprises, is realistic under normal circumstances of gradual changes in the product composition of total demand. However, most post-communist transitions took place in conditions of total (institutional, political, economic) crisis, which forced rapid and large changes in this product composition. Similarly, large changes took place during transition from war-time to peace-time just after WWII in the USA, Japan and Germany. As many labour and capital inputs are product-specific, the economy tends to respond to such rapid changes in demand with considerable inertia with respect to the allocation of resources. We suggest that inevitably large changes on the demand side and this inertia in the rate of adjustment on the supply side has been the main cause of the large falls in outputs observed during the early phase of transition.

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