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Output Collapse in Transitional Economies: A Possible Explanation Using a Two-sector Mesoeconomic Model

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Abstract

Using a two-sector mesoeconomic model, the paper examines the short-term effects of the demand shift between different sectors resulted from the economic liberalisation in a transitional economy, especially focussing on Russia. Findings are that, for a transitional economy without a well-functioning factor market, the demand shift may cause a short term economic slump. Moreover, the possibility of an economic slump is higher when there are unfavorable effects from changes in the price elasticity of demand.

Keywords: transitional economy, mesoeconomics, representative firm, demand shift, economic restructure, economic slump

1. Introduction

In the early 1990s, the world observed a wave of economic liberalisation and reform in the former central-planned economies. A main purpose of the reform in those economies is to restructure their distorted economies which did not match the liberated demand structures. Before economic liberalisation in those countries, investment was a function of government and there was hardly any private investment. Government expenditure and investment, however, had been distorted to largely favour those heavy industries and the MIC, while consumer demand for consumer goods and services had been suppressed. The twisted demand structure had accumulated the distorted economic structure. The former USSR[1], for example, had great concentration of resources in heavy industry, particularly in the military-industrial complex, but consumer goods and services were neglected before the reform. Table 1.1 shows that in 1988 nearly half of GDP in the former USSR were from industry, while only 9.3 percent and 13.9 percent were from agriculture and services. Moreover within industry, heavy industry had much greater share than light and consumer industry.

With the liberalisation of the economy, the demand has been shifting away from heavy industries and the MIC to other sectors. The old economic structure was no longer suitable for the new liberated demand structure and therefore economic restructure is needed. The objective of the restructure is to shift the resources out of those sectors which need to contract to the sectors which need to expand, and therefore to achieve a healthier economic structure and steady economic growth. As Lipton and Sachs said in their (1992, p. 213-214) paper:

[1] Since there was no independent Russia before 1990, here we use data of the former USSR to present the distorted economic structure before economic liberalisation. Afterwards, data of Russia is used for the analysis of the transition period from 1990 to 1996.

The benefits of sustained economic reforms are likely to be very great-much greater than is commonly supposed. The old command system was so inefficient and destructive of the quality of economic life that enormous scope exists for increases in average living standards within a few years, particularly as resources are shifted out of the military-industrial complex into other sectors.

In the long run, without doubt Lipton and Sachs are correct and there is some evidence which indicates that the economic structure of Russia has been changing rapidly over the last fewl years. According to the EIU Country Report, 1st quarter, 1995, the origin of GDP coming from services was 50 percent and this is a dramatic change relative to the 13.9 percent in 1988.

Table 1.1. Structure of Production: Distribution GDP in the Former USSR, 1988

(Percent of total)

Sector	Output
Industry	48.9
Electricity	2.2
Fuel	5.0
Metallurgy	3.7
Chemical	3.1
Machine building and metal working	15.1
Wood and paper	2.1
Construction materials	2.1
Light industry	6.1
Food	8.1
Other industry	1.4
Construction	10.7
Agriculture	9.3
Transportation and communication*	10.1
Trade and distribution	6.1
Other	0.8
Services	13.9

Source: Lipton and Sachs (1992).

*. Includes passenger services and goods services

Nevertheless, despite the remarkable change of the service sector, the transformation in industry (in a relatively short time) has not been occurring as well as some people expected. Table 2 shows that output levels of both consumer goods industries (which were supposed to be growing) and heavy industries (which were expected to be contracting) in Russsia had been falling from 1991 to 1996, although there were small improvements in Ferrous metallurgy and Chemicals & petrochemicals during 1995.

Table 1.2. Trends of industrial output by sector in Russia (1990=100)

	1990	1991	1992	1993	1994*	1995*	1996*(Jan-Mar)
Total	100	92	75	65	-22.8	-5.0	-7.0
extractive ind.	100	96	85	77	#	-2.0	-2.0
processing ind.	100	92	74	63	#	-5.0	-8.0
Electricity	100	100	96	91	-8.8	-3.0	3.0
Fuels	100	94	87	77	-11.0	-2.0	-1.0
Ferrous metallurgy	100	93	77	65	-17.4	2.0	-2.0
non-ferrous metallurgy	100	91	68	59	#	#	#
Engineering	100	90	77	65	-39.4	-10.0	-17.0
Chemicals & petrochemicals	100	94	73	58	-28.9	8.0	-14.0
Wood and paper	100	91	78	63	-31.2	-7.0	-15.0
Construction materials	100	98	78	65	-28.9	-8.0	-25.0
Light industry	100	91	64	49	-47.3	-31.0	-30.0
Food industry	100	91	76	69	-21.9	-9.0	-6.0

Source: CIU country profile and reports, 1995-1996;
*. real % change on the previous year.
#. data are not available

There are many reasons for this short-term underperformance (e.g., political instability, the soft budget constraint and resulting macroeconomic instability, the principal-agent problem, etc.), but the problems associated with demand shift and economic restructure on which little formal analysis has been done so far[2], may be highly relevant. As Karl-Heinz Paque pointed out:

> ...Again, I see, first of all, frictional problems of restructuring behind the crisis, and not issues of political economy. What distinguishes the experience of Central and Eastern Europe from other episodes of liberalisation-Olson mentions postwar Germany and post-Mao China - is the existence of a capital stock that is at least partly obsolete at world market prices and that calls for a wholesale restructuring with respect to product range, technologies used, and management practices.... (Paque, 1993, p. 33).

The present paper addresses the issue of demand shift and economic restructure, using a two-sector mesoeconomic model, by focusing on the important role of a well-functioning factor market for the transitional economies.

The paper is organised as follows. In section 2, a brief introduction to basic mesoeconomics is presented. Section 3 extends basic mesoeconomics to a two-sector model to analyse a transitional economy. Section 4 examines the comparative results of the model to give a possible but not the only explanation of the aforementioned short-term performance of some transitional economies. The conclusion is presented in the final section.

2. Mesoeconomical methodology

The reasons for us to use mesoeconomic model here are: firstly, it allows for non-perfect competition which might be a more appropriate approximation of transitional eocnomies after economic liberalisation than models based on perfect competition; secondly, it is easy to handle and generate rich comparative static results.

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[2] Sen, S. (1992) and Murshed, S. M. (1992) each provides a model on the military conversion in the former Soviet Union.

Mesoconomics, developed by Ng (1980, 1982 and 1986), is a method of economic analysis to provide microfoundation for macro economics by allowing for non-perfect competition. It uses the representative firm approach to approximate an economy's response to exogenous disturbances. In the initial equilibrium, the representative firm represents an economy. When the equilibrium is disturbed, the representative firm's response to the disturbances approximates the response of the whole economy. The interaction between the representative firm and the rest of the economy is approximated by some aggregate variables, namely aggregate output and average price level, which enter the representative firm's demand and cost functions. Theoretically, the most straightforward way to use the representative firm approach is to assume a number of identical or symmetrical firms; this has been done by many economists in the monopolistic competitive literature (e.g., Dixit and Stiglitz, 1977; Hart, 1982; Weitzman, 1982; etc.).

Mesoeconomics typically assumes that the number of firms in the economy is large, and that the representative firm is fairly small, such that it has no significant effects on the average price, aggregate demand, and the number of the firms. Moreover, it assumes that collusions are absent. These assumptions resemble those in Chamberlin's monopolistical competition analysis (Chamberlin, 1933). However, Chamberlin's analysis focused on the behaviour of individual firms whereas mesoeconomics studies the behaviour of the whole economy or industry in response to exogenous disturbances.

Besides its easiness to handle, mesoeconomics generates rich comparative static results. Nevertheless, the basic mesoeconomic model is about an economy or industry, it does not study the interrelationship between the different sectors within a economy. In the next section, the basic mesoeconomic model is extended to a two-sector model to study this interrelationship. The whole economy is divided into two sectors and each sector has a representative firm which represents each sector rather than the whole economy. The effects of demand shift (away from one sector to another sector) on the average prices and total output levels of both sectors are examined through the analyses of the behaviour of the representative firms.

3. The Model

In this section, the whole economy is divided into two sectors: one where demand contracts (or the sector which needs to transform, e.g., the heavy industry and military complex in Russia), and one where demand increases (or the sector which needs to expand, e.g., the light and consumer industry in Russia). The sector where demand decreases is denoted as sector X while the sector with increased demand is denoted as sector Z. A two-sector mesoeconomic model is used to examine the effects of a demand shift away from sector X to sector Z. Sector X and sector Z are assumed to consist of N_X and N_Z symmetrical firms such that each firm is representative of its own sector, where N_X and N_Z are exogenously large and exogenously given because the focus here is on the short-run analysis[3] .

The notations in this paper are defined as follows:

$\eta^{ab} \equiv \dfrac{\partial a}{\partial b}\dfrac{b}{a}$ i.e., the (proportionate) response of a with respect to a change in b only.

$\sigma^{ab} \equiv \dfrac{da}{db}\dfrac{b}{a}$ i.e., the (proportionate) response of a with respect to an exogenous change in b, with all endogenous variables allowed to change.

[3] The model can be extended to a long run model where the number of firms in each sector can be endogenised. See Ng (1986) for the basic long run model.

Following Ng (1980), the demand functions of the representative firms of both sectors are assumed to be

$$x_i = x_i\,(p_i, P_X, P_Z, (1-\lambda)\alpha) \tag{3.1}$$

$$z_j = z_j\,(p_j, P_Z, P_X, \lambda\alpha) \tag{3.2}$$

where x_i = quantity demanded for the representative firm of sector X;

z_j = quantity demanded for the representative firm of sector Z;

p_i = the price of the representative firm of sector X;

P_X = the average price of sector X;

p_j = the price of the representative firm in sector Z;

P_Z = the average price of sector Z;

α = the nominal aggregate demand of the whole economy;

λ = the share of the nominal aggregate demand expended in sector X;

$1-\lambda$ = the share of the nominal demand expended in sector Z.

A increase in λ in the above demand equations represents the demand shift away from sector X to sector Z. The demand functions above are more general than those derived from the maximization of a Cobb-Dorglas utility function, given the mesoeconomic simplification of ignoring inter-firm changes.

The cost functions of the representative firms in both sectors are assumed to be

$$C_i = C_i\,(x_i, X, Z, P_X, P_Z) \tag{3.3}$$

$$C_j = C_j\,(z_j, Z, X, P_Z, P_X) \tag{3.4}$$

where X = the total output of sector X;

Z = the total output of sector Z.

Here, exogenous cost changes are ignored in the cost functions for the purpose of focusing on the effects of demand shift between the two sectors. The average price of each sector may have a direct effect on the costs of both sectors (through the prices of material inputs) as well as an indirect effect through its effect on the money wage rate. The output of each sector may affect the costs of its own firm as well as the firm in the other sector by raising wage rate and interest rate (through a higher demand for labor and capital), and by external economies or diseconomies. Moreover $\eta^{c_1 P_X}$ and $\eta^{c_2 P_Z}$ in the above equations are unlikely to be greater than one (see Ng, 1982 for details).

The profit functions are then

$$p_i\, x_i\, [p_i, P_X, P_Z, (1-\lambda)\alpha\,] - C_i\, (x_i, X, Z, P_X, P_Z) \qquad (3.5)$$

$$p_j\, z_j\, (p_j, P_Z, P_X, \lambda\alpha\,) - C_j\, (z_j, X, Z, P_Z, P_X) \qquad (3.6)$$

Assuming that the representative firms maximize their profits with respect to the variables under their control[4] (i.e., x_i and z_j), we have the following first-order conditions:

$$p_i\,(1 + {}^{1}\!/\!_{\eta_1[p_i, P_X, P_Z, (1-\lambda)\alpha]}) = c_1\,(x_i, X, Z, P_X, P_Z) \qquad (3.7)$$

$$p_j\,(1 + {}^{1}\!/\!_{\eta_2(p_j, P_Z, P_X, \lambda\alpha)}) = c_2\,(z_j, X, Z, P_Z, P_X) \qquad (3.8)$$

[4] Since we are concerned with the effects of the demand shift after price liberalisation and privatisation in transitional economies, profit maximisation could be a reasonale approximation in this context although there were significant deviation from profit maximisation caused by various institutional effects during the transitional period. In Russia, price liberalisation was imposed through a presidential decree on December 3, 1991. Privatisation began in 1991 and was nearly completed at the end of 1993 (Aslund, 1995). But before privatisation there were serious principal-agent problems because managers could maximize the benefits of their own. The principal-agent problem has been addressed by Aslund (1995), Qian (1994) and others.

where $\eta_1 \equiv (\partial x_i/\partial p_i)(p_i/x_i)$, $\eta_2 \equiv (\partial z_j/\partial p_j)(p_j/z_j)$ is the demand elasticity of the representative firms of both sectors.

$c_1 \equiv \partial C_i/\partial x_i$ and $c_2 \equiv \partial C_j/\partial z_j$ are the marginal costs of the representative firms.

In equilibrium, demand equals supply in each sector and the equilibrium price of the representative firms in each sector must be the same as the equilibrium average price for each sector (otherwise the firms no longer represent the two different sectors). Therefore:

$$P_X X = (1-\lambda)\alpha \qquad (3.9)$$

$$P_Z Z = \lambda\alpha \qquad (3.10)$$

$$x_i N_X = X \qquad (3.11)$$

$$z_j N_Z = Z \qquad (3.12)$$

$$p_j = P_Z \qquad (3.13)$$

$$p_i = P_X \qquad (3.14)$$

To close the system, an extra equation is used to specify the determination of aggregate demand α. It can be generally assumed as follows:

$$\alpha = \alpha(P_X, P_Z, X, Z, M) \qquad (3.15)$$

where M is some exogenous set of (nominal) factors, probably including the money supply and other exogenous (independent of P_X, P_Z, X, Z) factors affecting aggregate demand. The only restrictions placed on this equation are $s_X > \eta^{\alpha X} > -s_X$, $s_Z > \eta^{\alpha Z} > -s_Z$, $s_X > \eta^{\alpha p_X} > -s_X$, $s_Z > \eta^{\alpha p_Z} > -s_Z$ to avoid the system being explosive. The first two restrictions are the most common ones indicating that the marginal propensity to expenditure is less than one (see Ng, 1980 for details).

Totally differentiating equation (3.9), (3.10), (3.11), (3.12), (3.13), (3.14) and (3.15) gives:

$$\frac{dP_X}{P_X}+\frac{dX}{X}=\frac{d[(1-\lambda)\alpha]}{(1-\lambda)\alpha}=\frac{d(1-\lambda)}{1-\lambda}+\frac{d\alpha}{\alpha}=-\frac{s_Z}{s_X}\frac{d\lambda}{\lambda}+\frac{d\alpha}{\alpha} \qquad (3.16)^{5}$$

$$\frac{dP_Z}{P_Z}+\frac{dZ}{Z}=\frac{d(\lambda\alpha)}{\lambda\alpha}=\frac{d\lambda}{\lambda}+\frac{d\alpha}{\alpha} \qquad (3.17)$$

$$\frac{dX}{X}=\frac{dx_i}{x_i} \qquad (3.18)$$

$$\frac{dZ}{Z}=\frac{dz_j}{z_j} \qquad (3.19)$$

$$\frac{dP_X}{P_X}=\frac{dp_i}{p_i} \qquad (3.20)$$

$$\frac{dP_Z}{P_Z}=\frac{dp_j}{p_j} \qquad (3.21)$$

$$\frac{d\alpha}{\alpha}=\eta^{\alpha P_X}\frac{dP_X}{P_X}+\eta^{\alpha X}\frac{dX}{X}+\eta^{\alpha P_Z}\frac{dP_Z}{P_Z}+\eta^{\alpha Z}\frac{dZ}{Z}+\eta^{\alpha M}\frac{dM}{M} \qquad (3.22)$$

where s_X = the share of total (nominal) expenditure on sector X at the initial equilibrium;

s_Z = the share of total (nominal) expenditure on sector Z at the initial equilibrium.

Totally differentiating (3.7), (3.8) and substituting in (3.16), (3.17), (3.18), (3.19), (3.20) and (3.21) yields [6]

$$\begin{aligned}&\left\{1-\eta^{c_1 P_X}-\frac{p_i}{c_1\eta_1}\left(\eta^{\eta_1 p_i}+\eta^{\eta_1 P_X}+\eta^{\eta_1[(1-\lambda)\alpha]}\right)\right\}\frac{dP_X}{P_X}-\left(\frac{p_i}{c_1\eta_1}\eta^{\eta_1[(1-\lambda)\alpha]}+\eta^{c_1 x_i}+\eta^{c_1 X}\right)\frac{dX}{X}\\&-\left(\eta^{c_1 P_Z}+\frac{p_i}{c_1\eta_1}\eta^{\eta_1 P_Z}\right)\frac{dP_Z}{P_Z}-\eta^{c_1 Z}\frac{dZ}{Z}=0\end{aligned} \qquad (3.23)$$

$$\begin{aligned}&\left\{1-\eta^{c_2 P_Z}-\frac{p_j}{c_2\eta_2}\left(\eta^{\eta_2 p_j}+\eta^{\eta_2 P_Z}+\eta^{\eta_2(\lambda\alpha)}\right)\right\}\frac{dP_Z}{P_Z}-\left(\frac{p_j}{c_2\eta_2}\eta^{\eta_2(\lambda\alpha)}+\eta^{c_2 Z}+\eta^{c_2 z_j}\right)\frac{dZ}{Z}\\&-\left(\eta^{c_2 P_X}+\frac{p_j}{c_2\eta_2}\eta^{\eta_2 P_X}\right)\frac{dP_X}{P_X}-\eta^{c_2 X}\frac{dX}{X}=0\end{aligned} \qquad (3.24)$$

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[5] $\frac{d(1-\lambda)}{1-\lambda}=\frac{\lambda}{\lambda}\frac{(-d\lambda)}{1-\lambda}=-\frac{s_Z}{s_X}\frac{d\lambda}{\lambda}$ since $\lambda = s_Z$ and $1-\lambda = s_X$ in equilibrium.

[6] See appendix A for mathematical details.

where $\eta^{c_1 x_i}$ refers to the slope of the marginal cost curve (MCC) of the representative firm in sector X;

$\eta^{c_1 X}$, $\eta^{c_1 P_X}$, $\eta^{c_1 Z}$ and $\eta^{c_1 P_Z}$ refer to the shift of the MCC of the representative firm in sector X caused by the change of the total outputs and the average prices of both sectors;

$\eta^{c_2 z_j}$ refers to the slope of the MCC of the representative firm in sector Z;

$\eta^{c_2 Z}$ $\eta^{c_2 X}$, $\eta^{c_2 P_Z}$ and $\eta^{c_2 P_X}$ refer to the shift of the MCC of the representative firm of sector Z caused by the change of the total outputs and the average prices of both sectors;

$-\frac{p_i}{c_1\eta_1}\eta^{\eta_1 p_i}, -\frac{p_i}{c_1\eta_1}\eta^{\eta_1 P_X}, -\frac{p_i}{c_1\eta_1}\eta^{\eta_1[(1-\lambda)\alpha]}$ are the effects of prices change and the demand change of sector X on the marginal revenue (MR) of the representative firm x through changing its demand elasticity [7]; $-\frac{p_i}{c_1\eta_1}\eta^{\eta_1 P_Z}$ is the effect of the average price in sector Z on the MR of representative firm x by changing its demand elasticity; all these effects are called the elasticity effects on the representative firm x;

[7] Denoting μ_1 and μ_2 as separately the marginal revenues of the representative firms in sectors X and Z, then $\eta^{\mu_1\eta_1} = \frac{\partial\mu_1}{\partial\eta_1}\frac{\eta_1}{\mu_1} = -\frac{p_i}{c_1\eta_1}$ since $\mu_1 = c_1 = p_i(1 + {}^1\!/_{\eta_1})$. Thus $-\frac{p_i}{c_1\eta_1}\eta^{\eta_1 p_i} = \eta^{\mu_1\eta_1}\eta^{\eta_1 p_i}$, $-\frac{p_i}{c_1\eta_1}\eta^{\eta_1 P_X} = \eta^{\mu_1\eta_1}\eta^{\eta_1 P_X}$, $-\frac{p_i}{c_1\eta_1}\eta^{\eta_1[(1-\lambda)\alpha]} = \eta^{\mu_1\eta_1}\eta^{\eta_1[(1-\lambda)\alpha]}$, $-\frac{p_i}{c_1\eta_1}\eta^{\eta_1 P_Z} = \eta^{\mu_1\eta_1}\eta^{\eta_1 P_Z}$. Similarly, $-\frac{p_j}{c_2\eta_2}\eta^{\eta_2 p_j} = \eta^{\mu_2\eta_2}\eta^{\eta_2 p_j}$, $-\frac{p_j}{c_2\eta_2}\eta^{\eta_2 P_Z} = \eta^{\mu_2\eta_2}\eta^{\eta_2 P_Z}$, $-\frac{p_j}{c_2\eta_2}\eta^{\eta_2(\lambda\alpha)} = \eta^{\mu_2\eta_2}\eta^{\eta_2(\lambda\alpha)}$, $-\frac{p_j}{c_2\eta_2}\eta^{\eta_2 P_X} = \eta^{\mu_2\eta_2}\eta^{\eta_2 P_X}$.

$-\frac{p_j}{c_2\eta_2}\eta^{\eta_2 P_j}, -\frac{p_j}{c_2\eta_2}\eta^{\eta_2 P_z}, -\frac{p_j}{c_2\eta_2}\eta^{\eta_2(\lambda\alpha)}$ are the effects of prices change and the demand change of sector Z on the MR of the representative firm z through changing its demand elasticity; $-\frac{p_j}{c_2\eta_2}\eta^{\eta_2 P_X}$ is the effect of the average price of sector X on the MR of representative firm z by changing its demand elasticity; all these effects are called the elasticity effects on the representative firm z.

Substitute (3.22) into (3.16) and (3.17), we have:

$$(1-\eta^{\alpha P_X})\frac{dP_X}{P_X}+(1-\eta^{\alpha X})\frac{dX}{X}-\eta^{\alpha P_Z}\frac{dP_Z}{P_Z}-\eta^{\alpha Z}\frac{dZ}{Z}=\frac{d\lambda}{\lambda}+\eta^{\alpha M}\frac{dM}{M} \qquad (3.25)$$

$$(1-\eta^{\beta P_Z})\frac{dP_Z}{P_Z}+(1-\eta^{\beta Z})\frac{dZ}{Z}-\eta^{\beta X}\frac{dX}{X}-\eta^{\beta P_X}\frac{dP_X}{P_X}=-\frac{s_Z}{s_X}\frac{d\lambda}{\lambda}+\eta^{\beta M}\frac{dM}{M} \qquad (3.26)$$

The four equations (3.23), (3.24), (3.25) and (3.26) can be used to solve for the four endogenous variables $\frac{dP_X}{P_X}$, $\frac{dX}{X}$, $\frac{dP_Z}{P_Z}$ and $\frac{dZ}{Z}$, as functions of exogenous variables $\frac{d\lambda}{\lambda}$ and $\frac{dM}{M}$. Thus the effects of the demand shift away from sector X to sector Z (the increase of λ) on the outputs and prices of the two sectors can be examined by the comparative static analysis in the next section.

4. Comparative statics results

To focus on the effects of the demand shift, the exogenous change in the aggregate demand dM is assumed to be zero. Moreover, since sector X is the sector which needs to transform and sector Z is the sector which needs to expand, the assumption of $\eta^{c_1 x_i}+\eta^{c_1 X}=0$ and $\eta^{c_2 z_j}+\eta^{c_2 Z}>0$ is taken in this paper. This is not unreasonable since the sector which needs to transform usually has huge excess capacity, while the sector which needs to expand may be in bad need of investment. Furthermore, it is usually difficult to reduce marginal cost for a decrease in production but more cost is likely to be incurred for an increase in production. Therefore this assumption is more applicable with this consideration.

Under the above assumptions, equations (3.23), (3.24), (3.25) and (3.26), which are are the basis for our comparative static results, can be written as the following matrix form.

$$\begin{bmatrix} 1-\eta^{c_1P_X}-H_1 & -(\eta^{c_1X_i}+\eta^{c_1X}+\frac{p_i}{c_1\eta_1}\eta^{\eta_1[(1-\lambda)\alpha]}) & -(\eta^{c_1P_Z}+\frac{p_i}{c_1\eta_1}\eta^{\eta_1P_Z}) & -\eta^{c_1Z} \\ -(\eta^{c_2P_X}+\frac{p_j}{c_2\eta_2}\eta^{\eta_2P_X}) & -\eta^{c_2X} & 1-\eta^{c_2P_Z}-H_2 & -(\frac{p_j}{c_2\eta_2}\eta^{\eta_2(\lambda\alpha)}+\eta^{c_2Z}+\eta^{c_2Z_j}) \\ 1-\eta^{P_X} & 1-\eta^{X} & -\eta^{P_Z} & -\eta^{Z} \\ -\eta^{P_X} & -\eta^{X} & 1-\eta^{P_Z} & 1-\eta^{Z} \end{bmatrix}$$

$$* \begin{bmatrix} \frac{dP_X}{P_X} \\ \frac{dX}{X} \\ \frac{dP_Z}{P_Z} \\ \frac{dZ}{Z} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ -\frac{s_Z}{s_X}\frac{d\lambda}{\lambda} \\ \frac{d\lambda}{\lambda} \end{bmatrix} \tag{4.1}$$

where $H_1 \equiv -\frac{p_i}{c_1\eta_1}(\eta^{\eta_1p_i}+\eta^{\eta_1P_X}+\eta^{\eta_1[(1-\lambda)\alpha]})$

$$H_2 \equiv -\frac{p_j}{c_2\eta_2}(\eta^{\eta_2p_j}+\eta^{\eta_2P_Z}+\eta^{\eta_2(\lambda\alpha)})$$

From equation group (4.1), we can solve for the effects of the demand shift away from sector X to sector Z (increase in λ) on the prices and output levels of both sectors. In subsection 4.1, firstly, we ignore all the elasticity effects ($\eta^{\eta_1p_i}$, $\eta^{\eta_1P_X}$, $\eta^{\eta_1P_Z}$, $\eta^{\eta_1[(1-\lambda)\alpha]}$, $\eta^{\eta_2p_j}$, $\eta^{\eta_2P_Z}$, $\eta^{\eta_2P_X}$, $\eta^{\eta_2(\lambda\alpha)}$), all the cross-sectional cost effects ($\eta^{c_2P_X}$, η^{c_2X}, η^{c_1Z}, $\eta^{c_1P_Z}$,) and all secondary demand effects ($\eta^{\alpha P_X}$, $\eta^{\alpha P_Z}$, $\eta^{\alpha X}$, $\eta^{\alpha Z}$) to concentrate on the "primary" effects; then the secondary demand effects are analysed. Subsection 4.2 allows the cross-sectional cost effects to examine the importance of the a well-functioning factor market by comparing the case with free factor mobility and the case without such mobility. Finally, the elasticity effects will be examined in subsection 4.3.

4.1. The primary effects and the secondary demand effects of the demand shift

First, let us examine the primary effects. Substituting $\eta^{\eta_1 P_I}$, $\eta^{\eta_1 P_X}$, $\eta^{\eta_1 P_Z}$, $\eta^{\eta_1[(1-\lambda)\alpha]}$, $\eta^{\eta_2 P_J}$, $\eta^{\eta_2 P_Z}$, $\eta^{\eta_2 P_X}$, $\eta^{\eta_2(\lambda\alpha)}$, $\eta^{c_1 Z}$, $\eta^{c_1 P_Z}$, $\eta^{c_2 X}$, $\eta^{c_2 P_X}$, $\eta^{\alpha P_X}$, $\eta^{\alpha P_Z}$, $\eta^{\alpha X}$, $\eta^{\alpha Z}$ = 0 into (4.1) and applying Crammer's Rule, we have:

$$\sigma^{P_X \lambda} = \frac{0}{s_X(1-\eta^{c_1 P_X})(1-\eta^{c_2 P_Z}+\eta^{c_2 z_J}+\eta^{c_2 Z})} = 0 \qquad (4.1.1)$$

$$\sigma^{X\lambda} = \frac{-s_Z(1-\eta^{c_1 P_X})(1-\eta^{c_2 P_Z}+\eta^{c_1 z_J}+\eta^{c_2 Z})}{s_X(1-\eta^{c_1 P_X})(1-\eta^{c_2 P_Z}+\eta^{c_2 z_J}+\eta^{c_2 Z})} = -\frac{s_Z}{s_X} \qquad (4.1.2)$$

$$\sigma^{P_Z \lambda} = \frac{(\eta^{c_2 z_J}+\eta^{c_2 Z})}{(1-\eta^{c_2 P_Z}+\eta^{c_2 z_J}+\eta^{c_2 Z})} > 0 \qquad (4.1.3)$$

$$\sigma^{Z\lambda} = \frac{(1-\eta^{c_2 P_Z})}{(1-\eta^{c_2 P_Z}+\eta^{c_2 z_J}+\eta^{c_2 Z})} \qquad (4.1.4)$$

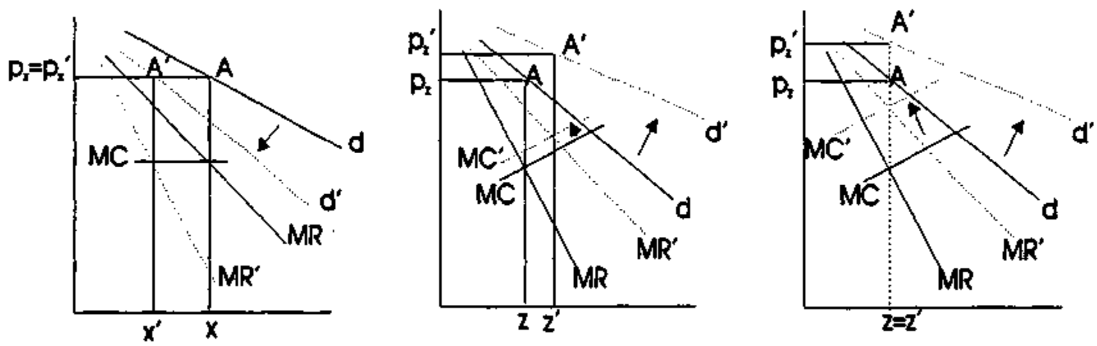
Since $d\lambda/\lambda = -(s_X/s_Z)d(1-\lambda)/(1-\lambda)$ from footnote 5, we then have:

$$\sigma^{P_X(1-\lambda)} = -\frac{s_X}{s_Z}\sigma^{P_X\lambda} = 0 \qquad (4.1.1')$$

$$\sigma^{X(1-\lambda)} = -\frac{s_X}{s_Z}\sigma^{X\lambda} = 1 \qquad (4.1.2')$$

Since the cross-sectional effects and secondary effects are ignored, the two sectors in the above analysis could be regarded as two independent sectors. Thus, as far as the primary effects are concerned, the results are the same as the results of Ng (1982). For sector X, a demand shift (away from sector X to sector Z) decreases its output equal-proportionately while its price remains unchanged. In the meantime, two cases could be identified for sector Z. Case A: $1-\eta^{c_2 P_z}>0$ when the demand shift increases both price and output of sector Z. Case B: $1-\eta^{c_2 P_z}=0$ when the demand shift increases the price of sector Z with its output unchanged. The primary effects could be illustrated in figure 4.1.1.

Figure 4.1.1: The Primary Effects



(a) (b): $\eta^{c_2 P_z}<1$ (c): $\eta^{c_2 P_z}=1$

where diagram (a) is for the representative firm in sector X[8], diagram (b) and (c) are for the representative firm in sector Z, A is the initial equilibrium, and A' is the equilibrium after the demand shift. For the representative firm in sector X, the demand shift decreases the output from x to x' with unchanged price. For the representative firm in sector Z, the demand shift

[8] In diagram (a), $\eta^{c_1 x_i}$ and $\eta^{c_1 X}$ are assumed to be zero for simplicity. It is not necessarily needed for the result. The result holds as long as $\eta^{c_1 x_i}+\eta^{c_1 X}=0$. In diagram (b) and (c), $\eta^{c_2 z_j}$ is assumed to be greater than zero. It is not necessarily needed for the results. The results hold as long as $\eta^{c_2 z_j}+\eta^{c_2 Z}=0$.

increases both output and price if $\eta^{c_2 P_Z} < 1$; it increases the price with its output unchanged if $\eta^{c_2 P_Z} = 1$.

Now adding the secondary demand effects ($\eta^{\alpha P_X}$, $\eta^{\alpha P_Z}$, $\eta^{\alpha X}$, $\eta^{\alpha Z}$), from matrix (4.1) we have:

$$\sigma^{P_X \lambda} = \frac{0}{s_X(1-\eta^{c_1 P_X})[(1-\eta^{c_2 P_Z})(1-\eta^{\alpha Z}-\eta^{\alpha X})+(\eta^{c_2 Z_j}+\eta^{c_2 Z})(1-\eta^{\alpha P_Z}-\eta^{\alpha X}]} = 0 \qquad (4.1.5)$$

$$\sigma^{X\lambda} = \frac{-(1-\eta^{c_2 P_Z})(s_Z-\eta^{\alpha Z})+(\eta^{c_2 Z}+\eta^{c_2 z_j})(s_Z-\eta^{\alpha P_Z})}{s_X[(1-\eta^{c_2 P_Z})(1-\eta^{\alpha Z}-\eta^{\alpha X})+(\eta^{c_2 z_j}+\eta^{c_2 Z})(1-\eta^{\alpha P_Z}-\eta^{\alpha X}]} < 0 \qquad (4.1.6)$$

$$\sigma^{P_Z \lambda} = \frac{(\eta^{c_2 Z}+\eta^{c_2 z_j})(s_X-\eta^{\alpha X})}{s_X[(1-\eta^{c_2 P_Z})(1-\eta^{\alpha Z}-\eta^{\alpha X})+(\eta^{c_2 z_j}+\eta^{c_2 Z})(1-\eta^{\alpha P_Z}-\eta^{\alpha X}]} > 0 \qquad (4.1.7)$$

$$\sigma^{Z\lambda} = \frac{(1-\eta^{c_2 P_Z})(s_X-\eta^{\alpha X})}{s_X[(1-\eta^{c_2 P_Z})(1-\eta^{\alpha Z}-\eta^{\alpha X})+(\eta^{c_2 z_j}+\eta^{c_2 Z})(1-\eta^{\alpha P_Z}-\eta^{\alpha X})]} \qquad (4.1.8)$$

Since $-s_X < \eta^{\alpha X}, \eta^{\alpha P_X} < s_X$, $-s_Z < \eta^{\alpha Z}, \eta^{\alpha P_Z} < s_Z$, then $\eta^{\alpha Z}+\eta^{\alpha X} < 1$, $\eta^{\alpha P_Z}+\eta^{\alpha X} < 1$. Comparing the above results with equation (4.1.1), (4.1.2), (4.1.3) and (4.1.4), we can see that adding secondary demand effects does not change the signs but affects the magnitude of the effects of the demand shift. For sector X, the demand shift (away from the sector X to the sector Z) decreases its output without changing its prices. For sector Z, there are still two cases. The price increases, and whether there is a positive response from the output depends on whether $1-\eta^{c_2 P_Z} > 0$ or $= 0$.

It is not certain whether the secondary demand effects are reinforcing or offsetting the primary effects of the demand shift; this depends on the relative strength of different secondary demand effects and the relative size of the two sectors (s_X, s_Z). For example, an increase in P_Z and Z may increase nominal aggregate demand (α) through $\eta^{\alpha Z}$ and $\eta^{\alpha P_Z}$ (suppose $\eta^{\alpha Z}$,

$\eta^{\alpha P_Z} > 0$). This increase in α may strengthen the primary effects on sector Z and offset those on the sector X; but in the meantime a decrease in X may decrease α, this decrease in α may strengthen the effects on the primary effects on sector X while offsetting those on sector Z. Only if the secondary demand effects from the increases in P_Z and Z dominate the secondary demand effect from the decrease in X, does adding secondary demand effects offset the primary negative effect on the output of sector X and reinforce the primary positive effects on the price and output of sector Z. (if $1-\eta^{c_2 P_Z} = 0$, it will neither reinforce nor offset the primary effect on the output of sector Z.)

4.2 *The importance of a well-functioning factor market*

In the preceding subsection, the cross-sectional cost effects were ignored for the purpose of analysing the primary effects and the secondary demand effects. In this subsection, the importance of a well-functioning factor market (or factor mobility) is elaborated through examining the cross-sectional cost effects. Here, the existence of a well-functioning factor market is defined as $\eta^{c_2 X} > 0$, that is, as the output of sector X decreases, the factors released can be used in sector Z and therefore lower the cost of sector Z. $\eta^{c_1 Z}$ is assumed to be zero throughout this subsection because of the excess capacity in sector X.

Firstly, suppose there is no factor mobility between the two sectors, then $\eta^{c_2 X} = 0$. From the model setting in section 1, the representative firm of each sector uses the output of another sector as its input, then it is reasonable to take $\eta^{c_1 P_Z} > 0$ and $\eta^{c_2 P_X} > 0$. Substituting these conditions into matrix (4.1) and ignoring the secondary demand effects and elasticity effects, we have

$$\sigma^{P_X\lambda} = \frac{\eta^{c_1P_Z}(\eta^{c_2z_j} + \eta^{c_2Z})}{(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z} + \eta^{c_2z_j} + \eta^{c_2Z}) - \eta^{c_1P_Z}\eta^{c_2P_X}} > 0 \qquad (4.2.1)$$

$$\sigma^{X\lambda} = \frac{-s_Z(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z} + \eta^{c_2z_j} + \eta^{c_2Z}) - s_X\eta^{c_1P_Z}(\eta^{c_2z_j} + \eta^{c_2Z}) + s_Z\eta^{c_1P_Z}\eta^{c_2P_X}}{s_X[(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z} + \eta^{c_2z_j} + \eta^{c_2Z}) - \eta^{c_1P_Z}\eta^{c_2P_X}]} < -\frac{s_Z}{s_X} \qquad (4.2.2)$$

$$\sigma^{P_Z\lambda} = \frac{(1-\eta^{c_1P_X})(\eta^{c_2z_j} + \eta^{c_2Z})}{(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z} + \eta^{c_2z_j} + \eta^{c_2Z}) - \eta^{c_2P_X}\eta^{c_1P_Z}} > 0 \qquad (4.2.3)$$

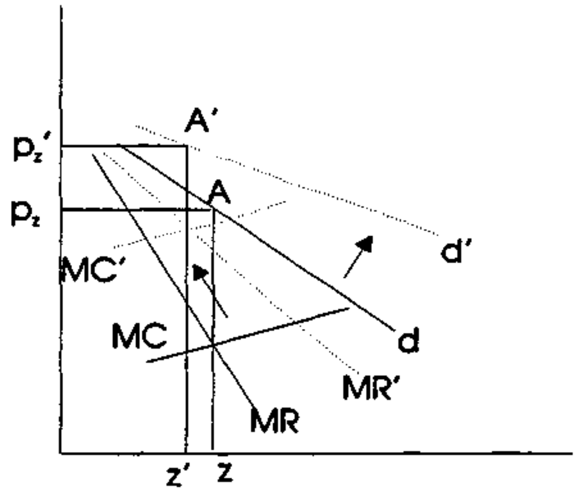
$$\sigma^{Z\lambda} = \frac{(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z}) - \eta^{c_1P_Z}\eta^{c_2P_X}}{(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z} + \eta^{c_2z_j} + \eta^{c_2Z}) - \eta^{c_1P_Z}\eta^{c_2P_X}} \qquad (4.2.4)$$

where the nominator, $(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z} + \eta^{c_2z_j} + \eta^{c_2Z}) - \eta^{c_1P_Z}\eta^{c_2P_X}$, is greater than zero for the stability of the system and for the purpose of signing comparative static effects (see Ng, 1982 for details).

Comparing the above results with the primary effects, $\sigma^{P_X\lambda}$ and $\sigma^{P_Z\lambda}$ becomes larger, $\sigma^{X\lambda}$ becomes smaller (but $|\sigma^{X\lambda}|$ becomes larger), $\sigma^{Z\lambda}$ becomes smaller[9] and is negative when $(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z}) - \eta^{c_1P_Z}\eta^{c_2P_X}$ <0. Thus, relative to the primary effects, when the effect of the price of each sector on the cost of another sector is taken into account and there is no factor mobility, the demand shift (away from sector X to sector Z) may increase the price of sector X, decrease the output of sector X more, increase the price of sector Z more, and could decrease the output of sector Z. This case for sector Z when its output level drops is illustrated in figure 4.2.1.

[9] See appendix B for mathematic details

Figure 4.2.1



where A is the initial equilibrium, and A' is the equilibrium after the demand shift. The demand shift increases the price of sector Z initially and therefore increases the price in sector X through the direct material input effect and indirect wage rate effect. The increase in the price of sector X in turn causes an upward shift of the MCC of the representative firm z and therefore further increases the price of sector Z. If the cross sectional price-on-cost effects are sufficiently great, the output level of sector Z may decrease.

If the released factor can flow freely into sector Z, then substituting in $\eta^{\rho_2 X} > 0$ and through routine calculation, we have:

$$\sigma^{P_x\lambda} = \frac{s_X\eta^{\rho_1 P_Z}(\eta^{\sigma_2 z_j}+\eta^{\rho_2 Z})-s_Z\eta^{\rho_2 X}\eta^{\rho_1 P_Z}}{s_X[(1-\eta^{\rho_1 P_X})(1-\eta^{\rho_2 P_Z}+\eta^{\sigma_2 z_j}+\eta^{\rho_2 Z})-\eta^{\rho_1 P_Z}\eta^{\rho_2 P_X}+\eta^{\rho_2 X}\eta^{\rho_1 P_Z}]} \tag{4.2.5}$$

$$\sigma^{X\lambda} = \frac{-s_Z(1-\eta^{\rho_1 P_X})(1-\eta^{\rho_2 P_Z}+\eta^{\sigma_2 z_j}+\eta^{\rho_2 Z})+s_Z\eta^{\rho_2 P_X}\eta^{\rho_1 P_Z}-s_X\eta^{\rho_1 P_Z}(\eta^{\sigma_2 z_j}+\eta^{\rho_2 Z})}{s_X[(1-\eta^{\rho_1 P_X})(1-\eta^{\rho_2 P_Z}+\eta^{\sigma_2 z_j}+\eta^{\rho_2 Z})-\eta^{\rho_1 P_Z}\eta^{\rho_2 P_X}+\eta^{\rho_2 X}\eta^{\rho_1 P_Z}]} < 0 \tag{4.2.6}$$

$$\sigma^{P_z\lambda} = \frac{(1-\eta^{\rho_1 P_X})[s_X(\eta^{\sigma_2 z_j}+\eta^{\rho_2 Z})-s_Z\eta^{\rho_2 X}]}{s_X[(1-\eta^{\rho_1 P_X})(1-\eta^{\rho_2 P_Z}+\eta^{\sigma_2 z_j}+\eta^{\rho_2 Z})-\eta^{\rho_1 P_Z}\eta^{\rho_2 P_X}+\eta^{\rho_2 X}\eta^{\rho_1 P_Z}]} \tag{4.2.7}$$

$$\sigma^{Z\lambda} = \frac{s_X[(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z})-\eta^{c_1P_Z}\eta^{c_2P_X}]+\eta^{c_2X}[s_X\eta^{c_1P_Z}+s_Z(1-\eta^{c_1P_X})]}{s_X[(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z}+\eta^{c_2Z_j}+\eta^{c_2Z})-\eta^{c_1P_Z}\eta^{c_2P_X}+\eta^{c_2X}\eta^{c_1P_Z}]} \tag{4.2.8}$$

Relative to the results without factor mobility between the two sectors (equations 4.2.1, 4.2.2, 4.2.3 and 4.2.4), $\sigma^{P_X\lambda}$ and $\sigma^{P_Z\lambda}$ becomes smaller, $\sigma^{Z\lambda}$ becomes larger and $\sigma^{X\lambda}$ becomes larger (but $|\sigma^{X\lambda}|$ become smaller)[10] . This means that, if the factors released from sector X can flow freely to sector Z, then relative to the case of no factor mobility between sectors, the price of sector X increases less, the output of sector X decreases less, the price of sector Z increases less, and the output of sector Z increases more or decreases less. All the additional effects are favourable to an economy in transition.

Summarizing subsection 1 and 2 gives the following results. For a transition economy without a well-functioning factor market and hence no free factor mobility between sectors, ignoring the elasticity effects, the shift in demand (away from sector X to sector Z) increases the prices of both sectors; decreases the output of the sector to be transformed (sector X), and may increase or decrease the output of sector Z. The output of sector Z decreases and hence the whole economy slumps if the cross-sectional cost effects from higher prices is sufficiently great $[(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z})-\eta^{c_1P_Z}\eta^{c_2P_X} < 0]$. A well-functioning factor market may add favourable effects on the economy (less inflation and more output).

4.3 *Elasticity effects*

The results presented in the previous section (the prices of both sectors increase and the outputs of both sector may decrease when there is no well-functioning factor market and the cross sectional cost effects from the prices are sufficiently large) may be quite surprising.

[10] See appendix C for the proof.

Nevertheless, all the elasticity effects were ignored in the above analysis. This subsection will show that the result will be strengthened if unfavorable elasticity effects are taken into account.

For simplicity of analysis, it is assumed that there is no free factor mobility between the two sectors ($\eta^{c_2 X}=0$), no secondary demand effects ($\eta^{\alpha P_X}, \eta^{\alpha X}, \eta^{\alpha P_Z}, \eta^{\alpha Z} = 0$), no elasticity change from the change of the total demand for each sector ($\eta^{\eta_1[(1-\lambda)\alpha]}$, $\eta^{\eta_2(\lambda\alpha)} = 0$) and no cross-sectional elasticity effect ($\eta^{\eta_1 P_Z}$, $\eta^{\eta_2 P_X} = 0$).[11]

Substituting these conditions into matrix (4.1) and applying Crammer rule, we have:

$$\sigma^{P_X\lambda} = \frac{\eta^{\eta_1 P_Z}(\eta^{c_2 Z_j} + \eta^{\eta_2 Z})}{(1-\eta^{\eta_1 P_X} + D_1)(1-\eta^{\eta_2 P_Z} + \eta^{c_2 Z_j} + \eta^{\eta_2 Z} + D_2) - \eta^{\eta_1 P_Z}\eta^{\eta_2 P_X}} \tag{4.3.1}$$

$$\sigma^{X\lambda} = \frac{-s_Z(1-\eta^{\eta_1 P_X} + D_1)(1-\eta^{\eta_2 P_Z} - D_2 + \eta^{c_2 Z_j} + \eta^{\eta_2 Z}) + s_Z\eta^{\eta_1 P_Z}\eta^{\eta_2 P_X} - s_X\eta^{\eta_1 P_Z}(\eta^{c_2 Z_j} + \eta^{\eta_2 Z})}{s_X(1-\eta^{\eta_1 P_X} + D_1)(1-\eta^{\eta_2 P_Z} + \eta^{c_2 Z_j} + \eta^{\eta_2 Z} + D_2) - \eta^{\eta_1 P_Z}\eta^{\eta_2 P_X}} < 0 \tag{4.3.2}$$

$$\sigma^{P_Z\lambda} = \frac{(1-\eta^{\eta_1 P_X} + D_1)(\eta^{c_2 Z_j} + \eta^{\eta_2 Z})}{(1-\eta^{\eta_1 P_X} + D_1)(1-\eta^{\eta_2 P_Z} + \eta^{c_2 Z_j} + \eta^{\eta_2 Z} + D_2) - \eta^{\eta_1 P_Z}\eta^{\eta_2 P_X}} \tag{4.3.3}$$

$$\sigma^{Z\lambda} = \frac{(1-\eta^{\eta_1 P_X} + D_1)(1-\eta^{\eta_2 P_Z} + D_2) - \eta^{\eta_1 P_Z}\eta^{\eta_2 P_X}}{(1-\eta^{\eta_1 P_X} + D_1)(1-\eta^{\eta_2 P_Z} + \eta^{c_2 Z_j} + \eta^{\eta_2 Z} + D_2) - \eta^{\eta_1 P_Z}\eta^{\eta_2 P_X}} \tag{4.3.4}$$

where $D_1 \equiv -\frac{p_i}{c_1\eta_1}(\eta^{\eta_1 p_i} + \eta^{\eta_1 P_X}) \equiv \eta^{\mu\eta_1}(\eta^{\eta_1 p_i} + \eta^{\eta_1 P_X})$ is the effects of the price of the representative firm in sector X and the sectoral average price on the MR through their effects on the demand elasticity of the representative firm x;

[11] All these assumptions are sufficient but not necessary.

$\mathrm{D}_2 \equiv -\dfrac{P_j}{c_2\eta_2}(\eta^{\eta_2 p_j} + \eta^{\eta_2 P_z}) \equiv \eta^{\mu_2\eta_2}(\eta^{\eta_2 P_j} + \eta^{\eta_2 P_z})$ is the effects of the price of the representative firm in sector Z and the sectoral average price on the MR through their effects on the demand elasticity of the representative firm z;

If $\mathrm{D}_2 < 0$ (i.e., the absolute value of the demand elasticity of the representative firm in sector Z decreases as its price and the sectoral average price increase) and $\mathrm{D}_1 = 0$, from equations (4.3.1), (4.3.2), (4.3.3) and (4.3.4), we have:

$$\sigma^{P_x\lambda} = \frac{\eta^{c_1P_z}(\eta^{c_2z_j} + \eta^{c_2Z})}{(1-\eta^{c_1P_x})(1-\eta^{c_2P_z} + \eta^{c_2z_j} + \eta^{c_2Z} + D_2) - \eta^{c_1P_z}\eta^{c_2P_x}} > 0 \tag{4.3.5}$$

$$\sigma^{X\lambda} = \frac{-s_Z(1-\eta^{c_2P_z} + D_2 + \eta^{c_2z_j} + \eta^{c_2Z})(1-\eta^{c_1P_x}) + s_Z\eta^{c_1P_z}\eta^{c_2P_x} - s_X\eta^{c_1P_z}(\eta^{c_2z_j} + \eta^{c_2Z})}{s_X(1-\eta^{c_1P_x})(1-\eta^{c_2P_z} + \eta^{c_2z_j} + \eta^{c_2Z} + D_2) - \eta^{c_1P_z}\eta^{c_2P_x}} < 0 \tag{4.3.6}$$

$$\sigma^{P_z\lambda} = \frac{(1-\eta^{c_1P_x})(\eta^{c_2z_j} + \eta^{c_2Z})}{(1-\eta^{c_1P_x})(1-\eta^{c_2P_z} + \eta^{c_2z_j} + \eta^{c_2Z} + D_2) - \eta^{c_1P_z}\eta^{c_2P_x}} > 0 \tag{4.3.7}$$

$$\sigma^{Z\lambda} = \frac{(1-\eta^{c_1P_x})(1-\eta^{c_2P_z} + D_2) - \eta^{c_1P_z}\eta^{c_2P_x}}{(1-\eta^{c_1P_x})(1-\eta^{c_2P_z} + \eta^{c_2z_j} + \eta^{c_2Z} + D_2) - \eta^{c_1P_z}\eta^{c_2P_x}} \tag{4.3.8}$$

where the nominator, $(1-\eta^{c_1P_x})(1-\eta^{c_2P_z} + \eta^{c_2z_j} + \eta^{c_2Z} + D_2) - \eta^{c_1P_z}\eta^{c_2P_x}$, is positive for the stability of the system and the purpose of signing the comparative static effects.

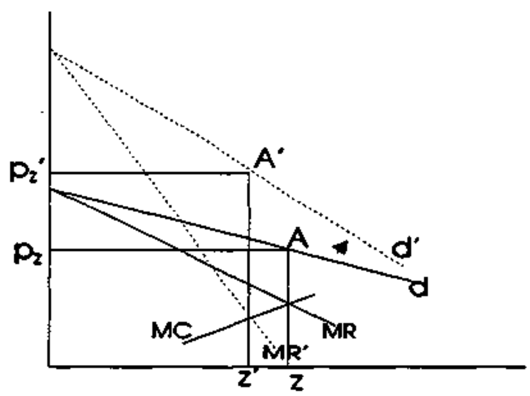
Comparing the above results with those in equations (4.2.1), (4.2.2), (4.2.3) and (4.2.4), $\sigma^{P_x\lambda}$ and $\sigma^{P_z\lambda}$ are positive and become larger; $\sigma^{X\lambda}$ is negative and becomes smaller (but $|\sigma^{X\lambda}|$ becomes larger); $\sigma^{Z\lambda}$ becomes smaller[12]. Therefore, given all other effects, if the absolute value of the demand elasticity of the representative firm in sector Z decreases as its own price and the average price in this sector increase, a demand shift (away from sector X to sector Z) causes the prices of both sectors to increase more and the output of the sector X to

[12] See appendix D for the proof.

decrease more than in the situation when there are no elasticity changes. Moreover, from equation (4.3.8), $\sigma^{Z\lambda}$ is more likely to be negative when there are unfavorable elasticity effects ($D_2<0$) than when there is no elasticity effect. Thus inflation, as well as the whole-range economic slump, is more likely to occur when there are unfavorable elasticity effects.

The case when the output level of sector Z drops can be illustrated by Figure 4.3.1, where A is the initial equilibrium. With a positive output-on-cost effect[13], the demand shift (away from sector X to sector Z) increases the price of sector Z initially. If $D_2 < 0$, the increase in price reduces the demand elasticity (in absolute terms) of the representative firm of sector Z. This justifies a further increase in price. If the elasticity effect is large enough, it will cause a reduction in output of sector Z when a new equilibrium is reached at A'.

Figure 4.3.1:



It may be argued that this situation is unlikely to prevail in most cases because the firm's demand elasticity is largely determined by the degree of product differentiation and the number of the firms, both of which are being held constant in the present analysis. The effect of the prices on the demand elasticity of the representative firm of sector Z, however, should

[13] For simplicity, $\eta^{c_2 P_Z}$, $\eta^{c_2 P_X}$ and $\eta^{c_2 Z}$ are taken as nil and $\eta^{c_2 z_j}$ is assumed to be greater than zero in the Figure.

not be ruled out completely. For example, higher price in sector Z may drive out consumers with low income levels and leave with higher income consumers who are less price-concerned, the absolute value of the demand elasticity for the representative firm of sector Z may therefore decrease. If $\eta^{e_2 P_Z}$ is close to one, then a small decrease in the absolute value of η_2 may be able to make $\sigma^{Z\lambda}$ negative.

Concerning methodology used in the section, it should be pointed out that all the assumptions adopted in the analysis are sufficient, but not necessary. The main purpose of making those assumptions is to simplify the algebra. For example, D_1 does not necessarily need to be assumed to be 0 in order to obtain the results in subsection 3. Even though $D_1 > 0$, if D_2 is negative and its absolute value is large enough, the output of sector Z may still decrease ($\sigma^{Z\lambda} < 0$). Moreover, to address the importance of a well-functioning factor market, it is not necessary to ignore the secondary demand effects and elasticity effects.

5 Conclusion Remarks

It has been shown in the previous section that lack of a well-functioning factor market and unfavourable elasticity changes may partly explain the short-term economic underperformance in Russia where demand were liberated. Because of technical reasons, it is very difficult to find data about the change of price elasticity of demand for Russia. However, it can not be denied that the income gap in Russia is becomeing greater. Greater income gap may drive low income consumers out of markets for certain goods.

Concerning the factor market, the problems in labor market and capital market have been constraining the development of an efficient factor market. In the labor market, as Layard and Richter (1995) have pointed out, housing and *propiska* (residence permit) firstly prevent the free mobility of the labor force. Under the old socialist system, housing, as well as health care and some other welfare services, was provided for by the enterprises in which workers had been working, and a *propiska* is needed to live in most major Russian cities. Secondly, workers are unwilling to leave their original working places since membership of a firm provides a source of social identity and, as inflation continues, unemployment benefits are very low in real terms. Thirdly, managers are willing to keep their redundant workers in work places. In addition to a number of financial reasons for gaining little by sacking workers (eg., high severance payments and high wage tax.), some managers do have a strong sense of obligation to their workers, either for paternalistic reasons or because in many enterprises the workers are now majority shareholders. All these may prevent the free labor mobility between sectors.

In capital market, besides the problem of the imperfect capital market itself[14] , the reasons for $\eta^{c_2,X}$ being close to zero are: first, the equipment of the contractual sector is obsolete and can hardly be reused in those expanding sectors; second, the inappropriate location of the equipment of the heavy industry caused by the cold war incurs huge transportation and removal costs to reuse it.

Due to the complexity of the problems in transitional economies, as mentioned in the introduction, this paper does not intend to be the only or even the main explanation of the prevailing economic slump, although it may be able to shed some light on it. Many other

[14] Russia started its stock market in 1992 and previously almost had no capital market in the western sense.

elements, including institutional, political, cultural, and also economic (e.g., soft budget constraint, public property right, and improper monetary policy etc.), may be relevant [15].

In addition to the transitional economy, our two-sector model with non-perfect competition may also be used to analyse other intersectoral changes in an economy.

[15] For hyperinflation, soft budget and loose monetary policy may be more relevant.

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Appendix A

The following is the derivation of equations (3.23) and (3.24).

Total differentiation of equation (3.7) gives:

$$dp_i(1+\frac{1}{\eta_1}) - \frac{p_i}{\eta_1^2}[\frac{\partial\eta_1}{\partial p_i}dp_i + \frac{\partial\eta_1}{\partial P_X}dP_X + \frac{\partial\eta_1}{\partial P_Z}dP_Z + \frac{\partial\eta_1}{\partial[(1-\lambda)\alpha]}d[(1-\lambda)\alpha]] =$$
$$\frac{\partial c_1}{\partial x_i}dx_i + \frac{\partial c_1}{\partial X}dX + \frac{\partial c_1}{\partial P_X}dP_X + \frac{\partial c_1}{\partial Z}dZ + \frac{\partial c_1}{\partial P_Z}dP_Z$$

Dividing through by $\mu_1 = c_1$ on both sides of the above equation arranging it in elasticity form, we have:

$$\frac{dp_i}{p_i} - \frac{p_i}{c_1\eta_1}[\eta^{\eta_1 p_i}\frac{dp_i}{p_i} + \eta^{\eta_1 P_X}\frac{dP_X}{P_X} + \eta^{\eta_1 P_Z}\frac{dP_Z}{P_Z} + \eta^{\eta_1[(1-\lambda)\alpha]}\frac{d[(1-\lambda)\alpha]}{(1-\lambda)\alpha}] =$$
$$\eta^{c_1 x_i}\frac{dx_i}{x_i} + \eta^{c_1 X}\frac{dX}{X} + \eta^{c_1 P_X}\frac{dP_X}{P_X} + \eta^{c_1 Z}\frac{dZ}{Z} + \eta^{c_1 P_Z}\frac{dP_Z}{P_Z}$$

Substituting equations (3.16), (3.18) and (3.20) into the above equation gives equation (3.23). Equation (3.24) could be derived similarly.

Appendix B

Relative to equations (4.1.1), (4.1.2), (4.1.3) and (4.1.4), it easy to see that, in equations (4.2.1), (4.2.2), (4.2.3) and (4.2.4), $\sigma^{P_X\lambda}$ and $\sigma^{P_Z\lambda}$ becomes larger, $\sigma^{X\lambda}$ becomes smaller (but $|\sigma^{X\lambda}|$ becomes larger); and $\sigma^{Z\lambda}$ becomes smaller iff:

$$\frac{(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z}) - \eta^{c_1P_Z}\eta^{c_2P_X}}{(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z}+\eta^{c_2z_j}+\eta^{c_2Z}) - \eta^{c_1P_Z}\eta^{c_2P_X}} <$$
$$\frac{(1-\eta^{c_2P_Z})}{(1-\eta^{c_2P_Z}+\eta^{c_2z_j}+\eta^{c_2Z})}$$

$\Leftrightarrow$ $\quad -\eta^{c_1P_Z}\eta^{c_2P_X}(1-\eta^{c_2P_Z}+\eta^{c_2z_j}+\eta^{c_2Z}) < -\eta^{c_1P_Z}\eta^{c_2P_X}(1-\eta^{c_2P_Z})$

$\Leftrightarrow$ $\quad \eta^{c_2z_j}+\eta^{c_2Z} > 0$, which is true under our assumption.

Appendix C

Relative to equations (4.2.1), (4.2.2), (4.2.3) and (4.2.4), it is easy to see that, in equations (4.2.5), (4.2.6), (4.2.7) and (4.2.8), $\sigma^{P_x\lambda}$ and $\sigma^{P_z\lambda}$ becomes smaller, and $\sigma^{X\lambda}$ becomes larger (but $|\sigma^{X\lambda}|$ becomes smaller); and $\sigma^{Z\lambda}$ becomes larger iff:

$$\frac{s_X[(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z})-\eta^{c_1P_Z}\eta^{c_2P_X}]+\eta^{c_2X}[s_X\eta^{c_1P_Z}+s_Z(1-\eta^{c_1P_X})]}{s_X[(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z}+\eta^{c_2z_j}+\eta^{c_2Z})-\eta^{c_1P_Z}\eta^{c_2P_X}+\eta^{c_2X}\eta^{c_1P_Z}]} >$$

$$\frac{(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z})-\eta^{c_1P_Z}\eta^{c_2P_X}}{(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z}+\eta^{c_2z_j}+\eta^{c_2Z})-\eta^{c_1P_Z}\eta^{c_2P_X}}$$

$$\Leftrightarrow \quad s_X\eta^{c_2X}\eta^{c_1P_Z}(\eta^{c_2z_j}+\eta^{c_2Z})+s_Z\eta^{c_2X}(1-\eta^{c_1P_X})[(1-\eta^{c_1P_X})* (1-\eta^{c_2P_Z}+\eta^{c_2z_j}+\eta^{c_2Z})-\eta^{c_1P_Z}\eta^{c_2P_X}]>0$$

which is obviously true under our assumptions[16].

Appendix D

Relative to equations (4.2.1), (4.2.2), (4.2.3) and (4.2.4), it is easy to see that, in equations (4.3.5), (4.3.6), (4.3.7) and (4.3.8), $\sigma^{P_x\lambda}$ and $\sigma^{P_z\lambda}$ are positive and become larger, $\sigma^{X\lambda}$ is negative and becomes smaller (but $|\sigma^{X\lambda}|$ becomes larger) when D_2 is negative; and $\sigma^{Z\lambda}$ becomes smaller iff:

$$\frac{(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z}+D_2)-\eta^{c_1P_Z}\eta^{c_2P_X}}{(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z}+\eta^{c_2z_j}+\eta^{c_2Z}+D_2)-\eta^{c_1P_Z}\eta^{c_2P_X}} <$$

$$\frac{(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z})-\eta^{c_1P_Z}\eta^{c_2P_X}}{(1-\eta^{c_1P_X})(1-\eta^{c_2P_Z}+\eta^{c_2z_j}+\eta^{c_2Z})-\eta^{c_1P_Z}\eta^{c_2P_X}}$$

$\Leftrightarrow$ $D_2(1-\eta^{c_1P_X})^2(\eta^{c_2z_j}+\eta^{c_2Z}) < 0$, which is true under our assumptions.

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[16] Note that $(1-\eta^{c_1P_X})*(1-\eta^{c_2P_Z}+\eta^{c_2z_j}+\eta^{c_2Z})-\eta^{c_1P_Z}\eta^{c_2P_X}$ must be greater than zero for the stability of the system (see p. 18).

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