PUBLIC SECTOR PRICING, CAPITAL MOBILITY AND NATIONAL INCOME: A TWO-SECTOR GENERAL-EQUILIBRIUM ANALYSIS

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Abstract. This paper examines the resource allocation and income effects of public-sector pricing. During the short run, raising public-sector prices leads to a worsening in public-sector efficiency, causing a decline in GNP. In the intermediate run, the policy begins to improve public-sector efficiency and, hence, increases GNP. At the outset of the transition to a steady state, the pricing policy continues to improve efficiency. Nevertheless, efficiency and GNP remain invariant across steady states in the long-run equilibrium. The implications of the pricing policy are also discussed.

1. INTRODUCTION

Public-enterprise outputs often constitute a significant portion of gross domestic product (GDP) or gross industrial output value (GIOV) in newly industrialized and less developed countries (LDCs). For instance, in spite of the economic reforms and liberalization that began 20 years ago, state-owned and collective-owned enterprises in China still accounted for 67 percent of GIOV in 1998. It is, however, well recognized that public-sector firms typically suffer from a lack of efficiency, a generally overpaid work force, and unprofitably low product prices for the products they produce. To remedy these public-sector problems, economic-reform programs have been called for and instituted to a varying extent. Basically, productivity improvement in the public sector can be achieved by increasing public-sector product prices and/or initiating job cuts in

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1 Since GDP covers only final goods and services, the ratio of public-owned enterprise output to GIOV is a more meaningful indicator.


3 The Chinese government relaxed price control over most of the daily necessities after economic reform was first instituted in 1979, and prices for most commodities are now market determined. Recently, the Hong Kong government changed its long time policy of virtually free public medical care to a policy with some charges, and changing ultimately to a policy of the user paying a substantial part of the cost. Also, according to a news article in The New York Times on April 19, 1993, the Fujimori Government in Peru restored public utility rates to profitable levels. See Devereux and Connolly (1992) for a related discussion.
the public sector. Since it is politically difficult, if not impossible, to cut public-sector employment, economic reforms have been implemented by adjusting the public-sector product prices upward to profitable levels.

The purpose of this paper is to examine the effects of economic reforms in terms of public-sector pricing on resource allocation and GNP. We derive several results for different planning horizons. In the short run, raising public-sector product prices with sectoral-specific capital may reduce GNP as a result of policy-induced inefficiency in the public sector. In the intermediate run, increasing public-sector prices with intersectoral capital mobility leads to higher GNP in a stable economy. Over the long run, a profitable pricing policy with intersectoral as well as international capital mobility does not affect efficiency and GNP. This policy may, nevertheless, improve GNP during the transitional period.

Essentially, given an overpaid work force and its associated inefficiency in the public sector, the success or failure of economic reforms depends crucially on whether profit-guided public-sector pricing policy mitigates or aggravates the existing loss from inefficiency in an economy with varying degrees of capital mobility.

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Table 1. Gross industrial output value in China, 1978–1998

<table>
<thead>
<tr>
<th>Year</th>
<th>GIOV</th>
<th>State Owned</th>
<th>Collective Owned</th>
<th>Individual Owned</th>
<th>Other Types</th>
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<td>(C)</td>
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<td>3916</td>
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<td>45730</td>
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Source: State Statistical Bureau of the People's Republic of China (1997): p. 413 and CD-ROM. All figures are quoted in 100 million Yuan, current price.

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4 The Fujimori Government in Peru slashed payrolls and eliminated tens of thousands of jobs in state-owned public utility companies. As a result, state company losses were reduced from $3 billion in 1990 to about $300 million in 1992, according to a New York Times story on April 19, 1993. Recently, in addition to restoring public utility rates to profitable levels, the Chinese government ceased to subsidize some state enterprises and to allow those with deep losses to go bankrupt. According to a Hong Kong newspaper, the Ming Pao, dated November 21, 1994, state-owned enterprises in Shanghai alone would dismiss half a million workers. ‘Stepping down from the post’, as is called in China, has become a common phenomenon in many big cities in China.


6 We follow Neary (1978) and Khan (1982) to use the mobility of capital as a measurement for time horizons.
This paper is structured as follows. In section 2, a two-sector general-equilibrium model is utilized to delineate the key features of public-sector firms in an economy. In sections 3 and 4, the effects of public-sector pricing policies are examined for the short run and the intermediate run, respectively. In section 5, we characterize the dynamics of the adjustment process of public-sector pricing and examine the equilibrium across steady states for the long run with intersectoral capital mobility, coupled with free entry and exit of public-sector firms. Section 6 offers concluding remarks.

2. THE MODEL

Consider an economy with two sectors, consisting of a public sector (X) with n firms and a private sector (Y). While firms in the public sector possess considerable market power, the private sector is nevertheless perfectly competitive. Both sectors produce goods by utilizing capital (K) and labor (L). Good Y in the private sector is produced with constant returns to scale technologies. Under perfect competition in sector Y, factor and goods prices are linked by the zero profit condition:

\[ g(w_Y, r_Y) = p_Y, \]  

where \( w_Y \) and \( r_Y \) are the wage rate and capital rental, and \( g(\cdot) \) is the unit-cost function for good Y. Choosing good Y as numéraire, \( p_Y \) can be normalized to be equal to one. Factors in the private sector are paid by their marginal productivities.

Concurrently, there are n oligopolistic firms in the public sector. The firm’s profit function is:

\[ \pi = px - c(w_X, r_X, x), \]

where \( p = p_X/p_Y \) is the relative price of good X, \( w_X \) and \( r_X \) are the wage rate and rental rate, \( x \) is the firm’s output, and \( c(\cdot) \) denotes the firm’s total cost function. The total output in sector X is simply: \( X = nx \). Workers in the public sector are paid a wage \( w_X \), which exceeds the private-sector wage. Here \( w_X \) is institutionally set above the marginal productivity of labor. The public sector thus is able to hire as many workers as the institution allows, often resulting in excess employment.

It is notable that firms in the public sector are typically plagued by inefficiency, which in the present analysis is expressed in terms of overpaying its work force. This can be modelled by positing the following intersectoral wage differential:

\[ w_X/w_Y = 1 + \mu, \]  

7 The two sector general-equilibrium model has been used extensively to study the inter-sectoral resource allocation effect of certain public policies. See, for example, the earlier work of Batra (1975).

8 The Head of the Hong Kong Monetary Authority, equivalent to the Chairman of the Federal Reserve Board in the U.S., is paid with an annual salary about ten times that of his counterpart. There are many such ‘overpaid’ examples of public sector employees.
where $\mu = (w_X/w_Y - 1)$ captures the degree of inefficiency in the public sector relative to the private sector. The limiting case in which $\mu = 0, w_X = w_Y$ implies zero inefficiency. In general, $w_X = w_Y (1 + \mu)$ with $\mu > 0$.9

Following Konishi et al. (1990) and Chao and Yu (1994), we assume that the cost function for a representative firm is of the form:

$$c(w_X, r_X, x) = m(w_X, r_X) x + f(w_X, r_X),$$

where $m(\cdot)$ and $f(\cdot)$ represent the total variable and fixed costs, respectively, and $m(\cdot)$ is the marginal cost.

Turning to the demand side momentarily, we assume, for the sake of convenience, that preferences are represented by a quasi-linear utility function, $U(X, Y) = u(X) + Y$, and $u(X) = aX - 1/2 bX^2$ with $a, b > 0$. Maximization of such a utility function yields an inverse demand function for good $X$ as: $p = a - bX$. This demand function has a useful property in that the income elasticity for demand of good $X$ is zero. Hence, the consumer surplus accruing from consuming $X$ is an exact measure of the gain to consumers.

Pricing of products by public sectors (the government) typically differs from that by private sectors. The public sector sets the price of its product according to or even below marginal cost. The rule of marginal-cost pricing is derivable simply from maximization of social welfare and this pricing policy often results in unrealistically low prices for goods produced by the public sector. Currently in LDCs, most economic reform programs call for the removal of government subsidies in the public sector and for increasing public-sector product prices to some profit yielding level. This pricing reform means a shift in pricing based on welfare maximizing toward a pricing based on profit maximizing. To capture this policy shift, the objective of each firm in the public sector, which is dictated by the objectives and interests of the state, can be modelled as a weighted average of profits and social welfare: $z\pi + (1 - z)v$, where $v = \int_0^\infty (a - bns) ds - p(X)x + \pi$ is the sum of consumer and producer surplus from a firm’s output $x$, and $0 \leq z \leq 1$. The first-order condition for maximizing this objective function with respect to $x$ is:

$$a - b(1 + z)nx = m(w_X, r_X). \tag{3}$$

Equation (3) confirms the two limiting traditional cases: Welfare maximization ($z = 0$) leads to marginal cost pricing, whereas profit maximization ($z = 1$) requires that marginal revenue be equal to marginal cost. It is clear that an increase in $z$ indicates that pricing is being guided toward the goal of profit maximization (we call it profitable pricing), yielding higher public sector prices. Here, $z$ is the key policy variable in the analysis.

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9 Sectoral wage differentials can result from a variety of imperfections other than public-sector inefficiency in the economy. See Khan (1980) and Upadhyay (1994) for discussions. This paper focuses on wage differential based upon public-sector inefficiency; $\mu$ can be influenced by public-sector management practices, promotion and career development opportunities and degree of job security in the civil service system, among other institutional factors.

The use of factors are constrained by the domestic endowments and inflows of foreign factors. Denoting the economy’s labor endowment by \( L \), full employment of labor implies:

\[
L_X + L_Y = L, \tag{4}
\]

where, by Shephard’s lemma, \( L_X = m_w(w_X, r_X)X + n_f(w_X, r_X) \) and \( L_Y = g_w(w_Y, r_Y)Y \). Although there are nominally \( L_X \) workers employed by the public sector, the effective labor force employed, denoted by \( E_X \), is of a size smaller than \( L_X \). \( E_X \) is a fraction of \( L_X \) according to the inefficiency parameter \( \mu \) in (2), that is, \( E_X = L_X / (1 + \mu) \). We may interpret \( \mu E_X \) as the level of disguised unemployment in the public sector.

Allowing international capital mobility in the longer run, we can identify for the capital market three time-dependent equilibria: short run, intermediate run and long run. Rodrik (1988) has convincingly argued that the weakness of capital markets in LDCs causes sluggish intersectoral capital movement; thus capital may be treated as sector specific in the short run. Therefore, a short-run equilibrium for capital markets requires

\[
K_X = m_r(w_X, r_X)X + n_f(w_X, r_X),
\]

\[
K_Y = g_r(w_Y, r_Y)Y, \tag{5}
\]

where \( K_X \) and \( K_Y \) are domestic capital stocks in sector \( X \) and \( Y \), which are assumed fixed in the short run.

In the intermediate run, capital becomes intersectorally mobile, and equilibrium in the capital market is reached when the rates of return on capital are equalized across sectors, \( r_X = r_Y = r \). Full employment of capital now implies:

\[
K = K_X + K_Y, \tag{6}
\]

where \( K \) is the total available capital stock which is fixed in the intermediate run.

In the present framework, capital can move internationally in the long run [Batra (1986), Neary (1988)]. If the domestic capital rate of return exceeds that of the foreign capital, available capital stock increases due to inflows of foreign capital:

\[
\dot{K} = \rho (r - r^*), \tag{7}
\]

where a dot over a variable denotes the time derivative of the variable, \( r^* \) denotes the given foreign rate of return on capital, and \( \rho' > 0 \).

Furthermore, we assume that in the long run the government, which regulates the number of firms in the short and the intermediate run, allows firms to enter or exit from sector \( X \). Firms will do so, depending on whether profits are positive or negative:

\[
\dot{n} = \varphi(\pi), \tag{8}
\]

where \( \varphi' > 0 \).

The dynamics of the two equations of motions (7) and (8) yield a steady state which is characterized by \( \dot{K} = 0 \) and \( \dot{n} = 0 \). The steady state defines a long-run equilibrium \((K^e, n^e)\) by
\[
\begin{align*}
    r(K^e, n^e, \alpha) &= r^*, \\
    \pi(K^e, n^e, \alpha) &= 0,
\end{align*}
\]
where the state variables are \( K \) and \( n \), and the policy variable is \( \alpha \). In the steady state, the international capital rental rate must prevail domestically and zero profits must hold in the public sector.

We will utilize this model to examine the short, intermediate, and long-run effects of public sector pricing policies on sectoral outputs, efficiency, and GNP. Note that GNP, consisting of profits, wages, and net capital returns, is given by
\[
GNP = n\pi + \left[w_XL_X + w_YL_Y\right] + \left[r_XK_X + r_YK_Y - r^*K^*\right] - \omega_X\mu E_X,
\]
where \( K^* \) stands for foreign capital. Profits can be either positive or negative in the public-sector firms. When negative profits occur, government collects taxes to finance the losses of firms. The social cost of inefficiency in terms of the disguised unemployment in the public sector is shown by the last term of (11).

3. THE SHORT RUN WITH SECTOR-SPECIFIC CAPITAL

The main focus of this study is the effect of profitable pricing policy on GNP by the public sector. The short run represents the limiting case in which entry of new firms into the public sector is restricted, and foreign capital is prevented from flowing into the home country. By totally differentiating the GNP equation (11) and using the factor employment conditions (4) and (5), we obtain the change in GNP in response to the profitable pricing policy as:
\[
\frac{dGNP}{d\alpha} = n\left(\frac{\partial \pi}{\partial x}\right)\left(\frac{dx}{d\alpha}\right) - w_YE_X\left(\frac{d\mu}{d\alpha}\right),
\]
where \( \partial \pi/\partial x = -(1 - \alpha)b_n x < 0 \) and \( \partial \pi/\partial n = -b x^2 < 0 \). The first term on the right-hand side of (12) is the output effect and the second term represents the efficiency effect of public-sector pricing. These two effects will be evaluated as follows.

Let a circumflex denote the percentage change in a variable. The output effect can be derived from differentiating the first-order condition for an oligopolistic firm in the public sector in (3) as
\[
-(1 + \alpha)^\xi - \beta \theta^m_K X - \hat{r}_X = \alpha \hat{\alpha},
\]
where \( \beta = m/bX \) and \( \theta^m_K X \) denotes the marginal cost share of factor \( i \) in sector \( X \). Equation (13) states that, under restricted entry with a given number of firms \( n \) in the short run, the profitable pricing by public firms lowers a firm’s output, thereby reducing public-sector demand for capital and
causing capital rentals to fall. The latter result can be seen from the change in (5) as:

$$\lambda_{kX}^m \dot{x} = s_{kX} \dot{r}_X,$$

(14)

where $\lambda_{kX}^m$ denotes the share of factor $i$ used as a variable input in sector $X$ and $s_{kX}$ is related to the elasticity of substitution between capital and labor. Equation (14) shows a positive relationship between $x$ and $r_X$ for a given $n$; a fall in $x$ leads to a decline in $r_X$.

Solving (13) and (14), we obtain a negative effect of $\dot{z}$ on $x$, that is, $\dot{x}/\dot{z} < 0$. To sustain product price above the welfare-maximizing price, public firms cut back their outputs, thereby reducing the firms’ demand for capital and causing a subsequent fall in its return, $\dot{r}_X/\dot{z} < 0$.

To determine the GNP implication in (12), we need to know the changes in $\mu$ as a result of a change in $z$. Differentiating the wage-differential equation (2) and the labor market-clearing condition (4), and then utilizing the result of the differentiation of (1) to obtain

$$q \ddot{\mu} = -\lambda_{lx}^m \dot{x} - s_{lx} \dot{r}_X,$$

(15)

where $q > 0$ (see Appendix) and $s_{lx}$ is associated with the elasticity of factor substitution between capital and labor.

Clearly, a policy shift towards profitable pricing by the public sector generates two effects on efficiency: the output effect and the factor-substitution effect. Given capital is sector-specific in the short run, an increase in $z$ leads to a reduction in the production of good $X$, and hence a cutback in the employment of workers. The laid-off workers will be absorbed by the private sector, thereby lowering the private wage. This reallocation of labor widens the pre-existing wage gap and thus results in more inefficiency in the public sector. Concomitantly, the fall in the cost of capital rental leads to a substitution of capital for labor and therefore to a further decrease in the demand for workers in sector $X$. This factor-substitution effect reinforces the output effect, rendering $\ddot{\mu}/\dot{z} > 0$ in (15).

Given that $\partial \pi/\partial x < 0$, $dx/dz < 0$ and $d\mu/dz > 0$ in (12), $d\text{GNP}/dz$ may take any sign. Thus, we can deduce:

**Proposition 1.** In the short run with restricted entry and capital immobility, if the induced inefficiency effect dominates (is outweighed by) the output effect in the public sector, then a shift in the policy towards profitable pricing by the public sector lowers (enhances) GNP.

GNP may drop as the policy leads to a higher relative public wage and hence to greater inefficiency in the public sector. It may be noted that the price effect is not explicitly modelled here. If the policy results in inflation during the transitional period, real wages in the public sector may fall. This works to

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10 The changes of (1) is: $\dot{w}_Y = -(\theta_{kY}/\theta_{lY}) \dot{r}_Y$, where $\theta_{iY}$ is the cost share of factor $i$ in sector $Y$. © 2002 Blackwell Publishers Ltd (a Blackwell Publishing Company).
mitigate the problem of overpaying public employees. If this happens, the policy would promote GNP.

4. THE INTERMEDIATE RUN WITH INTERSECTORAL CAPITAL MOBILITY

As noted earlier, capital in the intermediate run can become mobile intersectorally as a result of the removal of domestic capital market distortions, and so rentals are equalized, \( r_X = r_Y = r \). Given capital mobility, the equilibrium condition for the capital market is stated by (6). Differentiating (6) along with the labor market equilibrium condition in (4), we obtain

\[
M \frac{\dot{x}}{C} = (h \lambda_{KY} + k \lambda_{LY}) \dot{r} = 0,
\]

where \( h > 0 \) and \( k > 0 \) (see Appendix), and \( M \) represents the marginal capital intensity of sector \( X \) relative to sector \( Y \). \(^{11}\) A sufficient condition of stability for the model, shown in the Appendix, requires that \( M > 0 \).

Solving (13) and (16) yields: \( \frac{\dot{x}}{\dot{z}} < 0 \) and \( \frac{\dot{r}}{\dot{z}} < 0 \). Hence, under the stability conditions, a public-sector price increase results in a lowering of a firm's output. In addition, an increase in \( z \) has the effect of depressing capital rental. These intermediate-run results resemble those in the case of the short run.

Since capital in addition to labor is intersectorally mobile in the intermediate run, capital released as a result of production cutbacks in the public sector will be absorbed by the private sector. Since the private sector is assumed to be labor intensive relative to the public sector for the stability condition, the private-sector wage increases. Given an institutionally set public-sector wage, the policy of increasing public sector prices leads to a narrowing of the intersectoral wage gap and hence to a reduction in inefficiency. Coupled with a positive profit effect, the public-sector profitable pricing results in an increase in GNP in the intermediate run.

The foregoing analysis of the GNP effects of an increase in \( z \) can be summarized in the following proposition:

**Proposition 2.** In the intermediate run with intersectoral capital mobility, a switch to a profit-maximizing pricing in the public sector leads to a higher GNP under a stable economy.

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5. LONG-RUN EQUILIBRIUM AND DYNAMICS WITH FREE ENTRY AND INTERNATIONAL CAPITAL MOBILITY

In previous sections we assume the capital stock in the home economy and the number of firms in the public sector are fixed by government policy in the short and intermediate run. However, in the long run capital can move internationally due to liberalization and implementation of the WTO stated objectives,\(^{12}\) and

\(^{11}\) The concept of marginal-factor intensity originates with Jones (1968) and is utilized by Choi and Yu (1987) and Chao and Takayama (1990).

\(^{12}\) For example, China has permitted and welcomed foreign investment of various kinds since adopting an open-door policy in late 1970. Foreign investment before late 1970 was virtually non-existent in China.
firms are free to enter or exit from sector X as a measure to promote competition among public-sector firms and between the public and private sectors. This policy has been recently adopted by China, for example, to overhaul its massive inefficient state-owned enterprises. These free movement and adjustment conditions for capital and firms are expressed in (7) and (8), and the long-run equilibrium is characterized by \( r = r^* \) and \( \pi = 0 \) in (9) and (10).

The dynamics of capital movement and entry/exit of firms around the steady state can be approximated as:

\[
\begin{align*}
\dot{K} &= \rho' (\partial r / \partial K)(K - K^c) + \rho' (\partial r / \partial n)(n - n^c), \\
\dot{n} &= \phi' (\partial \pi / \partial K)(K - K^c) + \phi' (\partial \pi / \partial n)(n - n^c),
\end{align*}
\]

where \( \partial r / \partial K < 0, \partial r / \partial n > 0, \partial \pi / \partial K > 0 \) and \( \partial \pi / \partial n < 0 \) by the stability conditions, which are the negative trace and positive determinant of the system (see Appendix). Figure 1 graphically describes the dynamics of capital.
mobility and entry/exit of firms. The $K = 0$ and $n = 0$ loci represent the combinations of $K$ and $n$ which satisfy (17) and (18). The slopes of these two schedules are:

$$dK/dn|_K = -(\partial r/\partial n)/(\partial r/\partial K) > 0,$$

(19)

$$dK/dn|_n = -(\partial \pi/\partial n)/(\partial \pi/\partial K) > 0,$$

(20)

which are upward-sloping and, by the stability conditions, the schedule of $n = 0$ is steeper than the schedule of $K = 0$. Consequently, the long-run equilibrium at point $e$ in figure 1 is a stable node, in which any point off the equilibrium will converge to point $e$.

In the long run, the government in fact adopts two policies: pro-competition and profitable pricing; both policies are major elements of an economic reform package aimed at promoting efficiency and hence national welfare. It should be pointed out that the government is not interested in making profit per se, and thus profitable pricing viewed as a measure to achieve efficiency is not inconsistent with the pro-competition policy adopted in the long run. Let us now consider the effects of public-sector’s adoption of profitable pricing policy across steady states. The pricing policy will cause a rightward shift in both the schedules $K = 0$ and $n = 0$, as shown by:

$$\partial K/\partial \alpha|_K = -(\partial r/\partial \alpha)/(\partial r/\partial K) < 0,$$

(21)

$$\partial K/\partial \alpha|_n = -(\partial \pi/\partial \alpha)/(\partial \pi/\partial K) < 0,$$

(22)

where $\partial r/\partial \alpha < 0, \partial \pi/\partial \alpha > 0$ and $K$ is measured on the vertical axis in the diagrams. Figures 2 and 3 illustrate the key results: While profitable pricing promotes entry of new firms into the public sector, the effect of the policy on aggregate capital is, however, ambiguous. These results can be explicitly obtained by solving (13) and (16), along with the change of the public-sector zero-profit condition, $p_x = c(w_X, r, x)$, as

$$\hat{n}/\hat{\alpha} = (1 - \alpha)/(1 + \alpha) > 0,$$

(23)

$$\hat{K}/\hat{\alpha} = (A/\lambda_{LY})(\hat{n}/\hat{\alpha}) + (M/\lambda_{LY})(\hat{x}/\hat{\alpha}) \geq 0.$$ 

(24)

$$\hat{x}/\hat{\alpha} = -1/(1 + \alpha) < 0,$$

(25)

where $A$ denotes the average capital intensity of sector $X$ relative to sector $Y$, and $A > 0$ by the stability condition.

Equation (24) confirms that the effect of a profitable pricing policy on capital is ambiguous, depending on the relative strength of the entry effect

13 The changes in the zero profit condition is: $(1 - \alpha)\hat{x} + \hat{n} + \beta(\theta_{KX}^m + \delta \theta_{KX}^f)\hat{r} = 0$, where $\delta = f/mx$. 

and the output effect. In figures 2 and 3, the output of public-sector firms falls, and the firms release capital, as indicated by a downward movement of the curve of $\dot{K} = 0$. On the other hand, higher public-sector product prices lure new firms to enter, and this generates additional demand for capital, as shown by a rightward shift of the curve of $\dot{n} = 0$. As a result, the amount of aggregate capital available in the home economy at equilibrium may rise or fall depending on the relative magnitude of the two effects (as denoted by the relative shifts of the two schedules). In figure 2 where the entry effect is smaller than the output effect, the use of capital decreases in the long run; however where the entry effect exceeds the output effect in figure 3, the use of capital increases in the long run.

Finally, we turn to the effect of profitable pricing on GNP across steady states. It is interesting to note that since the home economy is small in the international capital market, $r$ is fixed by $r^*$ across steady states; so $w_Y$ is fixed in (1) and $\mu$ is fixed by (2). The pricing policy cannot further reduce inefficiency.

Figure 2. A fall in capital
in public firms across steady states. Hence, by (12), the effect of profitable pricing on GNP is:

\[
\frac{d\text{GNP}}{dx} = n(\partial\pi/\partial x)(dx/dx) + [\pi + n(\partial\pi/\partial n)](dn/dx).
\]  

That is, the income effect depends on the output effect and the entry effect. The entry effect is composed of profits earned by new entrants and the change in profits earned by existing firms in the public sector.\(^{14}\)

Substituting (23) and (25) into (26), we obtain a crisp result: \(\frac{d\text{GNP}}{dx} = 0\). The profitable pricing policy has no effect on GNP across the steady states. However, the policy does affect GNP during the transition leading to a long-run equilibrium. This can be explained intuitively. Referring to figures 2 and 3, the arrows denote the path of transition, during which a policy-induced cutback in public sector output at the outset leads to a decreased demand for capital and thus a fall in the capital rental.

\(^{14}\) By using (3) and \(\delta\pi/\delta n = -bx^2\), we obtain that \(\pi + n(\delta\pi/\delta n) = ax - 2bnx^2 - mx - f \leq ax - (1 + a)bnx^2 - mx - f \equiv -f\).
rate. Given the zero-profit condition for the private sector in (1), the lowered capital rental rate means a higher private sector wage, thereby narrowing the intersectoral wage differential and hence reducing public sector inefficiency. Consequently, GNP improves during the initial period of transition. Later on, the policy-induced entry of new firms leads to a higher capital rental rate and thus lower private sector wages. The widening of intersectoral wage differential and the resulting loss of efficiency in the later period completely offsets the earlier efficiency gain in the steady-state long-run equilibrium.

We have deduced the following proposition:

**Proposition 3.** A profitable pricing policy does not affect efficiency and GNP across long-run steady states; nevertheless, the policy may improve GNP during a period of transition.

### 6. CONCLUDING REMARKS

By way of summary, we delineate in figure 4 complete profiles of the effects of public-sector profitable pricing on GNP, efficiency and rate of returns on capital for the short run, the intermediate run, the long-run transition, and the steady state. During the short run with capital immobility, increasing public-sector product prices leads to a fall in the capital rental rate, a worsening in public-sector efficiency and an initial decline in GNP followed by rebounds.

In the intermediate run with intersectoral capital mobility, raising public-sector product prices will lead to a further fall in the capital rental rate, but an improvement in public-sector efficiency and a continued increase in GNP. Over the long run with international capital mobility, a public-sector profitable pricing policy will result in an initial reduction in the capital rental rate and an improvement in public-sector efficiency followed by a reversed shift in both variables. During the long run, GNP will increase initially followed by a downward shift adjustment. Nevertheless, the capital rental rate, public-sector efficiency and GNP will remain unvarying across steady states in the long-run equilibrium.

The long-run results in this paper indicate an important policy implication, that is, economic reform only in terms of profitable pricing by the public sector (as done by many developing and/or socialist countries in recent years) is inadequate for improving overall efficiency and promoting GNP. Economic reform that deals with the problem of excessive employment in the public sector should be instituted to fundamentally eliminate public-sector inefficiency. In this connection, the decision by China’s National People’s Congress in March 1998 to implement a large-scale consolidation and to downsize employment in public agencies and state-owned enterprises in the next five years appears to be a move in the right direction.
Figure 4. Time path of selected variables

REFERENCES


APPENDIX

A.1. The short-run results

From (13) and (14), the comparative statics under sectoral specificity of capital are

\[
\frac{\dot{x}}{\dot{x}} = -\alpha s_{KX}/D < 0,
\]

\[
\frac{\dot{r}_X}{\dot{r}_X} = -\alpha \theta_{KX}^m/D < 0,
\]

where \(\lambda_{KX}^m = m_r X/K_X, s_{KX} = (Xm_{rw} w_X + nf_{rw} w_X)/K_X\) and \(D = s_{KX}(1 + \alpha) + \beta^m_{KX} \theta_{KX}^m\) with \(\theta_{KX}^m = m_r r_X/m\). Note that \(\lambda_{LX}^m = m_w X/L, s_{LX} = (Xm_{w} r_X + nf_{w} r_X)/L\), and \(q = \mu/(1 + \mu)(\lambda_{LY} s_{KY} + s_{LY})/\theta_{KY}\) in (15).

A.2. The intermediate-run results

In the intermediate run, capital is mobile between sectors. Totally differentiating (6) yields
\[ \dot{\lambda}_{KX}^m \ddot{x} + \dot{\lambda}_{KY} \dot{y} - k \ddot{r} = 0, \]

where \( \dot{\lambda}_{KY} = K/y \), \( \dot{\lambda}_{KX}^m = m_x/X \), and \( k = (s_{KX} + s_{KY}/\theta_{LY}) \) with \( s_{KX} = (Xm_{rw}w_x + nF_{rw}w_x)/K \) and \( s_{KY} = Y_{gr}w_y/K \). The linkage between \( x \) and \( Y \) can be derived from the labor market condition in (4) and by utilizing the changes in (1) and (3) as

\[ \dot{\lambda}_{LX}^m \ddot{x} + \dot{\lambda}_{LY} \dot{y} + h \ddot{r} = 0, \]

where \( h = s_{LX} + s_{LY}/\theta_{LY} > 0. \)

From the above two equations, we can solve for the comparative statics results under intersectoral mobility of capital as

\[ \dot{x}/\dot{z} = z(h\theta_{KX}^m + k\lambda_{LY})/\Delta < 0, \]

\[ \dot{r}/\dot{z} = zM/\Delta < 0, \]

where \( M = \dot{\lambda}_{KX}^m \lambda_{LY} - \dot{\lambda}_{KY} \dot{\lambda}_{LX}^m \) and \( \Delta = -(1 + z)(h\lambda_{KY} + k\lambda_{LY}) - \beta\theta_{KX}^m M. \)

Note that as shown below the stability conditions of the system require that \( M > 0. \)

The change in inefficiency is

\[ \dot{\mu}/\dot{z} = (\theta_{KY}/\theta_{LY})(\dot{r}/\dot{z}) < 0. \]

A.3. The long-run results

A.3.1. Dynamics

By taking into consideration changes in \( n \) and \( K \) in the long run, we totally differentiate (3), (4) and (6) and combine the results to obtain:

\[-(1 + z)\ddot{x} - \beta\theta_{KX}^m \ddot{r}_X = z\ddot{z} + (1 + z)\ddot{n}, \]

\[ M\ddot{x} - (h\lambda_{KY} + k\lambda_{LY})\ddot{r} = -A\ddot{n} + \dot{\lambda}_{LY} \dot{K}, \]

where \( A = \lambda_{KY} \lambda_{LY} - \lambda_{KY} \lambda_{LX} \), denoting the average factor-intensity condition. From these two equations, we obtain:

\[ \ddot{r}/\dot{K} = (1 + z)\lambda_{LY}/\Delta, \]

\[ \ddot{r}/\dot{n} = -(1 + z)F/\Delta, \]

where \( F = \lambda_{KX}^l \lambda_{LY} - \lambda_{LX}^l \lambda_{KY}. \)

The stability conditions of the system in (17) and (18) require

trace = \( \rho'((\partial r/\partial K) + \varphi'((\partial \pi/\partial n)) < 0, \)

determinant = \( \rho' \varphi'[(\partial r/\partial K)(\partial \pi/\partial n) - (\partial r/\partial n)(\partial \pi/\partial K)] > 0, \)

where the partial derivatives of \( \pi \) with respect to \( K \) and \( n \) are:

\[
\frac{\partial \pi}{\partial K} = -(bnx^2/K)[\alpha \beta \lambda_{LY} \theta^m_{KX}/\Delta + \delta \beta \theta^f_{KX}(r/\hat{K})],
\]

\[
\frac{\partial \pi}{\partial n} = bx^2\{x(\hat{x}/\hat{n}) + \beta \theta^m_{KX}[x + \delta(1 + z)]F/\Delta\}.
\]

Hence, to assure \( \frac{\partial r}{\partial K} < 0, \frac{\partial r}{\partial n} > 0, \frac{\partial \pi}{\partial K} > 0 \) and \( \frac{\partial \pi}{\partial n} < 0 \), a sufficient condition for stability is that \( A > 0, M > 0 \) and \( F > 0 \).

Note that the partial derivative of \( \pi \) with respect to \( \alpha \) in (22) is

\[
\frac{\partial \pi}{\partial \alpha} = -(bnx^2/\alpha)[(1 - \alpha)(\hat{x}/\hat{z}) + \beta(\theta^m_{KX} + \delta \theta^f_{KX})(\hat{r}/\hat{\alpha})] > 0,
\]

by the stability conditions.

A.3.2. Equilibrium

Since \( r \) is fixed to \( r^* \) across steady states, the changes in (3), (4) and (5), and the zero-profit condition, \( p = c(w_X, r, x) \), are:

\[-(1 + \alpha)\dot{x} - (1 + \alpha)\dot{n} = \alpha \dot{z},\]

\[M\dot{x} + A\dot{n} - \lambda_{LY}\dot{K} = 0,\]

\[(1 - \alpha)\dot{x} + \dot{n} = 0.\]

Solving them yields the results in (23)–(25).