Development Strategy and Economic Institutions in Less Developed Countries*

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(Still Preliminary, Comments Welcome)

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Abstract

In this paper, we construct a three-sector model to explore the politically determined development objectives and the intrinsic logic of government intervention policies in less developed countries (LDCs). We argue that the distorted institutional arrangements in the socialist countries, including China, and many other LDCs after the World War II can be largely explained by their governments’ adoption of an inappropriate development strategy. Motivated by nation building, most developing countries, both socialist and non-socialist, adopted a comparative advantage-defying (CAD) strategy to accelerate the growth of capital-intensive, advanced sectors in their countries. Many firms in the priority sectors of CAD strategy were nonviable in open, competitive markets because the priority sectors went against their economies’ comparative advantages. The model shows that the government’s interventions, including distorted prices for products and essential factors of production, highly centralized planned resource allocation system and a micro-management mechanism in which firms were deprived of autonomy, are endogenous to the needs of maximizing resource mobilization for building up the priority sectors and of supporting non-viable firms in those sectors. Ignoring the endogenous nature of those distortions and interventions, the shock therapy or the Washington Consensus that attempts to carry out price liberalization, privatization, and elimination of other government interventions simultaneously would cause the economy to fall from a second-best to a third-best situation. A dual-track approach that allows the entry to the formerly suppressed sector while gradually removing the distortions is desirable.

Keywords: Factor Endowment, Development Strategy, Regulation, Institution, Trinity System

JEL Classification: H21, L25, L33, L5, O2, P3.
3. The Basic Model

3.1 Model Setup

Our analysis is based upon a simple three sector model of a dual economy. We consider a small LDC that trades three final goods, i.e., rural goods, labor-intensive industrial goods, and capital-intensive goods at exogenously given world prices. The exogenously given world prices (shadow prices) for rural goods, labor-intensive industrial goods, and capital-intensive goods are $p_r$, $p_l$, and $p_c$ respectively. We assume that rural goods and labor-intensive goods can only be used for consumption, while capital-intensive goods can only be used for investment.\(^1\) And the consumption goods are assumed to be normal.

In rural sector, natural resource (rural land) and rural labor are combined to produce rural output. The rural production function which exhibits constant returns to scale is as follows:

$$Y_a = F(T, H)$$

The variable $Y_a$, $T$, and $H$ refer to rural output produced, total natural resource which is owned within rural sector, and total labor employed in rural sector $a$. As in Sah and Stiglitz (1984), the role of incentives in the rural sector is also emphasized in our model.\(^2\) We assume rural sector’s population to be $N^1$, thus $H^1 / N^1 \equiv h^1$ denotes the hours worked by each rural worker and $T / N^1 \equiv t$ denote natural resource per rural worker. We denote a rural worker’s consumption of the rural and labor-intensive industrial goods to be $(c^1_a, c^1_l)$. The surplus of the rural good per rural worker, $S$, is given by $S = F(t, h^1) - c^1_a$. The utility function and budget constraint of a rural worker is represented by $U^1 = U(c^1_a, c^1_l, h^1)$ and $p_a S \geq p_l c^1_l$ respectively.

The urban population is $N^2$, and an urban worker supplies $h^2$ hours of work inelastically. We normalize $h^2 = 1$ for simplicity, thus, the total urban labor supply in this LDC is equal to urban population $H^2 \equiv N^2$. We denote an urban worker’s consumption of the rural and labor-intensive industrial goods to be $(c^2_a, c^2_l)$. The utility function and budget constraint of an urban worker is given by $U^2 = U(c^2_a, c^2_l)$ and $p_a c^2_a + p_l c^2_l = w$ respectively, where $w$ is the wage per hour.

Capital and urban labor are combined to produce industrial output both in labor-intensive

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\(^{1}\) We ignore the possibility of labor-intensive industrial being used for consumption and investment to avoid undue complexity. But the model in this paper could be easily expanded to include this possibility.

\(^{2}\) Lin (1990) emphasizes the role of incentives in the rural sector owing to the difficulty in supervising rural work.
sector and capital-intensive sector. The total capital stock in the LDC is \( K \), and \( k \equiv K / H^2 \) is capital stock per urban worker.

The production functions for labor-intensive sector \( l \) is as follows:

\[
Y_l = A_l K_l^\beta H_l^{1-\beta}
\]  

(1)

Production of capital-intensive output requires \( (1 - \delta) \Gamma \) units of capital-intensive goods as fixed input firstly,\(^3\) where \( \delta \in (0,1) \), and then allows variable input, i.e., capital and urban labor to produce final output according to following production function:

\[
Y_c = A_c K_c^\alpha H_c^{1-\alpha}
\]  

(2)

Here the subscript \( l \) denotes labor-intensive sector, and \( c \) denotes capital-intensive sector. Because sector \( c \) is more capital intensive than sector \( l \), we have \( \alpha > \beta \). The variable \( A_j \), \( Y_j \), \( K_j \), and \( H_j \) refer to total factor productivity, output produced, capital, and urban labor employed in sector \( j = l, c \). For analytical convenience, we assume that firm operating in each sector is competitive, i.e., the firm in sector \( c \) and sector \( l \) are price takers, and we also assume that there is at most one firm (if this firm is viable) in each sector.\(^4\) Like in Shleifer and Vishny (1994), we assume that \( \sigma_j \) of the firm \( j = l, c \) is owned by the manager \( m_j \), and \( 1 - \sigma_j \) is owned by the Treasury that is assumed to be passive.\(^5\) We do not distinguish between the manager and the shareholders of the firm, and we assume that the manager servers the interests of shareholders for simplicity.

The utility function of the manager \( m_l \) is given by

\[
U_{m_l} = \sigma_l (p_c A_c K_c^\alpha H_c^{1-\alpha} - rK_c - wH_c)
\]

The utility function of the manager \( m_c \) is given by

\[
U_{m_c} = \sigma_c \left( \left[ (1 - \delta) \Gamma - rK_c - wH_c \right] - (1 - \sigma_c) \Gamma \right)
\]

3.2 Competitive Equilibrium without Government’s intervention

Throughout this paper, we consider a LDC whose capital stock per urban worker equals to

\(^3\) Lin, Cai and Li (2003) summarizes that for a LDC, heavy industry has three basic characteristics: (1) a long construction cycle, (2) the need to import most equipment, and (3) a very large scale of initial investment. We introduce fixed input \( (1 - \delta) \Gamma \) in the process of producing capital-intensive goods to reflect these basic characteristics.

\(^4\) A normally managed firm is viable if this firm earns a socially acceptable expected profit without external subsidies or protections. Please see the definition of viability in Lin and Tan (1999) and Lin (2003) for details.

\(^5\) In a state-owned firm, \( \sigma_j \) is close to zero, whereas in a private firm, \( \sigma_j \) is close to one.
\[ \delta k, \text{ where } \delta \in (0,1) \text{ and } k = \left[ \frac{p_c A_k}{p_l A_l} \left( \frac{1-\alpha}{1-\beta} \right)^{1-a} \left( \frac{\alpha}{\beta} \right)^{\beta-a} \right]^{1/a}. \]

Given rural population \( N^1 \), urban population \( N^2 = H^2 \), natural resource per rural worker \( t \), hours of work supplied by urban worker \( h^2 = 1 \), total capital stock \( K \), and the exogenous world prices (shadow prices) for rural goods \( p_a \), labor-intensive goods \( p_l \), and capital-intensive goods \( p_c \), a competitive equilibrium without government’s intervention consists of combination of firm allocations, \{\( K_1, L_1, Y_1, K_c, H_c, Y_c \)\}, rural worker allocations, \{\( c^1_a, c^1_l, h^1 \)\}, urban worker allocations \{\( c^2_c, c^2_l \)\}, net exports of rural goods, labor-intensive goods and capital-intensive goods \( \{E_a, E_l, E_c\} \), a (nominal) wage rate \( w \) for urban labor, a (nominal) rental rate \( r \) for capital, such that the following conditions are satisfied:

1. Given output prices and factor prices \( \{p_l, p_c, w, r\} \), the firm allocation solves the following profit maximization problem:

\[
\max_{k, l, c} \{p_j Y_j - rK_j - wH_j\} \quad j = l, c
\]

subject to the production function (1) and (2).

2. Given the output prices and wage rate for urban worker \( \{p_a, p_l, w\} \), rural worker allocations maximize \( U^1 = U(c^1_a, c^1_l, h^1) \) subject to \( p_a S \geq p_l c^1_l \), and urban worker allocations maximize \( U^2 = U(c^2_a, c^2_l) \) subject to \( p_a c^2_a + p_l c^2_l \leq wh^2 \).

3. Markets clear:

\[ K_l + K_c = K \]
\[ H_l + H_c = H^2 \]
\[ N^1 S = N^2 c^2_a + E_a \]
\[ Y_l = N^1 c^1_l + N^2 c^2_l + E_l \]
\[ I = \begin{cases} -E_c + Y_c - \Gamma, & \text{if } Y_c - \Gamma > 0 \\ -E_c & \text{if } Y_c - \Gamma \leq 0 \end{cases} \]

4. Trade balance:

\[ 6 \text{ In our model, the extent of the scarcity in capital endowment in the LDC is an increasing function of } \delta. \]
Given output price, factor prices and outputs produced \(\{p_l, p_c, w, r, q_l, q_c\}\), the cost function of labor-intensive firm is

\[
\phi_l(q_l) = \frac{q_l}{A_l} \left( \frac{w}{1-\beta} \right)^{1-\beta} \left( \frac{r}{\beta} \right)^\beta,
\]

and the variable cost function of capital-intensive firm is

\[
\phi_c(q_c) = \frac{q_c}{A_c} \left( \frac{w}{1-\alpha} \right)^{1-\alpha} \left( \frac{r}{\alpha} \right)^\alpha,
\]

where \(q_l\) and \(q_c\) is the quantity produced by labor-intensive firm and capital-intensive firm respectively. Summarizing the analysis above, we have the following proposition.

**PROPOSITION 1:** For a LDC whose capital stock per urban worker equals to \(k = \delta k\), the capital-intensive firm will incur a loss if it is employed because \(\phi_c(q_c) + (1-\delta)\Gamma p_c > p_c q_c\), thus, only the labor-intensive production process is employed.

**PROOF:** Given output prices \(\{p_l, p_c\}\), the diversification cone of production function

\[
Y_l = A_l K_l^{1-\beta} H_l^{\beta-1} \quad \text{and} \quad Y_c = A_c K_c^{1-\alpha} H_c^{\alpha-1}
\]

where \(k = \delta k\) is \([k, \tilde{k}]\), where \(\tilde{k} = \left[ \frac{p_c A_c (1-\alpha)}{p_l A_l (1-\beta)} \left( \frac{\alpha}{\beta} \right)^{\alpha-\beta} \right]^{1-\beta-\alpha}\).

The capital-intensive production process would not be employed in a LDC whose capital stock per urban worker equals to \(k = \delta k\) even without fixed costs \((1-\delta)\Gamma p_c\). Thus, only the labor-intensive production process is employed in this LDC.

From proposition 1, we know the equilibrium (real) wage and rental rate of capital (labor-intensive industrial as numeriare) in the LDC are

\[
\frac{r^*}{p_l} = A_l \beta k^{\beta-1},
\]

\[
\frac{w^*}{p_l} = A_l (1-\beta) k^\beta
\]

The utility of the manager \(m_l\) is \(U_{m_l} = 0\), and the utility of the manager \(m_t\) is \(U_{m_t} = 0\).

The indirect utility function of the rural worker is obtained from

\[
V^1 \left( \frac{p_x}{p_t}, T \right) = \max_{c^1, c^1_t, \bar{h}} U(c^1, c^1_t, \bar{h}) + \lambda^1 \left[ \frac{p_x T}{p_t} \left( F_N^{1-\beta}, \bar{h} \right) - c^1_x \right] - c^1_t
\]

\[\text{We may say a firm is nonviable when it incurs net loss in this paper.}\]
where $\lambda^1$ is the rural worker’s positive marginal utility of income. From the envelope, we have

$$\frac{\partial V^1}{\partial \left(\frac{p_a}{p_l}\right)} = \lambda^1 S > 0$$

which means that the rural worker’s utility is an increasing function of rural product price $p_a$ and a decreasing function of labor-intensive product price $p_l$. We assume there is a threshold value $p_{al}$ for the relative price of rural product to labor-intensive product $\frac{p_a}{p_l}$ such that

$$V^1\left(p_{al}, T\right) = \bar{V}^1,$$

where $\bar{V}^1$ is the subsistence level for rural worker.

The indirect utility function of the urban worker is obtained from

$$V^2\left(\frac{p_a}{p_l}, \frac{w}{p_l}\right) = \max_{c_a, c_l} U(c_a^2, c_l^2) + \lambda^2 \left[ \frac{w}{p_l} \left( \frac{p_a}{p_l} - c_a^2 - c_l^2 \right) \right]$$

where $\lambda^2$ is the urban worker’s positive marginal utility of income. From the envelope theorem, we have

$$\frac{\partial V^2}{\partial \left(\frac{w}{p_l}\right)} = \lambda^2 > 0$$

and

$$\frac{\partial V^2}{\partial \left(\frac{p_a}{p_l}\right)} = -\lambda^2 c_a^2 < 0,$$

which means that the urban worker’s utility is an increasing function of the real wage rate $\frac{w}{p_l}$ and a decreasing function of the relative price of rural product to labor-intensive product $\frac{p_a}{p_l}$. We also assume there exists a threshold value $w_i$ for the real wage rate $\frac{w}{p_l}$ (labor-intensive good as numeraire) for $p_{al}$ such that

$$V^2\left(p_{al}, w_i\right) = \bar{V}^2,$$

where $\bar{V}^2$ is the subsistence level for urban worker.

The additive Bergson-Samuelson social welfare function is given by

$$\psi = N^1 W^1 \left[ V^1 \left( \frac{p_a}{p_l}, T\right) \right] + N^2 W^2 \left[ V^2 \left( \frac{p_a}{p_l}, \frac{w}{p_l}\right) \right]$$

where $W^i(.)$ is a concave and increasing function of $V^i(.)$, $i = 1, 2$. 


The investment equation of this LDC is

\[
I = \frac{1}{p_c} \left[ p_a (N^1 F(t, h^1) - N^1 c_a - H^2 c_a^2) + p_l (A I H^2 k^d - N^1 c_l^1 - H^2 c_l^2) \right]
\]

4. The Trinity of the Traditional Economic System

From the analysis in section 3, given that resources are allocated by the market mechanism, we can see producers will decide what to produce according to market prices of outputs and factors, thus, they would not produce capital-intensive goods in the LDC whose capital stock per urban worker equals to \( k \equiv \delta k \). If resources had been allocated by the market mechanism, capital would not have flowed to capital-intensive heavy industry sector. Rather, industrialization featuring light industry would have occurred, which would have been contradictory to the goal of implementing the Catch-Up strategy (heavy-industry-oriented development strategy) in this LDC. Thus, without a cluster of intervention policies being enforced, the government in the LDC could not successfully enforce the Catch-Up strategy. Now we analyze how these intervention policies are generated by the governments’ adopting Catch-Up strategy. For this, we need define the utility function of the government (politician) in the LDC. Suppose that the government in the LDC benefits from adopting Catch-Up strategy, i.e., the government in the LDC could gain utility \( B(q_e) \) from output of the capital-intensive sector \( q_e \) produced in the LDC itself. We assume the utility function of the government in the LDC is given by

\[
U_g = \psi + \rho I + B(q_e)
\]

where \( I \) is the investment in the LDC, \( \rho \) denotes the marginal social value of the investment, and \( \psi \) is given by (6).^{8}

4.1 Output Price Distortion

In order to set up heavy industrial projects, the government in the LDC could rely on collecting taxes from the rural sector and labor-intensive sector to subside capital-intensive sector. We denote the tax rate in rural sector and labor-intensive sector to be \( \tau_a \) and \( \tau_l \) respectively, and the subsidy rate in capital-intensive sector to be \( \tau_c \). Now the prices faced by rural sector, labor-intensive sector, and capital-intensive sector are \( p_a - \tau_a \), \( p_l - \tau_l \) and \( p_c + \tau_c \) respectively. The total tax revenue raised from rural sector and labor-intensive sector are denoted

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^{8} In the above utility function of LDC’s government \( U_g \), \( \psi + \rho I \) is borrowed from Sah and Stiglitz (1987), and \( B(q_e) \) is borrowed from Shleifer and Vishny (1994). But the utility function used in our paper emphasizes the government in the LDC’s strong motives of reaching a higher level of industrialization and leaping over some economic development phases by taking capital-intensive (heavy) industries or import substitution as a basic development path after these LDCs achieving political independence, which is totally neglected in Sah and Stiglitz (1987). And unlike that in Shleifer and Vishny (1994), the LDC’s government in our paper could be benevolent as well as could be leviathan.
to be $R_a$ and $R_l$ respectively, and the total subsidy to capital-intensive sector is denoted to be $R_c$. Like that in Acemoglu (2007), we also introduce two parameters $\phi_i \in [0, 1], \ i = a, l$ to measure how much of the tax revenue raised from sector $i = a, l$ can be redistributed to capital-intensive sector. The Treasury’s budget constraint is

$$\phi_a R_a + \phi_l R_l \geq R_c$$

We assume that $\phi_a = 0$ to reflect the fact that making tax collection from the small and scattered rural sector in the LDC was so difficult and costly that all tax revenue just covers the cost of collecting tax.\footnote{We assume $\phi_a = 0$ to avoid undue complexity, even the main results in our paper holds when $\phi_a \in (0, 1]$.} Now the Treasury’s budget constraint is given by

$$\phi_l \tau_i q_i \geq \tau_c q_c$$

where $q_i$ is the output produced by labor-intensive firm.

Given output prices $\{(p_l - \tau_l), (p_c + \tau_c)\}$, now the diversification cone of labor-intensive and capital-intensive production function is $[\Delta k, \Delta k]$, where $\Delta = \left[ \frac{(p_l - \tau_l) p_c}{(p_c + \tau_c) p_l} \right]^{1 - \beta}$. After product prices distortion, capital-intensive firm $c$ will still be non-viable and $U_m < 0$ provided that $q_c > 0$ when $k < \Delta k$; and labor-intensive firm $l$ would be non-viable and $U_m < 0$ provided that $q_l > 0$ when $k > \Delta k$. Summarizing analysis above gives following lemma.

**LEMMA 1:** As long as capital-intensive production process is employed, the output prices after distortion should guarantee that the factor endowments in the LDC must belong to the new diversification cone $[\Delta k, \Delta k]$, i.e., we must have $k \in (\Delta k, \Delta k)$, which means

$$\Delta < \delta < \frac{1 - \beta}{1 - \alpha} \Delta$$

From (8), we know that as long as capital-intensive production process is employed, we must have $\tau_l > 0$ and $\tau_c > 0$.

### 4.2 Factor Price Manipulation

Given the distorted product prices $(p_c + \tau_c, p_l - \tau_l)$, the equilibrium (if equilibrium exists) wage and rental rate of capital in a LDC when capital-intensive production process is employed

\footnote{We assume $\phi_a = 0$ to avoid undue complexity, even the main results in our paper holds when $\phi_a \in (0, 1]$.}
must be
\[ r^* = (p_c + \tau_c) A_c \alpha (K'_c)^{\alpha-1} (H'_c)^{1-\alpha} = (p_i - \tau_i) A_c \beta (K'_c)^{\beta-1} (H'_c)^{1-\beta} \] (9)
\[ w^* = (p_c + \tau_c) A_c (1-\alpha)(K'_c)^{\alpha} (H'_c)^{-\alpha} = (p_i - \tau_i) A_c (1-\beta)(K'_c)^{\beta} (H'_c)^{-\beta} \] (10)

where \( K'_j \) and \( H'_j \) are capital and urban labor used in the firm \( j = l, c \) after output price distortion.\(^{10}\)

Comparing the equilibrium real wage rate \( \frac{w^*}{p_i} \) and interest rate \( \frac{r^*}{p_i} \) (labor-intensive good as numeriare) without distortion with the equilibrium real wage rate \( \frac{w'}{p_i - \tau_i} \) which is determined by (10) and interest rate \( \frac{r'}{(p_i - \tau_i)} \) which is determined by (9) after output prices distortion yields following lemma:

**LEMMA 2:** Whenever the capital-intensive sector is employed in the LDC, the equilibrium (if equilibrium exists) real wage rate \( \frac{w^*}{p_i} \) after output prices distortion must be less than the equilibrium real wage rate \( \frac{w'}{p_i - \tau_i} \) without distortion. And the equilibrium (if equilibrium exists) real interest rate \( \frac{r^*}{p_i} \) after output prices distortion must be greater than the equilibrium real interest rate \( \frac{r'}{(p_i - \tau_i)} \) without distortion.

**PROOF:** Substituting (5) into (10), we obtain
\[ \frac{w^*}{w'/(p_i - \tau_i)} = \left[ \frac{k}{K'_i / H'_i} \right]^{\gamma \beta} \]
And
\[ \frac{w^*}{p_i - \tau_i} < \frac{w'}{p_i} \]
follows from \( K_i / H_i \) \( < k < K_c / H_c \) as long as capital-intensive sector is employed.

Substituting (4) into (9), we obtain
\[ \frac{r^*}{r'/(p_i - \tau_i)} = \left[ \frac{k}{K'_i / H'_i} \right]^{-\gamma \beta} \]
By the same reason we have

\(^{10}\) When production of capital-intensive output would not require fixed input, i.e., when \( \Gamma = 0 \), the wage rate \( w' \) and interest rate \( r' \) are the equilibrium factor prices, and \( K'_j \) and \( H'_j \) are equilibrium capital and urban labor used in the firm \( j = l, c \) after output price distortion.
\( \frac{r^*}{p_l - \tau_i} > \frac{r^*}{p_l} \).

Given the distorted product prices \((p_c + \tau_c, p_l - \tau_l)\) and the equilibrium real wage rate and interest rate \(\frac{w^*}{p_l - \tau_l}\) which is determined by (10) and interest rate \(\frac{r^*}{p_l - \tau_l}\) which is determined by (9), from Euler's theorem on homogeneous functions, we know that capital-intensive firm would incur a net loss of \((p_c + \tau_c)(1-\delta)\Gamma\) no matter what \(\tau_c\) and \(\tau_l\) are. And the net loss \((p_c + \tau_c)(1-\delta)\Gamma\) is a decreasing function of the capital stock per urban worker \(k = \delta k\) in the LDC. The analysis above gives the following result:

**PROPOSITION 2:** The government can not successfully implement the Catch-Up strategy (heavy-industry-oriented development strategy) in this LDC just by the policy instrument of distorting output prices.

Thus, the government of the LDC is obliged to manipulate factor prices as well as distort product prices to enforce Catch-Up strategy effectively, i.e., the government in LDC is obliged to either depress interest rate, or keep nominal wage rate down, or depress both.

We focus here on the role of low-interest-rate policy in the LDC’s enforcing Catch-Up strategy in accord with the widespread financial suppression existing in LDC, and investigate how low-interest-rate policy can arise form the government’s inappropriate development strategy. This requires us to specify the mechanism of urban wage determination firstly. Given the distorted relative prices of outputs \(\{(p_a - \tau_a), (p_l - \tau_l), (p_c + \tau_c)\}\), we denote the manipulated wage and rental rate of capital in the LDC to be \(w_d\) and \(r_d\) respectively.

After output price distortion and factor price manipulation, the indirect utility function of the urban worker is obtained from

\[
V^2 \left( \frac{p_a - \tau_a}{p_l - \tau_l}, \frac{w_d}{p_l - \tau_l} \right) = \max_{c_a, c_i} U(c_a^2, c_i^2) + \lambda^2 \left[ \frac{w_d}{p_l - \tau_l} - \frac{p_a - \tau_a}{p_l - \tau_l} c_a^2 - c_i^2 \right]
\]

where \(\lambda^2\) is the urban worker’s positive marginal utility of income. We assume that the government in the LDC can exercise a direct control over the urban wage only when the real wage rate of urban workers is above their subsistence levels, but when the real wage rate of urban workers equals to their subsistence levels, the government in the LDC could not depress urban

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11 Owing to capital-intensive production process could not be employed after output price distortion without factor price manipulation, the equilibrium wage and rental rate in the LDC are still determined by

\[ r^{**} = (p_l - \tau_l) A_l \beta k^{\beta - 1} \quad \text{and} \quad w^{**} = (p_l - \tau_l) A_l (1 - \beta) k^{\beta} \] respectively.
worker’s real wage arbitrarily, or else, the government in the LDC is obliged to depress the relative price of rural product to labor-intensive product to compensate urban worker’s utility.

To maintain the utility of the urban workers and rural worker above their subsistence levels, the minimum real wage rate (labor-intensive good as numeraire) should be no less than \( w_i \).

We assume that urban population \( N^2 \), capital stock \( K \), productivity parameters \( (A_i, A_i) \), output price \( (p_i + \tau_e, p_i - \tau_i) \), fixed input \( \Gamma \), the subsistence level for urban worker and rural worker \( (V^1, V^2) \), and parameters \( (\alpha, \beta, \delta) \) in the LDC satisfy

\[
\frac{w_i}{p_i - \tau_i} < w_i \tag{A 1}
\]

When assumption (A1) holds, we have \( w_d \equiv w_i(p_i - \tau_i) \). Given distorted relative prices of outputs \( \{(p_d - \tau_a), (p_i - \tau_i), (p_c + \tau_c)\} \) and depressed factor prices \( \{w_d, r_d\} \), the profit function of capital-intensive firm when \( K_c = K_c^* \) and \( H_c = H_c^* \) is

\[
\pi_c(p_c, \tau_c, r_d, w_d, K_c^*, H_c^*) = (p_c + \tau_c)[A_c(K_c^*)^a(H_c^*)^{1-a} - \Gamma] - r_dK_c^* - w_dH_c^* \tag{11}
\]

Substitution (9) and (10) in (11) yields

\[
\pi_c(p_c, \tau_c, r_d, w_d, K_c^*, H_c^*) = (r' - r_d)K_c^* + (w' - w_d)H_c^* - (p_c + \tau_c)(1 - \delta)\Gamma \tag{12}
\]

The necessary condition for the capital-intensive firm to be viable, i.e., for (12) to be non-negative, under distorted relative prices of outputs \( \{(p_d - \tau_a), (p_i - \tau_i), (p_c + \tau_c)\} \) and depressed factor prices \( \{w_d, r_d\} \) is

\[
(r' - r_d)K_c^* > [w_i(p_i - \tau_i) - w']H_c^* + (p_c + \tau_c)(1 - \delta)\Gamma \tag{13}
\]

Inequality (13) means that we must have \( r_d < r' \), i.e., in order to enforce Catch-Up strategy successfully, the government of the LDC should resort to depressing interest rate from \( r' \) to \( r_d \)

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12 In Sah and Stiglitz (1987), the government in a socialist economy can exercise a direct control over the urban wage without the consideration of urban worker’s welfare, while in a mixed economy (non-socialist economy), the urban wage is determined from \( V^2(p, w) = V^2 \), that is, the urban wage will be adjusted, in the face of changing prices, to preserve the welfare of urban workers, and the government in a mixed economy has no right to exercise a direct control over the urban wage.

13 Though the assumption of \( \phi_a = 0 \) implies that LDC can not collect tax directly from rural sector to subsidize capital-intensive sector, the government in the LDC still wants to lower the price of rural products to increase urban worker’s welfare.

14 When assumption (A1) holds, the redundant employment in the urban sector would be endogenously resulted from the Catch-Up strategy pursued by the government in the LDC.
as well as distorting output prices. And the depressed interest rate \( r_d \) should guarantee capital-intensive firm to be viable, i.e.,

\[
\pi_c(p_c, \tau_c, r_d, w_d) = (p_c + \tau_c)(A_c K_c^\alpha H_c^{1-\alpha} - \Gamma) - r_d K_c - w_d H_c \geq 0
\]  

(14)

where \( K_c \) and \( H_c \) are capital and urban labor used in the capital-intensive firm after output price and factor price distortion.

4.3 The Planned Resource-allocation System

Given distorted relative prices of outputs \( \{(p_a - \tau_a), (p_l - \tau_l), (p_c + \tau_c)\} \) and the quantity of capital used in capital-intensive firm \( K'_c \) and the quantity of labor employed in capital-intensive firm \( H'_c \), the marginal value product (MVP) of capital in capital-intensive firm is

\[
(p_c + \tau_c)A_c \alpha(K'_c)^{\alpha-1}(H'_c)^{1-\alpha} = r'
\]

and the MVP of labor in capital-intensive firm is

\[
(p_c + \tau_c)A_c (1-\alpha)(K'_c)^{\alpha}(H'_c)^{-\alpha} = w'
\]

After factor prices being depressed, the factor prices faced by capital-intensive firm are \( \{w_d, r_d\} \). Thus, the capital-intensive firm would like to use more capital than \( K'_c \) and employ less labor than \( H'_c \) owing to \( r_d < r' \) and \( w' < w_d \).

Given distorted relative prices of outputs \( \{(p_a - \tau_a), (p_l - \tau_l), (p_c + \tau_c)\} \) and the quantity of capital used in labor-intensive firm \( K'_l \) and the quantity of labor employed in capital-intensive firm \( H'_l \), the MVP of capital in the labor-intensive firm is

\[
r' = (p_l - \tau_l)A_l \beta(K'_l)^{\beta-1}(H'_l)^{1-\beta}
\]

and the MVP of labor in the labor-intensive firm is

\[
w' = (p_l - \tau_l)A_l (1-\beta)(K'_l)^{\beta}(H'_l)^{-\beta}
\]

Thus, the labor-intensive firm would like to employ less labor than \( H'_l \) owing to \( w' < w_d \) and want to use capital no less than \( K'_l \) providing that the interest rate faced by the labor-intensive firm no more than \( r' \).15

Summarizing the analysis above gives the following proposition:

15 We assume the interest rate faced by the labor-intensive firm to be \( r' \) for simplicity.
PROPOSITION 3: When assumption (A1) holds, a shortage of capital and a surplus of urban labor will be created in the LDC due to the introduction of Catch-Up strategy. Thus, the successful implementing Catch-Up strategy in the LDC involves the government of the LDC allocating capital and urban labor.

4.4 Depriving Firm of Autonomy

To be completed.
References: (不完整)


Mathematical Appendix: