Public Infrastructure, Employment and Sustainable Growth in a Small Open Economy With and Without Foreign Direct Investment

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- India's growth-employment performance:

$1990's \rightarrow$	GDP 6.1%	*Per capita* GDP 4%
$1950 - 1990 \rightarrow$	GDP 3.5%	*Per capita* GDP 1.5%
$1995 - 2000 \rightarrow$	*Employment* 1.02%	
$1985 - 1995 \rightarrow$	*Employment* 2.72%	
$1995 - 2000 \rightarrow$	*Rural Employment* 0.01%	
$1985 - 1995 \rightarrow$	*Rural Employment* 2.59%	
$1995 - 2000 \rightarrow$	*Total Unemployment* 20 $m \uparrow$ 27 m	

• Sectoral Behaviour:

Cross-country data 2002					
	GDP (US $ m)	Per capita GDP (US $)	Agriculture share in GDP (%)	Industry share in GDP (%)	Services share in GDP (%)
India	5,10,177	470	23	27	51
China	12,66,052	960	15	51	34
Ethiopia	7 6,059	100	40	12	48
Japan	39,93,433	34,010	1	31	68
Uganda	5,803	240	32	22	46
UK	15,66,283	25,510	1	26	73
US	1,03,83,100	35,400	2	23	75
Source: *World Development Indicators, 2004*					

• China is more advanced, the composition of its sectoral shares exhibits a higher echelon in economic evolution.

• Employment wise 60 % of India's labour force in agriculture, with no possibility of employment generating innovations. In organized manufacture, India's higher proportion compared to Thailand and Indonesia in the 1970's has reversed.

• India's growth performance in recent years explained mainly by services, which requires high productivity skilled labour, a relatively small fraction of India's work force. Hence, indifferent impact on overall employment scenario.

• It is believed that manufacture growth is a more promising avenue for employment growth. Can absorb unskilled labour. Manufacture growth traditionally viewed as an exercise in demand management. However, infrastructure is a major supply constraint. Consequently, a strong tendency for diminishing returns to capital in industry. Low rate of return, low rate of labour absorption and vicious circle of poverty.

• Services of infrastructure are often a public good, non-rival and non-excludable. Also, infrastructure stocks are bulky, with long gestation lags. Disincentives for private participation. Hence, government participation called for. The much deliberated two pronged strategy for development →

(1) private manufacture growth to absorb surplus labour and raise the rate of growth of employment and GDP, (2) simultaneous infrastructure development by government.

• Should a government opt for liberal economic policies to achieve these ends? What are the gains? Are there losses?

• To answer these questions, the paper considers a neoclassical economy characterized by private manufacture and government infrastructure. Studies the implications of liberalization on growth and welfare as the economy moves from autarky to free trade without foreign direct investment. This is followed by an analysis of free trade with foreign direct investment.

• Related works, which do not address the specific questions raised here, are Cheng *et al* (2005), Feenstra (1996), Lucas (1993), Rivera-Batiz, Romer (1991-a, 1991-b), Stokey (1996), Trindale (2005), Barro (1990), Barro and Sala-i-Martin (2004), Futagami *et al* (1993), Dasgupta (1999, 2001, 2003-04, 2004), Turnovsky (1997).

Model

• Two privately produced, tradable goods, a pure consumption good (Y) and a Solow type consumption cum investment good (Z).

• G is the non-traded, service as well as stock of infrastructure. Change in stock = $\dot{G}$.

• Y, Z, $\dot{G}$ produced by services of K, G and L.

• Surplus labour. Subsistence wage rate $\bar{w}$, *à la* Lewis (1954). $L_i/K_i = \lambda = constant,\ i = y, z, g$. Capital accumulation vehicle for employment generation. K_i, K redefined as joint input of private capital and labour.

• Z is numéraire. Price of Y is p, rate of interest r. Redefine r as $(r + \lambda\ \bar{w})$ $wlog$. No user charge for G.

• Lump-sum taxes T_y and T_z on sectors Y and Z to purchase private K-services. Vary across time points.

• Cobb-Douglas technologies.

$$\begin{aligned} Y &= Gf_y(k_y), f_y' > 0, f_y'' < 0, f_y = A_y k_y^{\alpha}; \\ Z &= Gf_z(k_z), f_z' > 0, f_z'' < 0, f_z = A_z k_z^{\beta}; \\ \dot{G} &= Gf_g(k_g), f_g' > 0, f_z'' < 0, f_g = A_g k_g^{\gamma}, \end{aligned}$$

where $k_i = K_i/G$, $i = y, z, g$.

• Profits in the Y and Z-sectors:

$$\begin{aligned} \Pi_y &= pY - rK_y - T_y \\ \Pi_z &= Z - rK_z - T_z \end{aligned}$$

• T_y and T_z are lump sum taxes, so Y, Z use all G. G-sector, not a profit maximizer, *assumed* to employ G to capacity. At each t, T_y and T_z fixed consistent with competitive shares. Government budget constraint –

$$rk_g = \frac{T_y}{G} + \frac{T_z}{G}$$

• Consumption – Savings choice.

$$\begin{aligned} \text{Max } U &= \int_0^{\infty} ln[Y_c^{\delta} Z_c^{1-\delta}]\ e^{-\rho t}\ dt \\ \text{subject to } E(t) + \dot{K}(t) &= r(t)K(t). \\ E(t) &= p(t)Y_c(t) + Z_c(t). \\ \text{Solution: } \dot{E} &= E(r - \rho). \end{aligned}$$

Autarky Equilibrium

• Existence of balanced growth equilibrium

New variable $x = E/G$.

• Static consistency check. At each t, i.e. given $k(t)$ and $x(t)$ –

7 unknowns $k_y,\ k_z,\ k_g,\ p,\ r,\ \dot{x}$ and $\dot{k}$,

7 equations – 2 marginal productivity conditions for capital in Y and Z-sectors, full employment, government budget and the following 3 equations:

$$\dot{x} = x(r - \rho - f_g(k_g)).$$

$$\dot{k} = k\left\{r - \frac{x}{k} - f_g(k_g)\right\}$$

$$f_y(k_y) = \frac{\delta x}{p}.$$

• Dynamic consistency check. Under balanced growth, $\dot{x} = 0$ and $\dot{k} = 0$. So, 7 equations determine the 7 unknowns $k_y,\ k_z,\ k_g, p,\ r,\ x$ and k. **Figure 1**.

Proposition 1 *Under autarky, the economy is characterized by a unique balanced growth path.*

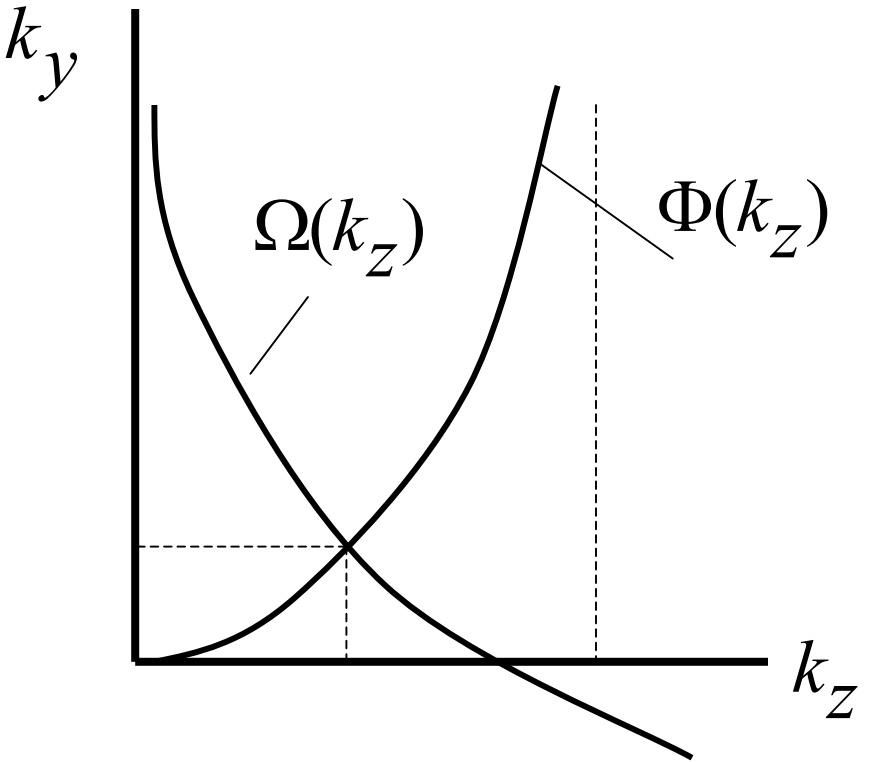


Figure 1 *Equilibrium under Autarky*

Small Open Economy, No International Capital Flows.

• Static consistency check. Domestic market equlibrium condition drops out. Replaced by $p = p^f$. At each t, 6 equations determine 6 unknowns, $k_y,\ k_z,\ k_g,\ r,\ \dot{x}$ and $\dot{k}$, given $k(t)$, $x(t)$ and the world price.

• Dynamic consistency check. For balanced growth, $\dot{x} = \dot{k} = 0$, and the set of unknowns changes to $k_y,\ k_z,\ k_g,\ r,\ x$ and k.

Proposition 2 *For any given world price ratio, the small open economy will necessarily be incompletely specialized.*

Intuition 1 In the presence of the pure public good, the factor allocation problem reduces to the allocation of the single factor K. Hence, the Inada conditions along with concavity rule out corner solutions.

Proposition 3 *There exists a unique free trade balanced growth path for each specification of the world price ratio. A rise (fall) in the world relative price of the pure consumption good leads to an increase (decrease) in the balanced growth rate of the economy.* **Figure 2**.

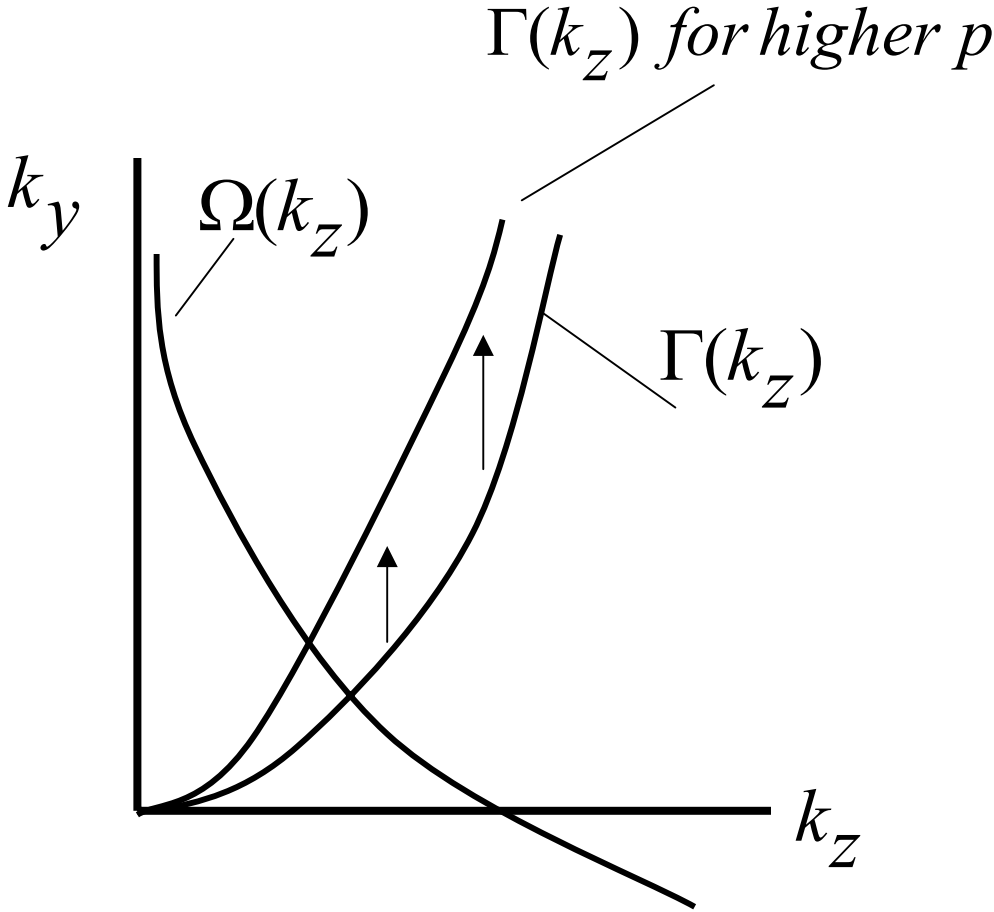


Figure 2 Equilibrium under Free Trade without FDI

Intuition 2 $p \uparrow \Rightarrow k_z \downarrow, k_y \uparrow$. Also, $k_z \downarrow \Rightarrow r \uparrow \Rightarrow \dot{E}/E \uparrow$. Note that $k_g \uparrow$ too. Possible, since G-sector not engaged in profit maximization.

Intuition 3 Developing economy should have a comparative advantage in producing the pure consumption good. So, $p \uparrow$ expected. Goal of employment generation and growth better served under free trade than under autarky.

Proposition 4 *Under free trade, the unique balanced growth equilibrium is globally saddle point stable.* **Figure 3**.

• Level effect on employment. High $k \Rightarrow$ high level of employment per unit of G over and above high growth rate. Judging level effect. **Figure 4**.

$$\left.\begin{array}{rcccl} r^a & = & p^a f_y'(k_y^a) & = & f_z'(\tilde{k}^a - k_y^a) \\ r^f & = & p^f f_y'(k_y^f) & = & f_z'(\tilde{k}^f - k_y^f) \end{array}\right\}$$

• Also, $\dot{G}/G = \dot{E}/E = r - \rho$. Hence, **Figure 5**,

$$\left.\begin{array}{rcl} r^a & = & \rho + f_g(k_g^a) \\ r^f & = & \rho + f_g(k_g^f) \end{array}\right\}$$

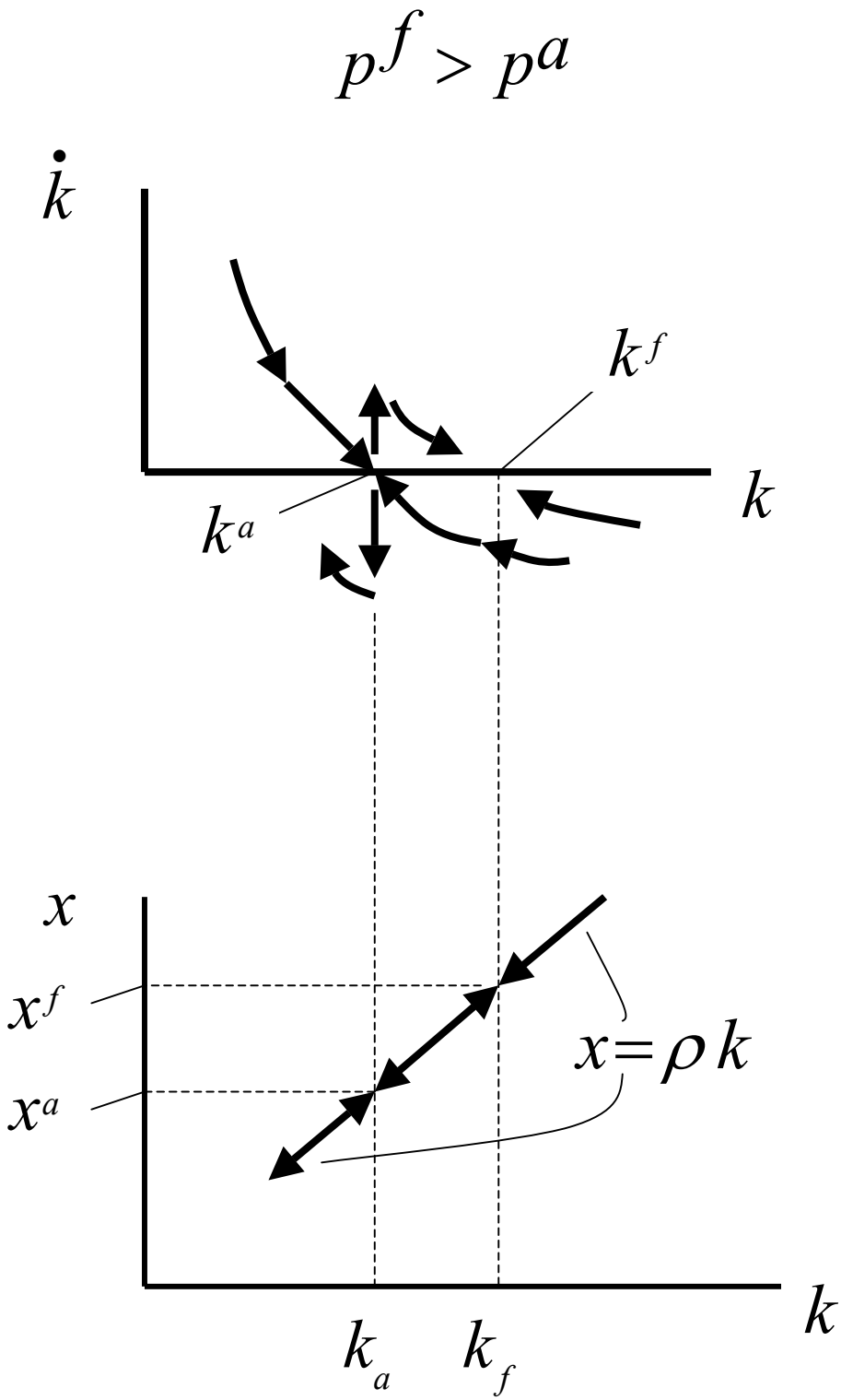
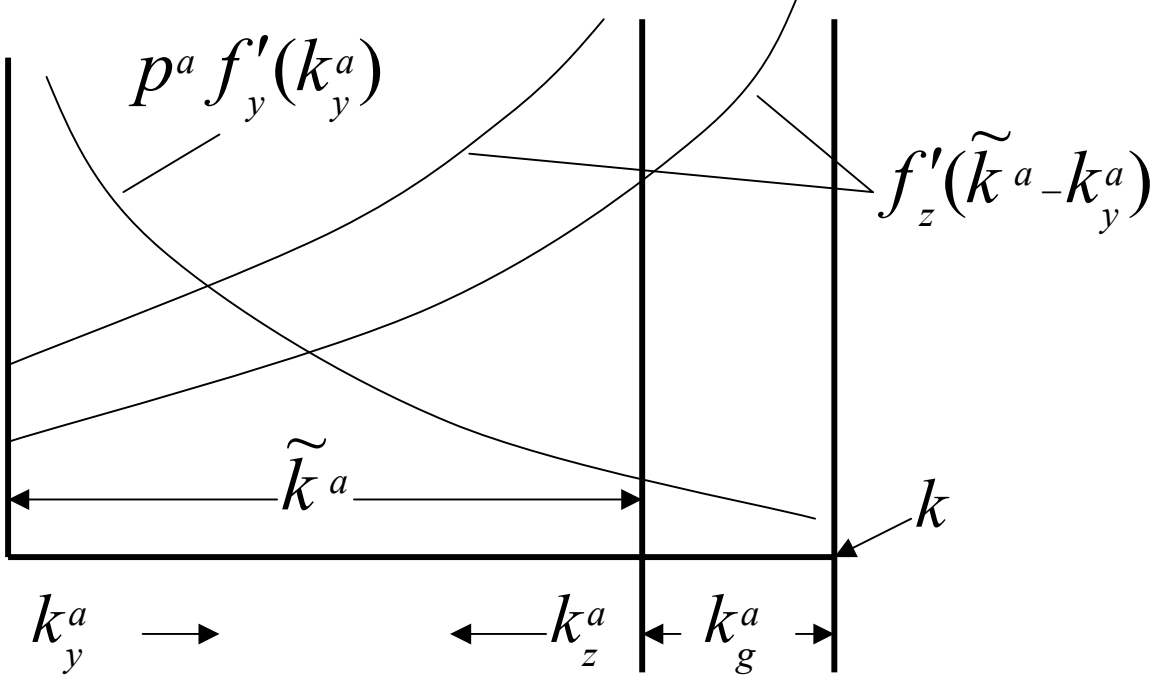


Figure 3 Stability of Equilibrium and Effect of Price Rise



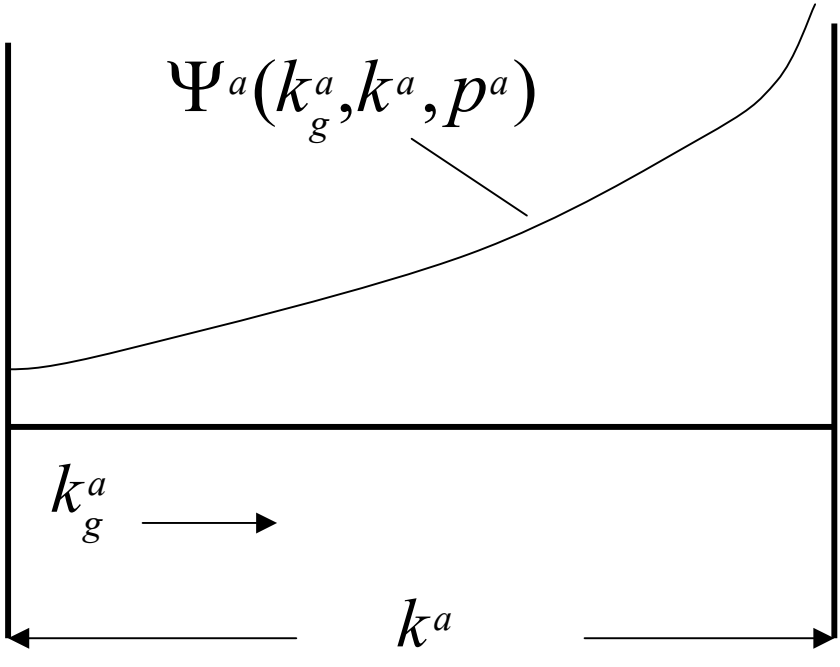


Figure 4 *Construction of* Ψ^a

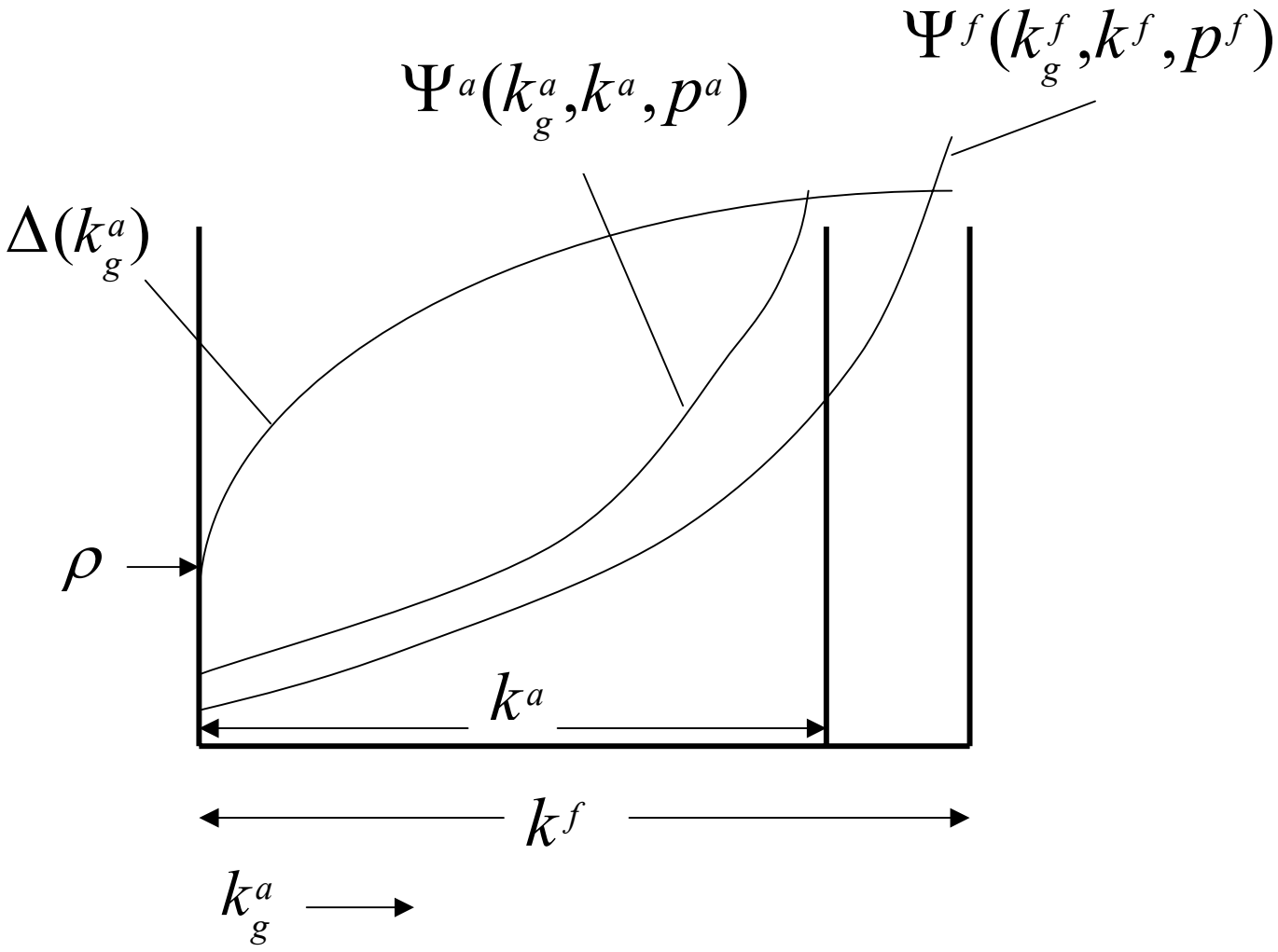


Figure 5 Comparing Autarky and Free Trade, $p^f > p^a$

Proposition 5 *The aggregate ratio of private to public capital for free trade is higher than the one for autarky if the free trade price of the pure consumption good is higher than the one for autarky.*

Intuition 4 Double check. We saw that $p^f > p^a \Rightarrow$ $Z \downarrow, Y \uparrow$. But $K/G \uparrow \Rightarrow K \uparrow$ relative to G even if $Z \downarrow$. Suggests capital stock $K \uparrow$ through imports.

Proposition 6 *The economy exports* (*imports*) *the pure consumption good and imports* (*exports*) *the consumption cum capital good along the balanced growth path if free trade leads to a higher* (*lower*) *world relative price of the pure consumption good compared to that under autarky.*

• Open economy leads to higher growth compared to autarky, yet there are two sources of inefficiency. In G-sector, $r \neq mpk$. Effective prices underlying taxes $\neq$ *social mp* of G. How does the optimal or Command Economy path behave? Only balanced growth analysis here.

The best sustainable or balanced growth path for the system is found by maximizing

$$\mathcal{H} = ln\ (Y_c^{\delta} Z_c^{1-\delta}) + \eta\ [p^f A_y (\phi_y K)^{\alpha} G^{1-\alpha}$$

$$+A_z (\phi_z K)^{\beta} G^{1-\beta} - p^f Y_c - Z_c]$$

$$+\xi\ ((1-\phi_y-\phi_z)K)^{1-\gamma} G^{1-\gamma}.$$

Proposition 7 *A unique socially optimal balanced growth rate exists for the small economy under free trade without foreign direct investment.*

Proposition 8 *In balanced growth equilibrium, the Command Economy employs a lower ratio of private to public capital compared to the Mixed Economy and enjoys a lower rate of growth.* **Figure 7**.

Intuition 5 Inefficient Mixed Economy dominates efficient Command Economy from the point of view of employment, latter dominates in welfare. The level of unemployment is a crucial index for judging a government's success in a democratic society, while higher aggregate utility with greater unemployment implies severe inequality.

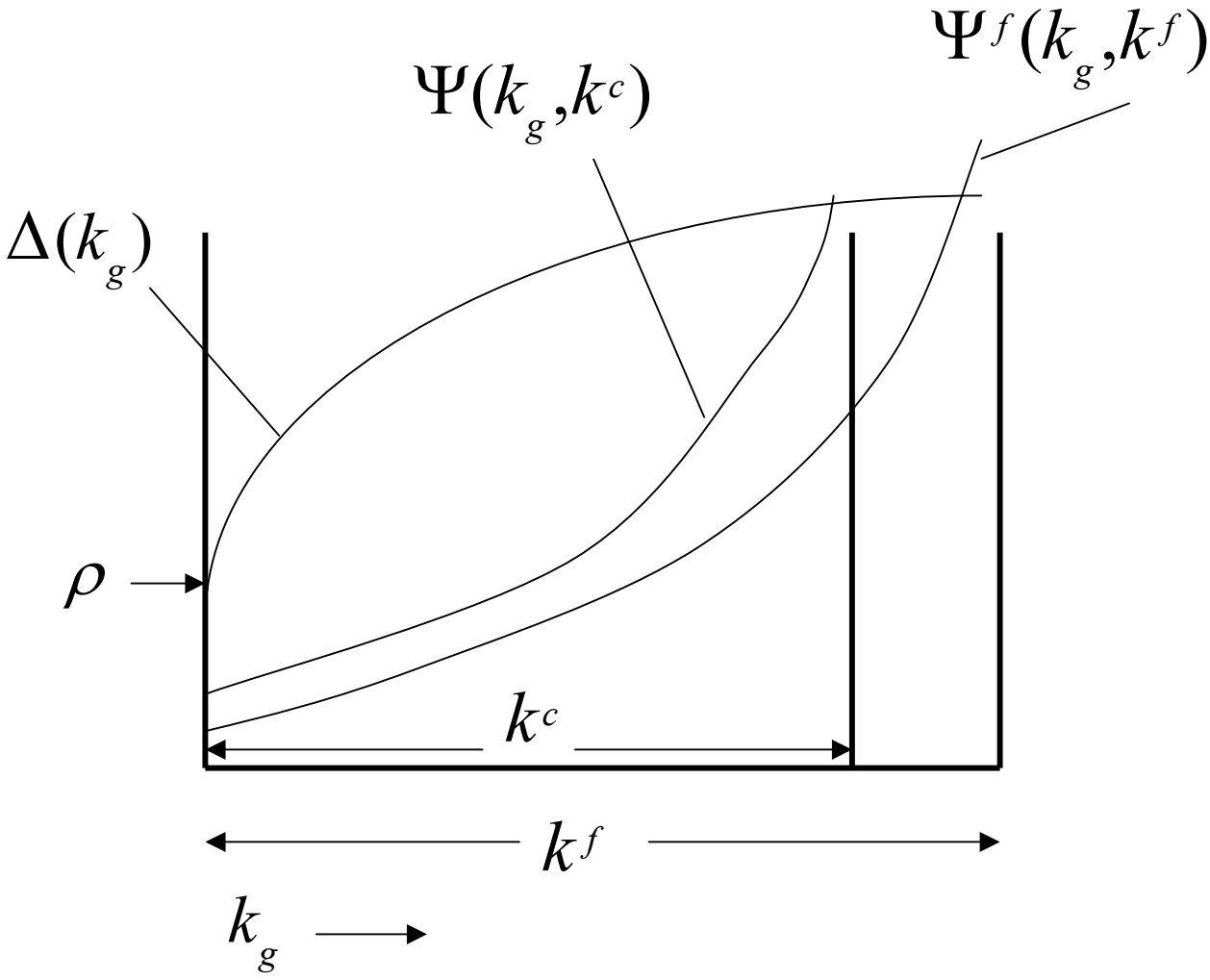


Figure 7 Comparing Free Trade and Command Solution

• Small Open Economy, Free International Capital Flow.

Proposition 9 *Under a flexible rate of interest, the inflow of fdi leads the small open economy to adjust instantaneously to its long term growth rates of aggregate capital, infrastructure, employment and consumption expenditure. Capital, employment and infrastructure grow at a common rate, higher than the one prevailing under balanced growth prior to the inflow of foreign capital. Household expenditure grows at a lower rate. The absolute levels of capital, employment and infrastructure are higher for all future. Finally, it is feasible for domestic and foreign capital to adjust instantaneously to the rate of growth of aggregate capital.*

• Arguments:

••
$$\left.\begin{aligned} r^{df} &= p^f f'_y(k_y^{df}), \\ &= f'_z(k_z^{df}), \end{aligned}\right\}$$

$$\begin{aligned} k^{df} &= k_y^{df} + k_z^{df} + k_g^{df}, \\ \text{and} \qquad k_g^{df} &= k_y^{df}\ \frac{1-\alpha}{\alpha} + k_z^{df}\ \frac{1-\beta}{\beta}\ , \end{aligned}$$

Since $r^{df} < r^f$, concavity $\Rightarrow k_i^{df} > k_i^f$, $i = y, z$. Thus, $k_g^{df} > k_g^f$. Finally, $k^{df} > k^f$. So, overall as well as sectoral K/G ratios are higher.

•• *Wlog* foreign capital flows are infinitely elastic at r^{df}. Suppose the economy is experiencing steady growth without foreign capital and fdi is allowed from $t = t_0$ onwards. Then, the gap $k_i^{df} - k_i^f$, $i = y, z, g$ can be filled up by foreign capital without any lag. Instantaneous adjustment to the new equilibrium.

•• Constancy of $k^{df} \Rightarrow K$, G grow at the same rate. But $k_g^{df} > k_g^f \Rightarrow (\dot{G}/G)^{df} > (\dot{G}/G)^f \Rightarrow K$ (inclusive of foreign capital) and public capital grow faster.

•• At t_0, $K^{df}_{t_0} > K^{f}_{t_0}$, since $k^{df} > k^{f}$ and $G^{df}_{t_0} = G^{f}_{t_0}$, G being non-traded. The absolute size of K is higher $\Rightarrow$ aggregate size of employment and rate of growth higher with free inflow of foreign capital.

•• However, $\dot{E}/E = r^{df} - \rho$ must fall.

•• Consider the identity

$$\frac{K_{dm}}{K}\frac{\dot{K}_{dm}}{K_{dm}} + \frac{K_{fr}}{K}\frac{\dot{K}_{fr}}{K_{fr}} = \frac{\dot{K}}{K}.$$

Given infinite elasticity of foreign capital supply, feasible for $\dot{K}_{fr}/K_{fr} = \dot{K}/K \; \forall \; t \geq t_0$. Hence,
$K_{dm}/K + K_{fr}/K = 1 \Rightarrow \dot{K}_{dm}/K_{dm} = \dot{K}/K \; \forall \; t \geq t_0$ also.

• Level effect on expenditure. Before fdi,

$$E^f(t_0) + \dot{K}^f_{dm}(t_0) = r^f K^f_{dm}(t_0) + \lambda\bar{w}\ K^f_{dm}(t_0),$$

Suppose fdi occurs creating additional employment, but that the interest rate as well as the domestic investment remain unaltered. Assuming foreign profits repatriated, equation changes to

$$E^f(t_0)+\dot{K}^f_{dm}(t_0) = r^f K^f_{dm}(t_0)+\lambda\bar{w}\ K^f_{dm}(t_0)+\lambda\bar{w}\ K^{df}_{fr}(t_0),$$

In this situation, $E^f(t_0) > E^{df}(t_0)$. However, adjustments are instantaneous, so effect of drop of r^f to r^{df} unclear.

• Conclusions:

1. Free trade without $fdi \Rightarrow$ higher growth rate, if p rises as expected.

2. Growth path inefficient, though rate of growth higher. Choice between aggregate utility and growth rate.

3. With fdi, unconditional rise in the rates of growth, except for rate of growth of E. Once again, tension between growth and welfare.

4. Paradox unimportant for labour surplus economy. Rise in aggregate utility does not percolate down to the population in the presence of unemployment, due to lack of purchasing power. A democratically elected government likely to opt for employment improvement.

5. It appears that in a small developing economy, free trade with fdi is unambiguously superior to autarky or trade without fdi.

6. Caveat. Under balanced growth, surplus labour disappears sooner or later. After this, labour markets move in to determine w and the model must change.