1 Key Notation

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A(t)</td>
<td>Index of technological efficiency in relatively advanced region</td>
</tr>
<tr>
<td>n</td>
<td>Constant rate of technological increase in relatively advanced region</td>
</tr>
<tr>
<td>B(t)</td>
<td>Index of technological efficiency in relatively backward region</td>
</tr>
<tr>
<td>\lambda</td>
<td>Positive constant, magnitude depends on factors like the quality of management and education level of labor force</td>
</tr>
<tr>
<td>A_0</td>
<td>The initial level of technological efficiency in the advanced region</td>
</tr>
<tr>
<td>B_0</td>
<td>The initial level of technological efficiency in the relatively backward region</td>
</tr>
<tr>
<td>K_f(t)</td>
<td>Capital stock of foreign-owned firms in relatively backward countries</td>
</tr>
<tr>
<td>K_d(t)</td>
<td>Capital stock of domestic firms</td>
</tr>
<tr>
<td>x \equiv \frac{B(t)}{A(t)}</td>
<td>Relative technological efficiency in relatively backward countries</td>
</tr>
<tr>
<td>y \equiv \frac{K_f(t)}{K_d(t)}</td>
<td>Ratio of foreign-owned to domestic-owned, measure of the technological penetration in the relatively backward country</td>
</tr>
<tr>
<td>\alpha</td>
<td>Positive constant to adjust wage for foreign sector</td>
</tr>
<tr>
<td>w_0</td>
<td>Wages in domestic sector</td>
</tr>
<tr>
<td>\rho_f, \rho_d</td>
<td>Rate of profit in foreign and domestic sectors</td>
</tr>
<tr>
<td>\tau</td>
<td>Tax rate for foreign businesses, \tau \in [0, 1]</td>
</tr>
<tr>
<td>s</td>
<td>Fixed fraction of the sum of the domestic sector profits saved for internal investment, s \in (0, 1]</td>
</tr>
<tr>
<td>r</td>
<td>Constant fraction of after-tax profits retained by the foreign sector for internal investment, r \in (0, 1]</td>
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</table>
2 Introduction

How does technology move from more advanced countries to the relatively backward ones? What is the relationship between technology transfer and foreign direct investment? Findlay uses his simple dynamic model of technology diffusion to give insight to these two questions. In his model, technology in the relatively backward region depends on the technology level in the advanced region, which he assumes is growing at an exogenous rate. This article also uses the model of contagious diseases to clarify the speed of technological diffusion—the greater the penetration of technology in a relatively backwards country, the faster the technological level will grow. In addition, Findlay assumes that the larger the gap between the advanced and relatively backward country the stronger the effect of technology growth. Finally, Findlay finds that technological improvement in the relatively backward country will impact the foreign country through profit rates to foreign-owned firms.

3 Role of Technology in Economic Growth

Technology is ideas or knowledge that increase production output with a given amount of input.

- For example, in the Cobb Douglas production function, it is represented as $\theta$, where $Y = \theta K^{\alpha} L^{(1-\alpha)}$

- Forms of technology:
  - Engineering discoveries such as more efficient machines.
  - Service concepts such as “all in one” shopping at Wal-Mart.
  - Basic knowledge such as physics, chemistry, etc.

- Sources of technology:
  - Innovation
  - Transferred from a more advanced firms or countries to a relatively backward one.

4 The Transfer of Technology

4.1 Main Idea

The greater the relative disparity in development levels between advanced and backward country, the greater pressure for change within the backward country. This pressure increases the rate of advancement of the backward country.

- Technological improvement is positively related to the level of backwardness and the level of FDI.
• The “Contagion Effect” demonstrates that the greater the diffusion of technology, the faster that technology will spread.

• The relatively backward countries’ technological efficiency never reaches the level of the advanced countries.

• The advanced countries’ technology level grows at an endogenous $n$.

• Profit rate of the domestic sector is constant.

4.2 Relative Backwardness Hypotheses

Following Nelson and Phelps (1966) model, the relative backwardness of a country can be modeled as follows:

• Index of technological efficiency in advanced region ($A(t)$) is assumed to be increasing at a constant rate $n$
  \[- A(t) = A_0 e^{nt} \ldots (1)\]

• Level of technology in the backward region ($B(t)$) is increasing with the motion equation as follows:
  \[- \frac{dB}{dt} = \dot{B} = \lambda (A_0 e^{nt} - B(t)) \ldots (2)\]
  Where $\lambda$ is a positive constant, which depends on an exogenous parameter such as quality of management or the education level of the labor force.

Integrating [2], we obtain the level of technology in backward region (see Appendix A.1).

\[- B(t) = \frac{\lambda}{(n+\lambda)} A_0 e^{nt} + \frac{(n+\lambda)B_0 - \lambda A_0}{n+\lambda} e^{-\lambda t} \ldots (3)\]
  Where $B_0$ is initial level of efficiency in backward region.

• As time tends to infinity, the ratio of technological level in backward to advanced region will approach an “equilibrium gap” of $\frac{\lambda}{(n+\lambda)}$ (see Appendix A.2)

\[- \lim_{t \to 0} \frac{B(t)}{A(t)} = \frac{\lambda}{(n+\lambda)} \ldots (4)\]

• If the disparity at time $t = 0$ is very large, $\frac{B_0}{A_0} < \frac{\lambda}{(n+\lambda)}$, then the rate of technological process in backward region will exceed $n$, but fall towards it asymptotically as the equilibrium gap is approached.

• We define relative backwardness as $x$, where $x \equiv \frac{B(t)}{A(t)}$.
4.3 Contagion Effect Hypothesis

- The rate of change of technical efficiency in the backward country is an increasing function of the diffusion of foreign technologies.

- One measurement of technological diffusion from foreign to domestic countries is based on ratio of capital stock of foreign-owned firms \((K_f)\) to the capital stock of domestically owned firms \((K_d)\).

\[
- y = \frac{K_f(t)}{K_d(t)}
\]

- The author postulates that the proportional growth of technical efficiency in backward country is the function of the relative backwardness and the contagion effect. There are many other factors that affect the technical efficiency growth such as education of labor force, market structure, etc, but those are assumed to be constant and not being focused on in this paper.

\[
- \frac{B}{y} = f(x, y) \text{ with } \frac{\partial f}{\partial x} < 0, \frac{\partial f}{\partial y} > 0 \ldots (4)
\]

- From previous section we know that \(x(t)\) is determined by \(\lambda, n, A_0, B_0\). The factors that determines \(y(t)\) will be discussed in the next section.

5 Direct Foreign Investment

- Stephen Hymer (1960) defines direct foreign investment as the transfer of capital, management, and new technology from one country to another.

- In this paper, foreign and domestic capital are treated as distinct factors of production, each with its own rate of return. Therefore the analysis will be separated between foreign sector and domestic sector.

5.1 Factor Price Frontier in the Domestic and Foreign Sectors

- The factor price frontier (FPF) is a locus of factor price combinations along which the unit cost of a good remain constant. The downward slope of the FPF curve is derived from the optimal cost equation and the slope is depends on the labor over capital ratio of the economy (see Appendix A.3).

- With technological efficiency in the backward region at \(t_0\), the maximum profit rate for each possible level of real wage rate in domestic sector is illustrated in Figure I.
It is assumed that $w_0$ and $K_d(0)$ are exogenously given and there is no employment and capital constraint. Labor is function of real wage and existing capital; and output is function of labor and domestic capital stock.

- It is assumed that foreign sector pays a higher wage rate $(1 + \alpha)w_0$, where $\alpha$ is a positive constant. Total output and employment are determined by $(1 + \alpha)w_0$ and $K_f(0)$.
• Technological progress will shifts factor price frontiers outward.
  – The domestic sector’s FPF (DD’) shifts to the right at rate \( \frac{\dot{B}}{B} \)
  – The foreign sector’s FPF (FF’) shifts to the right at rate \( n \).

5.2 Growth Rate of Capital in Domestic Sector

• Capital accumulation in the domestic sector \((K_d)\) is taken to be equal to a fixed fraction, \( s \), of the domestic income. Domestic income consists of domestic sector’s profit, \( \rho_d(t)K_d \) and proportional tax from foreign sector profit, \( \tau \rho_f K_f \).

\[
\frac{\dot{K}_d}{K_d} = s_d(t) + s \rho_f \frac{K_f}{K_d} \quad \ldots(5)
\]

• It is assumed that wage rate policy in domestic sector makes the rate of change in wage rate equal to the change in total factor productivity, so domestic profit is always constant.

\[
\rho_d(t) = \rho_d(0) = \bar{\rho}_d
\]

• From Figure II, \( \rho_f(t) \) is a function of technological efficiency, \( A(t) \), and wage rate \((1 + \alpha)w(t)\). By the wage policy, \( w(t) \) is function of \( B(t) \).

\[
\rho_f(t) = R(\frac{B(t)}{A(t)}) = R(x(t)), \text{ with } R' < 0 \quad \ldots(6)
\]

• The combination of equations (5) and (6) shows that the growth rate of domestic capital stock is a decreasing function of \( \frac{B(t)}{A(t)} \) and increasing function of \( \frac{K_f(t)}{K_d(t)} \).

5.3 Growth Rate of Capital in Foreign Sector

• Growth rate of foreign sector capital stock is equal to a fixed fraction, \( r \), of after tax profit in the sector.

\[
\frac{\dot{K}_f}{K_f} = r(1 - \tau) \rho_f(t) \quad \ldots(7)
\]

• The combination of equations (6) and (7) shows that the growth rate of foreign capital is also a decreasing function of \( \frac{B(t)}{A(t)} \) but independent of \( \frac{K_f(t)}{K_d(t)} \).

• Therefore, we know that the factors that determine \( y(t) \) are \( \frac{B(t)}{A(t)} \), \( \rho_d \), \( \rho_f \), \( s \), \( r \) and \( \tau \).
6 The Complete Model

Note, Figure III in the article has a mistake. The correct phase diagram is printed here.

6.1 Finding the Equilibrium

The equilibrium point for relative technical efficiency is \( x^* \), and ratio of foreign to domestic capital stock is \( y^* \).

- The analysis uses a system of two differential equations, one to describe the dynamics of the relative technical efficiency (\( x = \frac{\dot{B}}{\dot{A}} \)), and the other to describe changes in the penetration of foreign capital in the backward country (\( y = \frac{K_f}{K_d} \)).

- The change in \( x \) is described by the equation \( \dot{x} = \frac{B}{A} \left[ \frac{B}{\dot{B}} - \frac{A}{\dot{A}} \right] \) ...(10) (see Appendix A.4).
  
  Where we know that \( \frac{A}{\dot{A}} \) is an exogenous constant \( n \), so in order to have \( \dot{x} = 0 \) every combination of \( x \) and \( y \) must satisfy \( \frac{B}{\dot{B}} = n \).
  
  Combinations are represented by the upward sloping curve TT (upward sloping because \( \frac{d\dot{x}}{dy} > 0 \)). This will also imply that at any point above the TT curve, \( \frac{\dot{B}}{\dot{B}} < n \) (since \( \frac{\dot{B}}{\dot{B}} \) is a decreasing function of \( x \)) and therefore \( x \) should decrease.

- Similarly, the total differentiation of \( y \) is described as
\[ \dot{y} = \frac{K_f}{K_d} \left[ \frac{K_f' f'}{K_f'} - \frac{K_d'}{K_d} \right] \quad \text{(11)} \]

- From this we can obtain an expression for \( R(x) \) (equivalent to \( \rho_f \))

\[ R(x) = \frac{s \rho_d}{\tau (1 - \tau) - s \tau y} \quad \text{(12)} \]

(see Appendix A.6).

- From Equation (6), we know that \( R'(x) < 0 \), and because of this, if \( y \) increases, then \( x \) must decrease to maintain \( \dot{y} = 0 \). This is why the KK curve is downward sloping. This is expressed in the following two equations using (11) and (12) (see Appendix A.7).

\[ -\frac{\partial \dot{y}}{\partial y} \bigg|_{\dot{y}=0} = -s \tau \rho_f y < 0 \quad \text{(13)} \]

\[ -\frac{\partial \dot{y}}{\partial x} \bigg|_{\dot{y}=0} = \left[ r(1 - \tau) - s \tau y \right] R'(x)y < 0 \quad \text{(14)} \]

- In these two equations the analysis is conducted in \( \dot{y} = 0 \) to reflect the combinations \((x, y)\) that lead to a steady state in \( \frac{K_f}{K_d} \).

- This implies that \( y \) must decrease from any point above the KK curve.

- A high \( y \) (relative to the curve) implies that the accumulation of capital stock by the domestic sector is faster (because of higher tax revenues and higher domestic savings), and since the accumulation of capital stock by the foreign sector is unaffected, then the ratio \( y = \frac{K_f}{K_d} \) decreases.

- An increase in \( x = \frac{B}{A} \) reduces foreign companies’ profits, and this would imply less domestic tax revenues (and a smaller growth rate of domestic capital), but it is required that this effect be smaller than the effect of the reduction of the foreign sector’s growth rate (we need the denominator in (12) to be bigger than zero).

- Combining these two curves, we can obtain the steady state ratios \( x^* \) and \( y^* \), and according to the conditions of \( \frac{\partial \dot{x}}{\partial x}, \frac{\partial \dot{y}}{\partial y}, \frac{\partial \dot{y}}{\partial y}, \) and \( \frac{\partial \dot{y}}{\partial x} \) the stability of the system of equations is assured.

- Convergence to the Equilibrium

  - Suppose that \( \phi \) (the paper uses \( \alpha \)) is a point below the TT and the KK curves. In that case, the level of backwardness implies that the growth rate in the domestic rate of technical progress would be higher than the foreign rate \( (\frac{\dot{B}}{B} > n) \), and \( x \) should increase.

  - In this case \( y \) also increases because the accumulation of tax revenues and domestic capital stock is less than the growth rate of the capital stock in the foreign sector. Once KK is reached, the increase in domestic relative efficiency affects negatively the foreign penetration in the country, and once KK is crossed, \( y \) decreases while \( x \) is still increasing (is still below the TT curve).
Eventually, once TT is crossed, the decline in $y$ affects the accumulation of tax revenues and also $\frac{\partial f}{\partial y}$ is now smaller than $n$, which would lead to a decrease in $x$, and to the equilibrium point $(x^*, y^*)$.

Note, there was a mistake on page 12 of the article. The correct movement of $\phi$ (the paper uses $\alpha$) is printed here.

### 6.2 Effects of changing Parameters

- Suppose $n$ (constant rate of technology progress in advance region) increases.
  - TT is determined by $f(x, y) = n$.
  - If $n$ increases, $y$ should increase for a given $x$, or $x$ should decrease for a given $y$. Thus TT curve shifts to the right.
  - In the new equilibrium, we have lower $x^*$ and higher $y^*$. The technological gap increases, and dependence on foreign capital also increases.

![Phase Diagram](image)

- Suppose an increase in domestic education (where education is a parameter in the $f(x, y)$ function).
  - Increase in education will increase the impact of $x$ and $y$ to the rate of technological progress in backward region.
  - TT shifts to left.
  - Then $x^*$ rises and $y^*$ falls. There is a higher relative technological efficiency and a lower dependence on foreign capital.
• Suppose an increase in \( \tau \) (tax rate on foreign sector).
  
  – KK shifts to the left.
  
  – Lower \( x^* \) and lower \( y^* \). Dependence on foreign capital is reduced at a cost of lower relative technological efficiency.

• Suppose an increase in \( s \) (domestic propensity to save).
  
  – Increases domestic capital growth. KK shifts to the left.
  
  – Both \( x^* \) and \( y^* \) fall.
  
  – Besides affecting \( y \), if reinvestment helps the adoption of new technology (for example, invest in education), TT will then shift to the left. In this case, the reduction in \( x^* \) could be offset.
6.3 Extensions

- What if foreign investment dampens rather than accelerates technological progress in backward region?
  - $f(x, y)$ will be a decreasing function on both $x$ and $y$. Thus the slope of TT curve will be negative. Since KK and TT are determined by different functions, we assume the two curves will never be identical.

- Suppose TT and KK are parallel, or do not have intersection when $x$ and $y$ are both greater than 0.
  - No equilibrium point can ever be reached.

- If TT is to the right of KK, $x$ will keep increasing while $y$ will keep decreasing.
The intuition is that if the initial point is to the right or the left of both curves, the point will move towards the middle, based on the same argument as in the original model. In the first case, when the point is to the left of TT the relative technological efficiency \( x \) is too low, thus \( x \) will increase. Since the profit of foreign capital is negatively related to the relative technological efficiency, the growth rate of foreign capital will decrease, causing the ratio \( \frac{K_f}{\bar{K}_d} \) decrease. Therefore, the rate of technological progress in the backward region will be less dampened by foreign capital, resulting a faster increase in \( x \), which will again reduce \( \frac{K_f}{\bar{K}_d} \).

If TT is to the left of KK, \( x \) will keep decreasing while \( y \) will keep increasing.
• When TT is to the left of KK, for any point between the two curves, the relative technological efficiency will always decrease. The foreign capital profit rate will increase, so the foreign capital tends to grow faster than domestic capital, resulting in a higher $y$. Since $y$ tends to suppress the technological progress in backward region, the higher $y$ will, in turn, slow down the rate of change of the technological efficiency in the backward country, $B(t)$, which further increases the foreign profit, and therefore $x$ will be suppressed even more severely.

• Suppose TT and KK have one and only one intersection when $x$ and $y$ and both greater than 0.

  – When KK is steeper than TT, the determinant condition still holds, and any combination of $x$ and $y$ will converge to the equilibrium point.
– When TT is steeper than KK, the determinant condition will not hold. Either $x$ or $y$ will keep increasing, while the other will keep decreasing.

– Intuitively, we can apply the same arguments used with the parallel cases.
7 Conclusion

- Findlay examined the relationship of technological change in the backward region and the exposure to the technology of the more advanced region.
- His model provides insights on how changes in technological progress rate, tax, education and reinvestment rate will impact the long run relative backwardness and dependence on foreign capital.
- Possible criticism
  - No direct welfare implications in the model.
  - The model relies on the relative technological efficiency, not absolute.

A Appendices

A.1 Derivation of Equation (3)

\[ \dot{B}(t) = \lambda (A_0 e^{nt} - B(t)) \quad [1] \]
\[ B(t) + \lambda B(t) = \lambda A_0 e^{nt} \quad [2] \]
Multiply both sides of [2] with \( e^{\lambda t} \) and integrate from 0 to \( t \)

\[ \int_0^t e^{\lambda t} \dot{B}(t) dt + \int_0^t e^{\lambda t} \lambda B(t) dt = \int_0^t e^{\lambda t} \lambda A_0 e^{nt} dt \quad [3] \]
Integrate by parts for the first term

\[ \int_0^t e^{\lambda t} B(t) dt = e^{\lambda t} B(t) \bigg|_0^t - \int_0^t e^{\lambda t} B(t) dt \]
\[ \int_0^t e^{\lambda t} B(t) dt = e^{\lambda t} B(t) - B_0 - \int_0^t e^{\lambda t} B(t) dt \quad [4] \]

\[ e^{\lambda t} B(t) - B_0 - \int_0^t e^{\lambda t} B(t) dt + \int_0^t e^{\lambda t} B(t) dt = \int_0^t e^{\lambda t} \lambda A_0 e^{nt} dt \]

\[ e^{\lambda t} B(t) - B_0 = \lambda A_0 \left[ \frac{1}{n+\lambda} e^{(n+\lambda)t} \bigg|_0^t \right] \]
\[ e^{\lambda t} B(t) = \lambda A_0 \left[ \frac{1}{n+\lambda} e^{(n+\lambda)t} - \frac{1}{n+\lambda} \right] + B_0 \]
Multiply both sides by \( e^{-\lambda t} \)

\[ B(t) = \lambda A_0 \frac{e^{nt}}{n+\lambda} - \lambda \frac{1}{n+\lambda} A_0 \frac{1}{n+\lambda} e^{-\lambda t} + B_0 e^{-\lambda t} \]

\[ B(t) = \frac{\lambda}{n+\lambda} A_0 e^{nt} - \frac{(n+\lambda)B_0 - \lambda A_0}{n+\lambda} e^{-\lambda t} \quad [5] \]

A.2 Derivation of Equation in Section 4.2

\[ \lim_{t \to \infty} \frac{B(t)}{A(t)} = \lim_{t \to \infty} \left( \frac{\lambda A_0 e^{nt} + (n+\lambda)B_0 - \lambda A_0}{n+\lambda} e^{-\lambda t} \right) \]
\[ = \frac{\lambda}{n+\lambda} + \lim_{t \to \infty} \frac{(n+\lambda)B_0 - \lambda A_0}{n+\lambda} e^{-\lambda t} \]
\[ = \frac{\lambda}{n+\lambda} \]
A.3 Derivation of the Factor Price Frontier

Unit cost function: \( c(w, r) = w + r \)

Perfect competition implies that in the long run profits are zero:
\[
\pi = P_y - wL - rK = 0
\]
Then
\[
P = \frac{w}{Y} L + \frac{r}{Y} K
\]
Let \( \theta_L = \frac{L}{Y} \) be labor share in output and \( \theta_K = \frac{K}{Y} \) be capital share in output
Then
\[
P = w\theta_L + r\theta_K
\]
and
\[r = \frac{P}{\theta_K} - \frac{wL}{\theta_K} \]
with slope \( \frac{dr}{dw} = \frac{\theta_L}{\theta_K} \)
Thus the labor intensive economy (larger \( \theta_L \)) will have a steeper slope compared to capital intensive economy (larger \( \theta_K \)).

A.4 Derivation of Equation (10)

\[
x = \frac{B}{A}
\]
\[\frac{dx}{dt} = \dot{x} = \frac{\dot{B}A - \dot{B}B}{\dot{A}A} = \frac{\dot{B}A - \dot{B}B}{\dot{A}A} = \frac{\dot{B}}{\dot{A}} - \frac{\dot{B}}{\dot{A}} \cdot \frac{\dot{B} - \dot{A}}{\dot{A}} = \frac{\dot{B}}{\dot{A}} \left( \frac{\dot{B}}{\dot{A}} - \frac{\dot{A}}{\dot{A}} \right)
\]

A.5 Derivation of Equation (11)

\[
y = \frac{K_f}{K_d}
\]
\[\frac{dy}{dt} = \dot{y} = \frac{\dot{K}_f K_d - \dot{K}_d K_f}{K_d} = \frac{\dot{K}_f}{K_d} \cdot \frac{K_f}{K_d} - \frac{\dot{K}_d}{K_d} \cdot \frac{K_f}{K_d} = \frac{\dot{K}_f}{K_d} \left( \frac{K_f}{K_d} - \frac{K_f}{K_d} \right)
\]

A.6 Derivation of Equation (12)

From (11) we have \( \frac{\dot{K}_f}{K_d} = \frac{\dot{K}_d}{K_d} \)
Plug in (5), (6), and (7) we find
\[
r(1 - \tau)R(x) = \rho_d + s\tau \rho_f(t) \cdot y
\]
since \( \rho_d(t) = \rho_d(0) = \hat{\rho}_d \)
We then have \( \rho_f = R(x) = \frac{s\rho_d}{r(1 - \tau) - s\tau \rho_f} \ldots (13) \)

A.7 Derivation of Equations (13) and (14)

We have (11) \( \dot{y} = \frac{\dot{K}_f}{K_d} \left( \frac{K_f}{K_d} - \frac{K_f}{K_d} \right) \)
Plug in (5), (7), \( \dot{y} = y(r(1 - \tau)\rho_f - s\rho_d - s\tau \rho_f \cdot y) \ldots [1] \)
Take derivative, \( \frac{\partial y}{\partial y} = r(1 - \tau)\rho_f - s\rho_d - 2ys\tau \rho_f \ldots [2] \)
Plug in \( \dot{y} = 0 \) since \( y \neq 0 \) we have
\[
r(1 - \tau)\rho_f - s\rho_d - s\tau \rho_f y = 0 \ldots [3]
\]
Plug [3] into [2] and we have \( \frac{\partial y}{\partial y} \bigg|_{y=0} = s\tau \rho_f y < 0 \ldots (13) \)
From [1] substitute \( \rho_f \) with \( R(x) \)
We have \( \dot{y} = y[r(1 - \tau)R(x) - s\rho_d - s\tau R(x)] \)
Take the derivative for \( \frac{\partial \dot{y}}{\partial x} = y[r(1 - \tau)R'(x) - s\tau R'(x)] \)

Rearranging, we have \( \frac{\partial \dot{y}}{\partial x} = [r(1 - \tau) - s\tau]R'(x)y \)

When \( y' = 0 \), \( [r(1 - \tau) - s\tau]R'(x)y < 0 \)

Thus, \( \frac{\partial \dot{y}}{\partial x} = [r(1 - \tau) - s\tau]R'(x)y < 0 \)

A.8 Notes on Equation (15)

If the expression \( \left[ \frac{\partial \dot{x}}{\partial y} \cdot \frac{\partial \dot{y}}{\partial y} - \frac{\partial \dot{x}}{\partial x} \cdot \frac{\partial \dot{y}}{\partial x} \right] \) is less than zero, the equilibrium point \((x^*, y^*)\) would not be stable. Suppose for a moment that \( \frac{\partial \dot{x}}{\partial y} < 0 \) (which would imply that a higher penetration of foreign capital in the economy retards technological advance in the backward country), then any deviation from the equilibrium would bring two possible scenarios: permanent accumulation of foreign capital that leads to a deterioration of technical efficiency in the backward country, or a permanent decrease in foreign capital relative to domestic capital, which would lead to permanent improvements in technical efficiency in the backward country.

A.9 Notes on the Profit Rate Assumption

The assumption of a constant profit rate is not necessarily realistic given the different structures in labor markets, which could translate into growth rates different than the rate of technical efficiency growth. The only case in which this could affect the conclusions of the model is when the increase in the wage rates in the foreign sector is less than the exogenous growth rate of technical efficiency in the advanced country, because in that case the sign of \( R' \) in equation (6) will be positive, implying that the KK curve could show a negative slope. A small increase in wages could be a consequence of employers with market power in the labor market.

A.10 Notes on Empirical Support of the Model

On the effects of FDI on domestic firms Gorg and Greenaway (2004) review the theory and empirical results related to spillovers in productivity, to assess the channels that are working and the environment in which the technology transfer is produced, in order to derive some implications for policy. Their work suggest that evidence is mixed, which can be interpreted as if some multinational companies are effective in preserving to themselves the technological improvements.

However, this failure to capture the relation between FDI and technology transfer can be seen as a result of not conducting the analysis on proper data, given that most of the empirical works have been based on industry-level data, rather than firm-level data. It also points the necessity of studying the effects of different forms of investment (mergers or acquisitions), corporate governance in the adoption of new technologies.
References


