

**The Dynamic Interaction between HRD and FDI &
How Does it Affect Sustainable Economic Growth in Host Country**

Purpose: Discussion
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The overriding theme of APEC 2006

Towards a Dynamic Community for Sustainable
Development and Prosperity

The priorities endorsed by SOM I

- 1.1. To promote of APEC cooperation to enhance trade and investment;
- 1.2. To enhance competitiveness of small- and medium-sized enterprises;
- **1.3. To promote integration capacity through human resources development, IT cooperation, and partnership for development;**
- 1.4. To enhance human security: counter terrorism, health security, disaster preparedness, and energy security;
- 1.5. To promote anti-corruption and transparency;
- 1.6. To connect APEC economies through tourism and cultural exchange; and
- 1.7. To reform APEC towards a more dynamic and effective community.

The ECOTECH Work plan Endorsed by SOM I

Terms of Reference for the Steering Committee
on ECOTECH (SCE)

SCE 2006 work plan

The Characteristics of Economic Growth Transition

- Industrial Economy \Rightarrow Knowledge-Based Economy
- Traditional Closed Economy \Rightarrow Opened Market Economy

The Research Methods:

- **Theoretic Method:**

Endogenous Growth Model

- **Empirical Method:**

Vector Auto-Regressive Model

Granger Causality Testing

Johansson Trace Testing about Co-Integration

Error Correction Model

Endogenous Growth Model I:

the general economic equilibrium of singular-sector economy

$$\dot{k} = [f(H/K) - (H/K) \cdot f'(H/K) - \delta - n] \cdot k - c \quad (1)$$

$$g_c = (1/\theta)[f(H/K) - (H/K) \cdot f'(H/K) - \delta_K - \rho] \quad (2)$$

$$\lim_{t \rightarrow \infty} \{k(t) \cdot e^{-[f(H/K) - (H/K) \cdot f'(H/K) - \delta - n]t}\} = 0 \quad (3)$$

growth rate of economy rely on H/K – the proportion of human capital and physical capital

Endogenous Growth Model II:

the general economic equilibrium of two-sectors economy

- the Cobb-Douglas functions of consumption sector

$$Y = N(t) * c(t) + \dot{K}(t) = AK(t)^\beta [v(t)h(t)N(t)]^{1-\beta} h_a^\nu \quad (4)$$

- the Cobb-Douglas functions of human capital sector

$$\dot{h}(t) = h(t)^\xi \theta [1-v(t)] h_a^\psi \quad (5)$$

$$\dot{h}(t) = h(t)^{\xi+\psi} \theta [1-v(t)] = h(t)\theta [1-v(t)] \quad (6)$$

- Maximization of inter-temporal utility function

$$\max \int_0^\infty e^{-\rho t} \frac{c(t)^{1-\sigma} - 1}{1-\sigma} N(t) dt, \sigma > 0 \quad (7)$$

Endogenous Growth Model II:

- The equilibrium economic growth rate:

$$g^* = \frac{(n + \theta - \rho)(1 - \beta + \nu)}{\sigma(1 - \beta + \nu) - \nu + (1 - \beta)(1 - \xi)} \quad (8)$$

- growth rate of economy rely on the human capital spillover effect not only inter-sectors but inner-sector

Endogenous Growth Model III:

the equilibrium conditions of four-sectors economy

- **Utility & Profit Maximization**

 - utility maximization of ultimate consumption consumers

 - utility maximization of ultimate consumption producers

 - utility maximization of capital equipment producers

 - profit maximization of R&D producer

 - profit maximization of human capital producer

- **Market Clearance**

 - clearance of labor market clearance of human capital market

 - clearance of consumption market clearance of patent market

Endogenous Growth Model III:

- The equilibrium economic growth rate:

$$g = \frac{[(\nu + \xi)/(1 - \phi) + \Lambda][\nu B \psi \Delta - (1 - \phi)\rho / (\nu + \xi)]}{1 + \nu \Delta} \quad (9)$$

- growth rate of economy rely on the human capital spillover effect and technological change rate.

Endogenous Growth Model IV:

the general economic equilibrium of four-sectors economy under opened market condition

the Cobb-Douglas functions of consumption sector :

$$Y = u^\alpha H_Y^\beta \int_0^A x_i^{1-\alpha-\beta} di \quad (10)$$

the Cobb-Douglas functions of capital equipment sector :

$$x_i = y_i \quad (11)$$

Endogenous Growth Model IV:

the general economic equilibrium of four-sectors economy under opened market condition

the functions of R&D sector :

$$\dot{A} = \delta H_A A^\phi F^\gamma h_A^\xi \quad (12)$$

the functions of human capital development sector :

$$\dot{H} = B(1-u)F^\mu h^\psi \quad (13)$$

optimal consumption path by the standard condition :

$$\frac{\dot{c}}{c} = \frac{r - \rho}{\sigma} \quad (14)$$

Endogenous Growth Model IV:

- The equilibrium economic growth rate:

$$g = \frac{\left(\frac{\gamma(\psi - 1) + \mu(\xi + 1)}{(\phi - 1)\mu} + \Lambda \right) \Delta}{1 + \Delta} \left(\Theta B F^\mu h^\psi - \frac{\rho}{\frac{\gamma(\psi - 1) + \mu(\xi + 1)}{(\phi - 1)\mu} \Delta} \right)$$

(15)

$$u = 1 - \frac{\Delta - \frac{\rho}{\Theta B F^\mu h^\psi}}{1 + \Delta} = \frac{1 + \frac{\rho}{\Theta B F^\mu h^\psi}}{1 + \Delta}$$

(16)

Empirical examination

Vector Auto-Regressive Model

$$Y_t = \sum_{i=1}^m \Pi_i Y_{t-i} + \mu + U_t \quad (17)$$

$$\Delta \text{LnGDP}_t = c_1 + \sum_{i=1}^5 \alpha_i \Delta \text{LnGDP}_{t-i} + \sum_{i=1}^5 \beta_i \Delta \text{LnFDI}_{t-i} + \sum_{i=1}^5 \phi_i \Delta \text{HRD}_{t-i} \quad (18)$$

$$\Delta \text{LnFDI}_t = c_2 + \sum_{i=1}^5 \delta_i \Delta \text{LnGDP}_{t-i} + \sum_{i=1}^5 \gamma_i \Delta \text{LnFDI}_{t-i} + \sum_{i=1}^5 \eta_i \Delta \text{HRD}_{t-i} \quad (19)$$

$$\Delta \text{HRD}_t = c_3 + \sum_{i=1}^5 \mu_i \Delta \text{LnGDP}_{t-i} + \sum_{i=1}^5 \tau_i \Delta \text{LnFDI}_{t-i} + \sum_{i=1}^5 \xi_i \Delta \text{HRD}_{t-i} \quad (20)$$

- $$\begin{aligned} \Delta \text{LnGDP}_t = & 0.1628 + 0.0661 * \Delta \text{LnGDP}_{t-1} + 0.4114 * \Delta \text{LnGDP}_{t-2} - 0.5267 * \Delta \text{LnGDP}_{t-3} - \\ & 0.3131 * \Delta \text{LnGDP}_{t-4} - 0.6020 * \Delta \text{LnGDP}_{t-5} + 0.0424 * \Delta \text{LnFDI}_{t-1} - 0.1093 * \Delta \text{LnFDI}_{t-2} + \\ & 0.0626 * \Delta \text{LnFDI}_{t-3} + 0.0567 * \Delta \text{LnFDI}_{t-4} - 0.0325 * \Delta \text{LnFDI}_{t-5} + 0.0945 * \Delta \text{HRD}_{t-1} + \\ & 0.0884 \Delta \text{HRD}_{t-2} - 0.1712 * \Delta \text{HRD}_{t-3} - 0.0514 \Delta \text{HRD}_{t-4} - 0.0370 \Delta \text{HRD}_{t-5} \quad (21) \end{aligned}$$
- $$\begin{aligned} \Delta \text{LnFDI}_t = & 1.1355 - 7.0614 * \Delta \text{LnGDP}_{t-1} + 11.9269 * \Delta \text{LnGDP}_{t-2} - 11.2849 * \Delta \text{LnGDP}_{t-3} + \\ & 2.1246 * \Delta \text{LnGDP}_{t-4} - 5.9242 * \Delta \text{LnGDP}_{t-5} + 1.1535 * \Delta \text{LnFDI}_{t-1} - 1.9301 * \Delta \text{LnFDI}_{t-2} + \\ & 0.6138 * \Delta \text{LnFDI}_{t-3} + 0.2953 * \Delta \text{LnFDI}_{t-4} - 0.2335 * \Delta \text{LnFDI}_{t-5} - 0.3738 * \Delta \text{HRD}_{t-1} + \\ & 0.5258 \Delta \text{HRD}_{t-2} - 1.1932 * \Delta \text{HRD}_{t-3} - 0.4666 \Delta \text{HRD}_{t-4} + 0.5385 \Delta \text{HRD}_{t-5} \quad (22) \end{aligned}$$
- $$\begin{aligned} \Delta \text{HRD}_t = & -0.0488 + 8.0203 * \Delta \text{LnGDP}_{t-1} - 6.3551 * \Delta \text{LnGDP}_{t-2} + 3.6296 * \Delta \text{LnGDP}_{t-3} - \\ & 1.5193 * \Delta \text{LnGDP}_{t-4} + 1.7000 * \Delta \text{LnGDP}_{t-5} - 1.3653 * \Delta \text{LnFDI}_{t-1} + 0.3246 * \Delta \text{LnFDI}_{t-2} - \\ & 0.2004 * \Delta \text{LnFDI}_{t-3} - 0.2594 * \Delta \text{LnFDI}_{t-4} - 0.0421 * \Delta \text{LnFDI}_{t-5} - 0.3720 * \Delta \text{HRD}_{t-1} - \\ & 0.9942 \Delta \text{HRD}_{t-2} + 0.3293 * \Delta \text{HRD}_{t-3} - 1.3345 \Delta \text{HRD}_{t-4} + 0.0728 \Delta \text{HRD}_{t-5} \quad (23) \end{aligned}$$

Empirical examination

the result of Granger Causality Testing

Zero Hypothesis	F stat	Probability
DLNFDI does not Granger Cause DLNGDP	0.88195	0.60105
DLNGDP does not Granger Cause DLNFDI	5.38509	0.09718
DHRD does not Granger Cause DLNGDP	6.21561	0.08068
DLNGDP does not Granger Cause DHRD	0.89058	0.59734
DHRD does not Granger Cause DLNFDI	0.87463	0.60423
DLNFDI does not Granger Cause DHRD	29.1074	0.00929

Empirical examination

the result of Johansson Trace Testing about Co-Integration

Zero hypothesis	Eigenvalue	Trace stat	5% critical	1% critical
$\text{rk}(\Pi) = 0$	0.9391	80.4648	29.68	35.65
$\text{rk}(\Pi) \leq 1$	0.6405	21.6794	15.41	20.04
$\text{rk}(\Pi) \leq 2$	0.0093	0.1967	3.76	6.65

Empirical examination

the regressive result of Error Correction Model

- $$\text{LnGDPT-1} = 4.0281 + 1.6864 \text{ HRDt-1}$$

(-11.0614)

- $$\text{LnFDIt-1} = -9.1289 + 4.5232 \text{ HRDt-1}$$

(-6.9841)

The Synthetic Functions of HRD, FDI & GDP

- $$\Delta \text{LnGDP}_t = 0.4270 * \Delta \text{LnGDP}_{t-1} - 0.3413 * \Delta \text{LnGDP}_{t-2} - 0.1709 * \Delta \text{LnGDP}_{t-3} - 0.5504 * \Delta \text{LnGDP}_{t-4} - 0.0206 * \Delta \text{LnFDI}_{t-1} + 0.0196 * \Delta \text{LnFDI}_{t-2} + 0.0102 * \Delta \text{LnFDI}_{t-3} + 0.0260 * \Delta \text{LnFDI}_{t-4} + 0.0904 * \Delta \text{HRD}_{t-1} + 0.1176 * \Delta \text{HRD}_{t-2} - 0.0620 * \Delta \text{HRD}_{t-3} + 0.0180 * \Delta \text{HRD}_{t-4} + 0.1344 - 0.1786 * (\text{LnGDP}_{t-1} - 1.6864 * \text{HRD}_{t-1} - 4.0281) - 0.0634 * (\text{LnFDI}_{t-1} - 4.5232 * \text{HRD}_{t-1} + 9.1289)$$
- $$\Delta \text{LnFDI}_t = -1.0741 * \Delta \text{LnGDP}_{t-1} + 2.4013 * \Delta \text{LnGDP}_{t-2} - 4.0519 * \Delta \text{LnGDP}_{t-3} - 2.0008 * \Delta \text{LnGDP}_{t-4} + 0.9125 * \Delta \text{LnFDI}_{t-1} + 0.0430 * \Delta \text{LnFDI}_{t-2} + 0.1834 * \Delta \text{LnFDI}_{t-3} + 0.1153 * \Delta \text{LnFDI}_{t-4} - 0.1528 * \Delta \text{HRD}_{t-1} + 0.0207 * \Delta \text{HRD}_{t-2} - 1.1382 * \Delta \text{HRD}_{t-3} - 0.6691 * \Delta \text{HRD}_{t-4} + 0.2815 - 2.0417 * (\text{LnGDP}_{t-1} - 1.6864 * \text{HRD}_{t-1} - 4.0281) - 0.7115 * (\text{LnFDI}_{t-1} - 4.5232 * \text{HRD}_{t-1} + 9.1289)$$
- $$\Delta \text{HRD}_t = 3.7602 * \Delta \text{LnGDP}_{t-1} - 3.6475 * \Delta \text{LnGDP}_{t-2} + 1.8752 * \Delta \text{LnGDP}_{t-3} - 1.4317 * \Delta \text{LnGDP}_{t-4} - 0.1744 * \Delta \text{LnFDI}_{t-1} + 0.4013 * \Delta \text{LnFDI}_{t-2} + 0.1536 * \Delta \text{LnFDI}_{t-3} + 0.0745 * \Delta \text{LnFDI}_{t-4} - 0.2964 * \Delta \text{HRD}_{t-1} - 1.2292 * \Delta \text{HRD}_{t-2} - 0.6828 * \Delta \text{HRD}_{t-3} + 0.4350 * \Delta \text{HRD}_{t-4} - 0.2099 - 3.9506 * (\text{LnGDP}_{t-1} - 1.6864 * \text{HRD}_{t-1} - 4.0281) - 1.3125 * (\text{LnFDI}_{t-1} - 4.5232 * \text{HRD}_{t-1} + 9.1289)$$

CONCLUSION:

- human capital development and FDI are respectively the important inside and outside stimulus of host country's economic growth
- the interaction between them is also a key determinant of equilibrrious growth path.

The background is a deep blue gradient, transitioning from a lighter blue at the top to a darker blue at the bottom. A thin, white horizon line is visible in the upper third of the image. On the left side, there is a bright, circular sun flare that creates a shimmering effect across the blue background. The text "Thank You" is centered in the middle of the image.

Thank You